Three Consecutive Years of Eclipse Chasing in Spain

Master thesis

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Abstract:

The sky has always been inspiring for humankind. He has always observed the sky to explore the universe and understand its scientific laws. In the world of astronomy, a total solar eclipse is one of the most spectacular nature's shows. Solar eclipse can be a great pretext to promote tourism in a scientific way and eclipse chasing is a kind of astrotourism that promotes sustainable tourism development.

This research is a pioneering work to demonstrate a rare opportunity for Spain to host one of the greatest eclipse chasing events through history in 2026, 2027 and 2028. This work aims to provide a primary study about the upcoming phenomena in order to start an early comprehensive plan to organize these events. The thesis follows studying the role of this rare opportunity to promote tourism in Spain based on planning, education and awareness.

The research is both, descriptive and quantitative, consisting of a literature review followed by empirical investigation cooperating with the most well-known experts of this area. More than fifty experts and over 100 interested people from all over the world have collaborated in the research answering to online questionnaires. The findings show fantastic potentials in Spain to be prepared and hold eclipse celebrations throughout the country. The author presents featured locations to observe the upcoming eclipse in Spain based on astronomical calculations, weather forecast models and tourism potentials. Moreover, the thesis suggests the most necessary actions and creative activities to be accomplished in line with the objectives of this research.

Keywords: tourism, Spain, eclipse chasing, astrotourism, solar eclipse, astronomy

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I hope this thesis will be inspiring and useful for Spain to host eclipse chasers and eclipse events.

Girona, September 2017

Mohammad Soltanolkotabi

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List of Abbreviations

UNWTO: World Tourism Organization

IAU: International Astronomical Union

ESA: The European Space Agency

UNESCO: The United Nations Educational, Scientific and Cultural Organization

NASA: The National Aeronautics and Space Administration

MAB: Man And Biosphere

CHAPTER1: INTRODUCTION

1.1 Background

The sky has always been inspiring for humankind. He has always observed the sky to explore the universe and understand its scientific laws. In the world of astronomy, a total solar eclipse is one of the most spectacular nature's shows. Solar eclipse is a great pretext to promote tourism in a scientific way and eclipse chasing is a kind of astrotourism that promotes sustainable tourism development. Eclipse chasers believe that the experience of observing a total solar eclipse is a unique opportunity that shows nature at its best colors.

During totality the Moon covers the Sun's face and casts the darkest part of its shadow, the umbra, on Earth. At this time, the sky goes dark, bright planets and stars appear, temperature normally falls, and birds and animals often go quiet.

Although an annular solar eclipse is much less important for astronomers since there won't be any totality, however observing a remaining ring of sunlight in the sky would be worth observing to local astronomers and even unprofessional people. Especially when it comes to see the ring of fire near horizon before sunset or after sunrise, astrophotographers can't wait to record this unique show of the sky next to natural or cultural elements as it's going to happen in 2028 before the sunset of January 26 in Spain.

Solar eclipses happen every eighteen months on average somewhere on the earth (Percival, 2015) and according to the importance of the eclipse and the availability of the eclipse path, a considerable number of professional and amateur astronomers, astrophotographers, eclipse chasers and adventurers of all around the world travel to witness this rare show of the sky. Most of them are coming from long distances basically seeking to see a couple of minutes of totality or annularity.

Definitely early planning in a host community within the path of totality can bring more people together to celebrate this event. Moreover, by effective cooperation between different sectors, tourism development and substantial benefit are predictable in the region both in the short and long term.

The track of the Moon's shadow across Earth's surface is called the Path of Totality (Espenak, 2014). Almost every year a path of totality of a solar eclipse appears on surface of the earth however, a specific location on earth will be visited by a total solar eclipse only once in about 375 years on average (Littmann, M., Espenak, F., & Willcox, K. 2008).

As an amateur astronomer with approximately fifteen years of experience when I found out this rare opportunity of "three solar eclipses in three consecutive years in Spain" I was pretty surprised. Before that no one had noticed this unique chance for Spain or never had covered it as astronomers mentioned later. Repeating three solar eclipses in a country in less than three years is absolutely rare according to the eclipse maps. Moreover, each of those three eclipses has its unique properties that make it very special and important.

In 2026, 2027 and 2028, the paths of 3 solar eclipses will cross Spain. The eclipses of 2026 and 2027 will be total and that of 2028 will be annular. The first eclipse will occur on Wednesday 12 August, 2026. The total eclipse will visible from the Arctic, Greenland, Iceland, Atlantic Ocean and a vast area of northern Spain. The total eclipse will pass over northern Spain from the Atlantic coast to the Mediterranean coast as well as the Balearic Islands. 2026 total eclipse will be visible from Valencia, Zaragoza, Burgos, Valladolid, Leon, Palma and Bilbao but both Madrid and Barcelona will be just outside the path of totality (NASA, 2014). This is the first total solar eclipse to occur in Spain since more than a hundred years ago. The last total eclipse in Spain happened on August 30, 1905 and followed a similar path of totality across the country (NASA, 2013).

The second eclipse will happen less than a year later on 2 August 2027 in the southern coast of Spain. The path of totality will pass first over the Strait of Gibraltar between Spain and Morocco, crosses over all the North African countries and touches some parts of Saudi Arabia, Yemen, and Somalia (NASA 2014). This total solar eclipse will be the second longest total solar eclipse to occur in the 21st century after the one on July 22, 2009 (Littmann, M., Espenak, F., & Willcox, K. 2008). Although a narrow area of southern cost will visit the path of totality this time, however Spain can remain among the first countries as a destination to host eclipse chasers. This total solar eclipse will visible from Malaga, Cadiz, Marbella and Strait of Gibraltar whereas Tarifa in the south has the best situation in the soil of Spain to have more than four minutes of totality. On the other hand, cruise ships could take people to the part of the path of totality where the total phase of the eclipse would last about 6 minutes (NASA 2014).

Finally, less than six months later, Spain will welcome to another solar eclipse which is an annular one and occurs on January 26, 2028. It will be visible across South America through Ecuador, Peru, Brazil, and French Guiana; in Funchal; and in Tangier and southern Spain and Portugal. The path of annularity will pass over southwest of Spain from the Atlantic coast to the Mediterranean coast (NASA, 2014). Many astronomers believe that annular solar eclipses are not as spectacular and important as total ones. However, since this annular solar eclipse happens near the western horizon before sunset, this would be a great motivation for astrophotographers to record this memorable event.

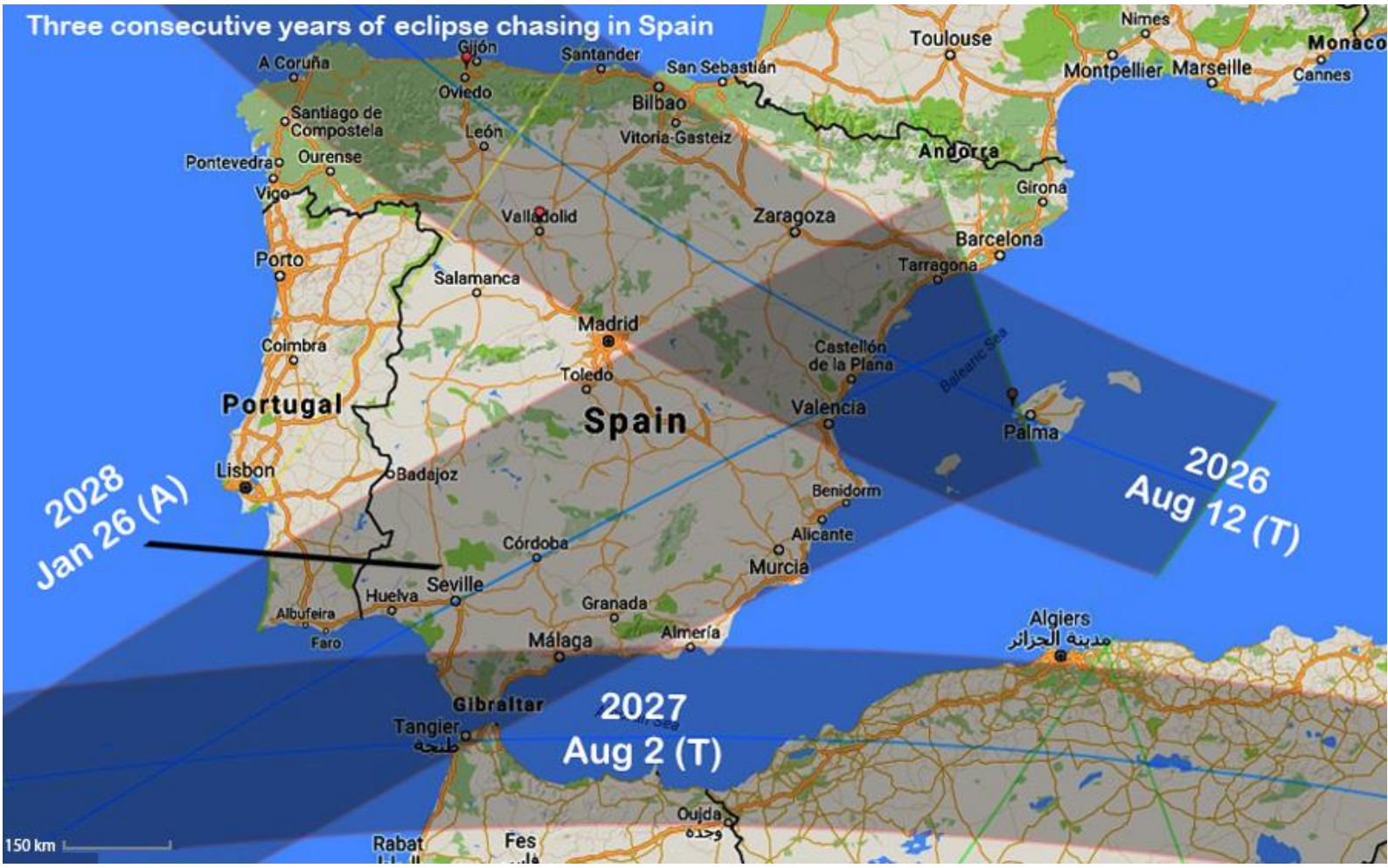

Figure 1: The paths of Totality and Annularity of three solar eclipses in Spain in three consecutive years (Source: Own design based on Total Solar Eclipse - Interactive Google Map - Xavier Jubier)

1.2 Research problem

The paths of totality and annularity of these three eclipses covers a vast area in Spain which is about 70% of the whole Spanish territory. These phenomena are magnificent and important not only among the astronomers and eclipse chasers, but also spectacular and inspiring for many people. That would be a considerable audience and remarkable potential for tourism and educational sector. Definitely Spain must take advantage of its rare opportunity and start eclipse planning as soon as possible to prepare enough infrastructures and requirements to host great number travelers within and outside the eclipse main path.

Moreover, since the eclipse happens in a big area including different cities, rural regions, abandoned areas, natural and cultural sites, by early planning in tourism sector cooperating with other relevant entities, this event can promote tourism in less-known areas of Spain.

1.2.1 Spain and its role in tourism development

Spain is one of the world's leading tourist destinations, thanks to its variety of attractions. In this regard, it is important to note that Spain is the world's third country with the most World Heritage sites in the list of UNESCO (UNESCO, 2017), the first in terms of UNESCO Biosphere Reserves (UNESCO, 2016), or the country with the most Blue Flag beaches in the world (blueflag, 2017).

1.2.1.1 Spanish Tourism in Numbers

In 2015 Spain welcomed just over 68 million visitors making it the world's third most visited nation after France and the United States (UNWTO, 2016). It exceeded 75 million visitors in 2016 and Spain’s tourism sector is readying itself for a record number of arrivals in 2017, boosted for the sixth year running. Ongoing security fears in other Mediterranean destinations such as Tunisia, Egypt and Turkey has also resulted in renewed interest in Spain as a safe tourist destination (thelocal, 2017). Spanish tourism executive’s credit security fears in competing sunshine destinations across the Mediterranean and in the Middle East for the rise in visitors to Spain's shores but Rifai rejects this theory. "*Spain did well because Spain is doing the right thing*" in terms of how it promotes itself as a destination and welcomes visitors, he said.

Each visitor to Spain spent an average of €800 ($842) during their stay, a figure that is comparable to the global average, said Rifai. They spent a total of over €60 billion in the country in 2016, he added (thelocal, 2017).

When it comes to astroturism it seems that despite the relevant potentials and infrastructures in Spain, this type of tourism can have a greater market in Spain to welcome to much more travelers as astroturists.

1.2.2 Astrotourism in Spain

Spain is one of the pioneers to promote astrotourism in the world and a fantastic territory to practice astrotourism. The Canary Islands, Andalusia, Catalonia, Galicia and Extremadura are the main regions were this amazing experience is becoming more and more popular. Definitely, the Canary Islands are one of the best places in the world one can enjoy the world of astronomy. Two of the best observatories in the world are in La Palma and Tenerife island. The Observatory del Roque de los Muchachos (ORM) is situated on the edge of the Caldera de Taburiente National Park, 2.396 m. above sea level on the island of La Palma and It is home to one of the most extensive fleets of telescopes to be found anywhere in the world. Observatory of Teide on Tenerife island is ideally suited for studying the sun. For this reason, it is home to Europe's finest solar telescopes (Instituto de Astrofísica de Canarias, 2017).

"Astrotourism is already a component of the Canaries' booming tourism industry, drawing about 200,000 visitors annually. But with the 2014 designation of the islands as part of a larger EU Sky Route itinerary for visitors, and the creation in 2011 of a music and astronomy festival, Canarian officials believe more star trekkers will soon be taking the winding drive up the mountain at dusk to sit on what might be called one of nature's sky-decks" (New York Times, 2016).

1.2.3 Why it´s worth observing a total or an annular solar eclipse

Solar eclipses are among the rarest astronomical phenomenon. A total or an annular solar eclipse is a great memorable moment in everybody's life. They are rare, exciting and very spectacular. If you hope a total eclipse to come to you, it takes quite a long time. Although total and annular solar eclipses occur almost every year somewhere in the Earth, they are pretty rare at any specific location. On average it happens at single locations only about once every four centuries (Littmann, M., Espenak, F., & Willcox, K. 2008). So, if you are willing to travel, you can probably go and see one. Some people who observe a total solar eclipse have been waiting eagerly for that for a long time. Moreover, a total or an annular solar eclipse offers everybody a unique opportunity to see a natural phenomenon that shows the basic principles of physics and mathematics.

However, a total solar eclipse is not just passing the Moon in front of the sun's disk. That´s the appearance of stars in the sky during a day for a couple of minutes. That's an opportunity for the astronomers and eclipse chasers of all around the world to get together and celebrate a great unforgettable moment.

1.2.4 The importance of the event and research

Three Solar eclipses in less than years in Spain is rare, unique and important in many aspects. Our both important total solar eclipses of this research are going to occur in summer vacation season when Spain hosts innumerable domestic and international tourists. That would be a perfect opportunity for many people to spend a part of their holidays to see a total solar eclipse in Spain. On the other hand, according to the cloud cover maps, suitable weather condition is predictable in August in a vast area within the paths of totality in Spain. The importance of the issue can be studied in two parts: The importance of the event and the importance of the research.

1.2.4.1 The importance of the event

As stated earlier, repeating a solar eclipse in a country is pretty rare according to the astronomical calculations and eclipse maps. If you don't travel to observe a total solar eclipse normally you have to wait for that a long time. Each of our three eclipses in Spain has specific importance and it's worth studying separately.

A. The total solar eclipse of 2026 august 12

- This total solar eclipse occurs over Spain for the first time in nearly 120 years NASA, (2013).
- The total solar eclipse of 2026 is the first total solar eclipse to occur over the Europe mainland (the main European Union territory without considering Iceland, Greenland and remote European islands) since 1999 (own research based on NASA eclipse maps).
- This total solar eclipse will be visible also in the Arctic, Greenland, a small part of Iceland, Atlantic Ocean, and a very small area in the north of Portugal (NASA, 2013), however it is pretty clear that Spain can be the main destination to host eclipse chasers of all around the world.
- The 2026 eclipse is especially unique because of the uninterrupted land masses it will pass over Spain and the path of totality covers approximately one third of the entire Spanish territory (NASA, 2013).
- The path width of a total solar eclipse is normally less than 200 kilometers wide whereas the path of totality of the 2026 eclipse in Spain is approximately 290 kilometers wide (Jubier, 2017).
- The total solar eclipse of 2026 happens in august when a great number of tourists come to Spain during the summer vacations every year.
- The eclipse of 2026 occurs in the summer when a better weather condition and clear sky is predictable in Spain to observe the event.
- The totality of this eclipse will be visible in western coast of Spain and Balearic Islands just above the western horizon. That would be a glorious unforgettable show in the sky to see the totality while sunset or just before that.

B. The total solar eclipse of 2027 august 2

- The total solar eclipse of 2027 has the second longest totality in the 21st century (Littmann, M., Espenak, F., & Willcox, K. 2008).
- The maximum duration of totality will be observed in Egypt and will be 6min 22sec (NASA, 2014).
- The path of totality will pass over the Strait of Gibraltar and the total solar eclipse will visible in the morning from Malaga, Cadiz, Marbella, Tarifa etc.
- The more we move to the south a longer totality will be seen (NASA, 2014).
- Tarifa in the south has the best geographic situation in the soil of Spain with more than four minutes of totality (NASA, 2014).

- Although some cities like Malaga and Cadiz are located quite far from the center line, however the duration of totality is remarkable. That would be about two minutes in Malaga and three minutes in Cadiz which is even longer than the last year's best totality duration in the whole country (NASA, 2014).
- This eclipse happens in Spain only a year after the total solar eclipse of 2026 in the north of country.
- Spain will be the only European country to visit the path of totality. (It also passes the small British territory of Gibraltar)
- Once again summer vacation provides a good opportunity for travelers to come and enjoy this inspiring sky show in the southern coast of Spain
- The central line of the path will not pass over the soil of Spain but still over four minutes of totality could be seen from the southern coast such as Tarifa (NASA, 2014).
- Since this solar eclipse occurs in summer clear sky is predictable in this part of Spain to observe the event.
- There won't be any further totality in Europe till 2053, in which, once again Spain will be the only European country that hosts the path of totality (NASA, 2013).
- In 2053 once again the path of totality touches the Strait of Gibraltar but a very smaller area will visit the totality and it would be much shorter (NASA, 2013).

C. The annular solar eclipse of 2028 January 26

- The annular solar eclipse of 2028 has the second longest annularity in the 21st century (Littmann, M., Espenak, F., & Willcox, K. 2008).
- The maximum duration of annularity will be observed in Brazil and will be 10min 27sec (NASA, 2014).
- The Annular Solar Eclipse of 2028 Jan 26 is visible from Ecuador, Peru, Brazil, Suriname, Spain, and Portugal (NASA, 2014).
- The pass of annularity enters the soil of Spain from the southwestern coast, touches a vast area of Spain and the annularity ends in western coast, Ibiza and Mallorca by the sunset (NASA, 2014).
- Sevilla and Cordoba are just under the centerline and Valencia is very close to this line (NASA, 2014).
- Touching the ring of fire by the Mediterranean waters at sunset will be extraordinarily beautiful.

- Since the annular eclipse appears near the western horizon, that would be a great chance to capture the ring of fire next to the natural and architectural elements.
- There won't be any further annularity in Spain till 2059, in which only a very small part of Catalonia including Girona will visit the path of annularity (NASA, 2013).
- The path of annularity is about 350 kilometers wide and covers approximately half of Spain (NASA, 2014).
- This eclipse happens just six months after the total solar eclipse of 2027 august 2 in the south.
- Some areas in the south including Malaga, Cadiz, Gibraltar and Tarifa will visit booth total and annular eclipses in six months.

1.2.4.2 The importance of the research

Astrotourism is an increasing tourism nowadays in the world and an attracting growing interest. A great number of people travel every year basically to enjoy the sky but, there are very few academic papers, thesis and researches in this issue. This report is probably the first academic thesis on eclipse chasing and I hope it can be a good starting point for further researches.

The world of astronomy with its diversity of related activities such as astrotourism and eclipse chasing can make a remarkable contribution to the sustainable development and responsible tourism in the host communities. As previously mentioned, the main paths of our three solar eclipses cover more than a half of the whole Spanish territory. Since the paths cross a vast area with natural and cultural potentials, it would be a great opportunity for sustainable development in the areas within the path of totality that are not among the top tourist destinations in Spain. In addition, less-known regions can be introduced to eclipse chasers and people to distribute the observers along the path of totality.

This research sounds necessary to start an early comprehensive planning and preparing Spain as the host country to welcome to eclipse observers. On the other hand, the result of this report can be used in the further researches and could be a reference to help other host communities in which the paths of totality or annularity cross.

1.3 The objectives, hypothesis and questions

1.3.1 General objective

This study is generally aiming to provide a primary study and necessary information about the upcoming events and trying to present it to the relevant entities to start an early planning in order to prepare Spain for hosting one of the greatest solar eclipse chasing events of history.

1.3.2 Specific objectives

The specific objectives of the study are:

1. Studying the paths of these three solar eclipses in Spain, exploring the best locations to host eclipse observers (based on early weather models, technical requirements and local potentials) and suggest them to eclipse chasers.

2. Demonstrating the rare situation of Spain as one of the best areas on Earth to observe these three eclipses, raising public awareness and promote it nationally and internationally.

3. Recognizing and studying eclipse chaser's most important concerns and requirements

4. Providing technical information and knowledge in order to start an early, effective and comprehensive planning in Spain as a destination to host one of the greatest solar eclipse events in history.

1.3.3 Hypothesis and questions

This study is following the further hypothesis:

The rare opportunity of Spain to observe three solar eclipses of 2026, 2027 and 2028 plays an important role to develop creative ideas in tourism industry of Spain through eclipse chasing based on cultural and natural potential.

1.3.4 Questions:

We hope to find rational answers for the following questions:

- How can we use cultural and natural potentials to organize the eclipse events in Spain?
- What is the role of education in promotion of these events in Spain?
- How can we use this rare opportunity to develop tourism in long term programs?

- What is the role of astronomers and astrotourists in tourism sustainable development during the three years of eclipse chasing in Spain, before and after that?
- How can Spain host one of the greatest astrotourism events of history through an early and comprehensive plan in cooperation with relevant organizations such as UNESCO, IAU, UNWTO, ESA etc.?

1.4 Proposed research methodology

This thesis uses qualitative research methods and an exploratory case study design. Through an empirical study in cooperation with eclipse planers, experts and consultants we are trying to test and analyze the hypotheses.

1.5 Relevant organizations and sectors to cooperate in the research

An effective and comprehensive planning for organizing eclipse chasing events in a local community is impossible without a mutual cooperation between the relevant entities and sectors. The World Tourism Organization headquartered in Spain plays an important role to cover the importance of this event. International Astronomy Union can highly support this project scientifically. The Man And Biosphere committee in Spain can take advantage of this opportunity to cover its mission and objectives such as sustainable tourism development through the education and public awareness among local communities. Moreover, Biosphere reserves can be used to host observers along the paths of totality and annularity. Local governments should cooperate with solar eclipse chasers and experts to use the local potentials and Facilities. Tourism industry must improve its infrastructures and get ready to host one of the greatest eclipse chasing events in our planet. Media and social networks are supposed to cover the importance of what is going to happen and increase the public awareness and all above wont possible without a joint comprehensive plan.

1.6 Glossary

The following part is directly derived from the glossary of NASA on solar eclipse terms published by Fred Espenak:

Total solar eclipse: A solar eclipse in which the Moon's umbral shadow traverses Earth (Moon is close enough to Earth to completely cover the Sun). During the maximum phase of a total

eclipse, the Sun's disk is completely blocked Moon. The Sun's faint corona is then safely revealed to the naked eye.

Annular solar eclipse: A solar eclipse in which the Moon's antumbral shadow traverses Earth (the Moon is too far from Earth to completely cover the Sun). During the maximum phase of an annular eclipse, the Sun appears as a blindingly bright ring surrounding the Moon.

Totality: The maximum phase of a total eclipse during which the Moon's disk completely covers the Sun. Totality is the period between second and third contact during a total eclipse. It can last from a fraction of a second to a maximum of 7 minutes 32 seconds.

Annularity: The maximum phase of an annular eclipse during which the Moon's entire disk is seen silhouetted against the Sun. Annularity is the period between second and third contact during an annular eclipse. It can last from a fraction of a second to a maximum of 12 minutes 29 seconds.

Path of totality: The track of the Moon's umbral shadow across Earth.

Path of annularity: The main path of an annular eclipse where the eclipse can be seen annular.

Central line: During a central solar eclipse, the central axis of the Moon’s shadow cone traverses Earth's surface. The track produced by the shadow axis is called the central line of the eclipse. The duration of a total or annular eclipse is longest on the central line.

Umbra: The Moon's dark inner shadow.

CHAPTER 2: METHODOLOGY

The following chapter of the thesis will be dedicated to the methodology of the study. This thesis uses qualitative research methods and an exploratory case study design. When it comes to generalizability of qualitative research findings, the purpose is to extend the findings and conclusions from the study conducted on a sample population, to the population at large. First of all, the research methods for sample selection and data collection will be discussed. Afterwards, the section will provide with the insight into questionnaire design, variables and techniques which were applied in order to test and analyses the hypotheses.

2.1 Sample selection

There were not special requests to focus on specific gender group or specific age group but respondents were divided in two main groups:

1- Astronomy experts especially eclipse chasers
2- Unprofessional people interested in astronomy

For the first group, a minimum of 50 participants were needed. At the end, 52 people took part in this research, which was sufficient in order to start analysis. For the second group, a minimum of 100 participants were needed and at the end, 104 participants took part in this research. The reason for studding the case using two main groups of respondents was that an eclipse event has normally two main groups of audience:

1. Eclipse chasers and astronomers with remarkable relevant scientific background or experience
2. Any other person without a serious relevant background interested in observing a total or an annular solar eclipse in their lives

Each group might have different requirements, concerns and infrastructures so they will have different points of view and opinions as well.

2.2 Data collection

Data were collected online through the google online questionnaire from January to June, 2017. The thesis research was made in an exploratory case study design. This type of research enables fieldwork and data collection with the purpose of exploring the certain phenomena that has been perceived by the researcher, or the phenomena that was perceived to have a possible inter-connection. Data collection is being studied in two parts according to the two main groups of respondents.

1. **Astronomy experts especially eclipse chasers** were selected among well experienced experts using personal contacts from International Astronomy Union (IAU), Nasa, Solar Eclipse Mailing List (SEML), Local experts and some other people with international eclipse chasing experience. They were kindly asked personally to collaborate in the research, answer to the survey and help the author improving the issue using their great opinions and experience. The result was remarkable and a good number of well-known eclipse chasers and experts accepted to participate with open arms. "*I didn't know that Spain has three solar eclipses within three years, two of the total a year apart. That's really amazing! I completely agree with your idea of capitalizing on that rare opportunity in Spain. Whether it for businesses or science or anything else, the experience will be a good one for all observers"* said Make Simmons, Founder and President of Astronomers Without Border.

   It must be mentioned that the majority of experts who have been collaborated in the research were absolutely busy since they were organizers and planers of the American Great Eclipse, getting ready for the big event on August 21, 2017. Many of them are well-known scientists and lecturers on eclipse events, a number of them are professional eclipse tour organizers, some are eclipse consultants or eclipse meteorologists and many of them are famous professional or amateur astronomers with very unique eclipse experiences such as eclipse observation from the air, cruise ships and different areas of all around the world.

2. **Unprofessional people interested in astronomy** were invited to participate and answer to the survey in social network groups and websites related to tourism activities and adventures. It was tried to focus more on European Union residents since that would be much easier and cheaper for them to come to the path of totality and see the solar eclipses. A good number of the participants received the request to answer to the survey in different posts published in a vast number of Couchsurfing groups. Couchsurfing is a global community of 14 million people in more than 200,000 cities who share their life, their world and their journey. Couchsurfing connects travelers with a global network of people willing to share in profound and meaningful ways, making travel a truly social experience. Couchsurfing members are normally young, adventurers, backpackers and experienced travelers.

CHAPTER 3: REVIEW OF LITERATURE

3.1 Tourism sustainable development

Tourism industry is considered among the largest industries in the world. However, the effects of tourism have become a big concern and requirement. As tourism grows up around the world, sustainable tourism development becomes an important concern for the tourist destinations. The concept of sustainable tourism has been expanded to reduce the negative effects of tourism activities, which has become almost universally accepted as a desirable and politically appropriate approach to tourism development (Sharpley, 2003). Many experts (Richards & Hall, 2003; Briguglio, Archer, Jafari, & Wall, 1996; Butler, 1991; Sharpley, 2000; Vellas & Becherel, 1999; WCED, 1987) argue that 'sustainable tourism development' concerns an economic, social and environmental tourism development that aims at the continuous improvement of tourists.

Since 1992 the UNWTO has suggested sustainable approaches on tourism development and later in 1993 issued a popular sustainable tourism publication as *sustainable tourism development: guide for local planners*. Since that time the UNWTO has been a global leader with respect to tourism policies, planning and the management of sustainable tourism (Edgell, 2016).

Astronomical tourism that is flourishing nowadays all over the world offers great opportunities for a socially-responsible and sustainable development. (stars4all, 2017).

3.2 Astrotourism

Astronomical tourism or astrotourism is an activity of travelers wishing to enjoy the sky related leisure and knowledge. Jafari (2017) believes that the concept of astrotourism is acquiring new meanings and insights. In a broad sense, astrotourism focuses on adventures for the purpose of astronomy, related purposes or simply doing amateur astronomy activities during the journeys. Additionally, some cultural resources, including archaeological sites such as Stonehenge, have also proven to have an astrotourism potential, offering research opportunities for specialists (Fayos -Solà, Marín, and Rashidi, 2014).

Astrotourism is probably one of the most effective ways to bring tourism and tourists closer to nature for a comprehension of the physical world systems and dynamics. It serves both the purpose of meaningful tourism and to the conservation of essential resources, such as unpolluted nightscapes, as well as to host communities' appreciation of conservation policies. Astrotourism epitomizes the tendencies towards more meaningful tourism experiences, based on conservation of natural resources, knowledge, and science, potentially enriching the traveler and the host communities. In the recent years, astrotourism has gained its pace in the list of tourism motivations and thus it should not be taken lightly. However, its progress will continue to depend on its professional integration into advanced destination management and governance systems. (Fayos -Solà, Marín, and Jafari, 2014).

Astrotourists are ranging from the general public to amateur and even professional astronomers. On the other hand, the scientific community has also been interested in astrotourism, as a way to appeal to young scientists and amateurs, as means to disseminate knowledge, and a vehicle to engage the understanding and approval of taxpayers, donors, and investors. Kannappan (2001) argues that amateur astronomy has had its origins by the end of the 19th century, at a time when increased professionalization of astronomers required a differentiation of practitioners' types, while "hard core" astronomy could still continue to benefit from non -professional contributors widespread around the globe. Actually, amateurs and "astronomical societies" have pre -dated the concept and practice of astrotourism, and greatly assisted in its recent consolidation. The popularity of amateur astronomy and increasingly affordable equipment provide a best case and scenario for the dissemination of scientific ethic and method beyond the laboratory or observatory walls (Fayos -Solà, Marín, and Jafari, 2014)

Astrotourism is an emerging and promising field for enjoyable and meaningful experiences in contemporary tourism. It can enrich human capital both among the visiting publics and within the host communities, while simultaneously fostering the quest for scientific, technological, and governance innovation in the institutional fabric. Astrotourism has expanded over the last few years, as the scientific community disseminates its objectives, knowledge, and ethics through society at large, and tourism entrepreneurs respond to increasing demand for meaningful tourism experiences (Fayos -Solà, Marín, and Jafari, 2014).

3.2.1 Astrotourism destinations

When it comes to the best astrotourism destinations in the world it could not be listed clearly in general since it depends on the type of astrotourism adventure. Regarding the night sky based journeys that would be pretty clear where to go. The best locations for the dark skies observations has been listed as starlight reserves. Starlight Reserve is a site with a quality night sky and very low light pollution. Its main function will be to preserve the quality of the night sky and its associate values, whether they are cultural, scientific, astronomical, natural, or landscape-related. The Declaration in Defense of the Night Sky and the Right to Starlight was approved during the Starlight Conference, held on the island of La Palma in April 2007. It constitutes the general and conceptual framework of the Starlight initiative. The proposal to develop a “Starlight Reserve Concept" was one of the additional recommendations to the Starlight Declaration, to be carried out with the support of the Organizations that promoted the Declaration and the Starlight Scientific Committee, in cooperation with the World Heritage Centre through its Thematic Initiative “Astronomy and World Heritage. The Working Group “Starlight Reserves and World Heritage” met on March 11th, 2009 in the framework of the International Workshop and Expert Meeting “StarLight Reserves and World Heritage. Scientific, Cultural and Environmental Values” for the revision of this document. This Workshop was organised by UNESCO-Mab and World Heritage Centre, International Astronomical Union (IAU), and Instituto de Astrofísica de Canarias (IAC), with the support of the Fuerteventura Island Government. Nowadays among the worldwide starlight reserves, some destinations such as Canary Islands and Atacama in Chile stand out. (starlight, 2012)

However as mentioned previously astrotourism is not limited in the night sky observations. Historical sites with astronomical backgrounds or archaeoastronomical values could be considered as astrotourism destinations. Fayos -Solà, Marín, and Jafari, (2014) argue that Stonehenge, Chichen Itzá, Giza, Chankillo, Mesa Verde, Persepolis, Almendres, Gochang or Chaco Canyon, have also potentials to be considered as astrotourism destinations.

Moreover, a good number of astrotourists travel round the world in order to observe astronomical events such solar and lunar eclipses, bright comets of the sky, transits, occultations etc. in this regards they have to be in the right locations where the phenomena happens.

3.3 Solar eclipse

3.3.1 Solar eclipse and its types

Sometimes when the moon orbits Earth, it moves between the sun and Earth. When this happens, the moon blocks the light of the sun from reaching Earth. This causes an eclipse of the sun, or solar eclipse. During a solar eclipse, the moon casts a shadow onto Earth. According to NASA (2017) this phenomenon can be occurring in three types:

1. **Total solar eclipse**: A total solar eclipse is only visible from a small area on Earth. The people who see the total eclipse are in the center of the moon's shadow when it hits Earth. The sky becomes very dark, as if it were night. For a total eclipse to take place, the sun, moon and Earth must be in a direct line.
2. **Partial solar eclipse**: This happens when the sun, moon and Earth are not exactly lined up. The sun appears to have a dark shadow on only a small part of its surface.
3. **Annular solar eclipse**: An annular eclipse happens when the moon is farthest from Earth. Because the moon is farther away from Earth, it seems smaller. It does not block the entire view of the sun. The moon in front of the sun looks like a dark disk on top of a larger sun-colored disk. This creates what looks like a ring around the moon.

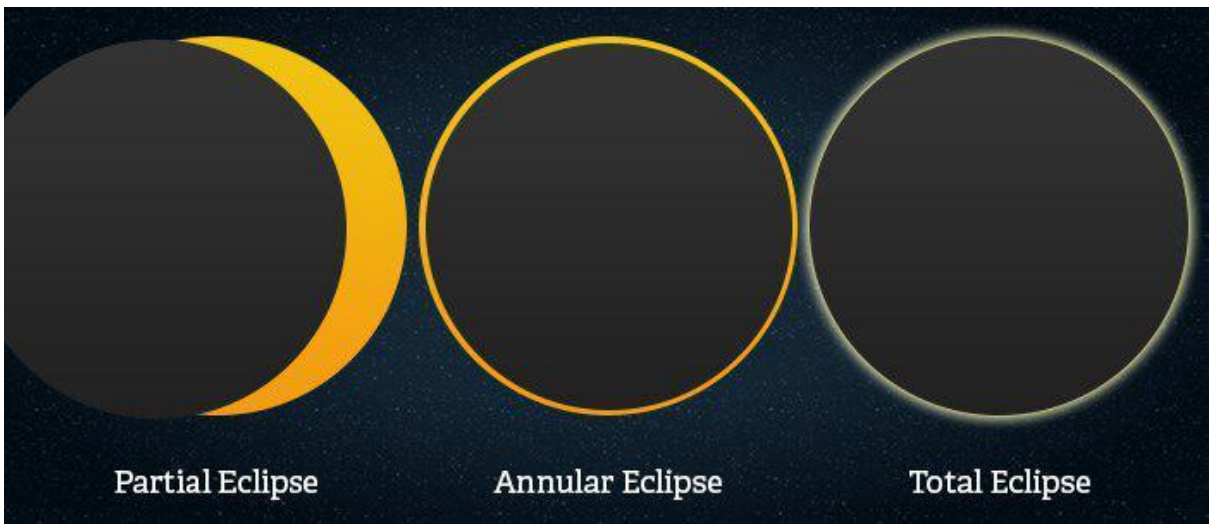

Figure 2. Types of solar eclipses

3.3.2 The longest duration of totality and annularity

The sun is 400 times the diameter of the Moon, yet it's about 400 times farther from the earth, so the two appear almost exactly the same size in the sky. It is this geometry that provides us with the unique total eclipses seen on earth when our Moon just bravely covers the face of the sun. the sun is not always exactly the same angular size in the sky. The reason is that the earth's orbit is not circular but elliptical, so the earth's distance from the sun varies. When the earth is closest to the sun (early January) the sun's disk is slightly larger in angular diameter and it's harder for the Moon to cover the sun to create a total solar eclipse. On the other hand, since the angular diameter of the Moon is smaller than the angular diameter of the sun on average, annular solar eclipses are more frequent than total eclipses (Littmann, M., Espenak, F., & Willcox, K. 2008).

The theoretical longest totality of an eclipse can be 7 minutes 31 seconds. However, in the 21st century there is no totality longer than 7 minutes. The longest totalities of our century are:

1. July 22, 2009: 6m 39s
2. August 2, 2027: 6m 23s
3. August 12, 2045: 6m 6s
4. May 22, 2096: 6m 6s

As it's clear the second eclipse is the one to be studied in this report and the second longest one in the 21st century.

The theoretical longest annularity of an eclipse can be 12 minutes 30 seconds. However, in the 21st century there is no annularity longer than 12 minutes. The longest totalities of our century are:

1. January 15, 2010: 11m 08s
2. January 26, 2028: 10m 27s
3. February 5, 2046: 9m 42s

It's obvious that the second eclipse is the one to be studied in this report and the second longest one in the 21st century (Littmann, M., Espenak, F., & Willcox, K. 2008).

3.3.3 How is a total solar eclipse?

Many eclipse chasers such as Rick brown, describe total solar eclipse as a unique event that shows nature at its very best the colors, the light and all in all the whole experience. Rick has experienced more than twelve total solar eclipses round the world and describes the experience of totality just fascinating, unduplicatable and unbelievable thing to see (Russo, 2012).

During a total solar eclipse, the disk of the moon covers the last sliver of light from the sun, and the sun's outer atmosphere, the corona, becomes visible. During totality, the area inside the moon's shadow is cloaked in twilight a very different feeling to experience in the middle of the day. Just before and just after totality, observers can see this cloak of darkness moving toward them across the landscape, and then moving away. These effects are not visible during a partial solar eclipse, so sky watchers are encouraged to see if they are inside the path of totality during the total eclipse. (space, 2017).

A totality rarely lasts more than several minutes. Nevertheless, it is considered to be one of the most awe inspiring spectacles in all of nature. The sky takes on an eerie twilight as the Sun's bright face is replaced by the black disk of the Moon. Surrounding the Moon is a beautiful gossamer halo. This is the Sun's spectacular solar corona, a super-heated plasma two million degrees in temperature. The corona can only be seen during the few brief minutes of totality. For amateur astronomers and eclipse chasers, an eclipse of the Sun presents a tempting target to photograph (Mreclipse, 2014)

There are 5 stages in a total solar eclipse as described in timeanddate (2017):

Partial eclipse begins (1st contact): The Moon starts becoming visible over the Sun's disk. The Sun looks as if a bite has been taken from it.

Total eclipse begins (2nd contact): The entire disk of the Sun is covered by the Moon. Observers in the path of the Moon's umbra may be able to see Baily's beads and the diamond ring effect, just before totality.

Totality and maximum eclipse: The Moon completely covers the disk of the Sun. Only the Sun's corona is visible. This is the most dramatic stage of a total solar eclipse. At this time, the sky goes dark, temperatures can fall, and birds and animals often go quiet. The midpoint of time of totality is known as the maximum point of the eclipse. Observers in the path of the Moon's umbra may be able to see Baily's beads and the diamond ring effect, just after totality ends.

Total eclipse ends (3rd contact): The Moon starts moving away, and the Sun reappears.

Partial eclipse ends (4th contact): The Moon stops overlapping the Sun's disk. The eclipse ends at this stage in this location (timeanddate, 2017).

3.4 Eclipse chasing

Eclipse chasing is a kind of astrotourism including trips and adventures to observe eclipses round the world. Kate Russo (2012), is an Australian physiologist found herself addicted to eclipse chasing since 1999 on her first total solar eclipse observation. She describes eclipse chasing as a total addiction and believes that for many who have experienced totality, once in a lifetime is not enough. They may travel to see another totality, willing to repeat the experience and find themselves addicted to eclipse chasing.

Eclipse chasing is an adventure with a specific purpose. *Although most travel might be considered to have a special purpose eclipse chasing is one of those rare situations where the purpose is a climatic event* (eclipse-chasers, 2015).

Because total solar eclipses are rare in a specific location and they usually occur somewhere else in the world, it requires travel over great distances to experience them. (Percival, 2015). The same author as an astronomy educator since 1969, invites us to his challenge offering the further suggestion regarding the total solar eclipse of 2017 in the United States:

1. Every school-age child in the path of totality gets to see the eclipse.
2. Every person in the path of totality sees the eclipse.
3. Every person within two hundred miles of the centerline sees the eclipse.
4. As many people as possible from the rest of the world see the total solar eclipse.

Rick, a well experienced eclipse chaser argues that eclipse chasing is pretty difficult, some destinations one may get taken to are very remote and expensive to go. However, he encourages people to experience total solar eclipses as an unforgettable memory of life (Russo, 2012).

3.4.1 History of eclipse chasing

For centuries, astronomers have been traveling round the world to observe and record astronomical phenomena such as eclipses, transits etc. According to NASA (2017) In Ancient China, solar and lunar eclipses were known as astronomical signs to foretell the future of the Emperor. The ancient Chinese believed that solar eclipses occur when a celestial dragon

devours the sun. They also believed that this dragon attacks the Moon during lunar eclipses. In the Chinese language, the term for eclipse was "shi" which also means "to eat". The same report by NASA mentions that Babylonian Clay Tablets provide physical records of ancient eclipses viewed by humans, in this instance between 518 and 465 BCE. Babylonian astrologers kept careful records of celestial events including the motions of Mercury, Venus, the sun, and the moon on tablets dating from 1700 to 1681 BCE. Later records identified a total solar eclipse on July 31, 1063 BCE, that "turned day into night," and the famous eclipse of June 15, 763 BCE, recorded by Assyrian observers in Nineveh.

Russo (2012) mentions that according to the *Scientific American* journal, reported eclipse expedition findings and reports dating back to the late 1800s make reference to esteemed individuals who would travel alongside scientific expeditions to the path of totality. She believes that modern day eclipse chasing tours began in 1972, when the cruise ship "Voyage to darkness" sailed 900 miles from New York to intercept the path of totality. However nowadays thanks to technology and traveling facilities, traveling to the path of totality is much accessible. Moreover, it would be much easier to obtain right information, access to weather forecasts and find the best locations to experience totality.

3.4.2 Eclipse chasers

Eclipse chasers are people from different ages, backgrounds and interests willing to see eclipses. They may do whatever they can to be in the path of totality or annularity of a solar eclipse even if it's among the remotest areas of the earth. As mentioned previously many eclipse chasers have found themselves addicted to travel and see solar eclipses. Russo (2012) defines an eclipse chaser as: "*an individual who has made a life choice to give in to their insatiable desire to re-experience the thrill and excitement of totality".* She explains that not everybody who observes a total solar eclipse goes on to be an eclipse chaser since for many people observing an eclipse can be great but enough once. According to her opinion what makes eclipse chasers different from other observers is their amazing passion to chase solar eclipses. On the other word, solar eclipse becomes a main reason for the eclipse chasers to get together along the path of totality or annularity every year or couple of years to celebrate their new experience. Russo also describes eclipse chasers as travelers with a tolerance of flexibility.

3.4.3 Eclipse tours

Solar eclipses are great events which generate interest among the public and promote tourism. If anyone round the world is willing to see the eclipse, they have to travel to the path of totality or annularity. An eclipse trip can be planned independently or in an organized. Harrington (1997), describes the advantages of each options. He mentions monitory savings as the most important positive point of individual eclipse trip. Moreover, travelling independently increases creativity according to the travelers tastes, especial needs and limitations. For instance, it gives more flexibility to independent travelers to escape probable cloudiness and move to a better location. However solar eclipse tours have become increasingly common and popular recently responding to the eclipse chasers needs. Eclipse tours offer a certain scenes of security that traveling independently does not. Big tours arrange observing sites, transportation during the trip, offer local guide who is dominant to the area and suggest the best accommodations close to the observation site. Many prearranged tours include seminars and lectures about the event, eclipse photography etc. Harrington explains that accommodation and transportation reservations could be a serious concern for the individuals since it might be totally booked by the big tour operators and travel agencies. It is highly suggested to be arrive at the final destination a few days before the event to see the situation and select a suitable view. Nussbaum (2016) has enjoyed his eclipse chasing experience in a professional organized tour and he suggests it to people. Moreover, professional eclipse tour organizers have access to weather forecasting experts and data sources and they accept the responsibility to move the group to an alternative site.

Cruising ships are other options offered by eclipse tour organizers to observe a total solar eclipse at sea. The tour can approach a cruise ship company and charter all or part of a ship. In this case, the eclipse tour operator, resells tickets to the pre-arranged eclipse cruise. The ship can be totally filled with eclipse observers willing to see the total solar eclipse and celebrate the event together. Relevant lectures and meetings can be organized in the cruise. A day before, safety glasses and filter are given to the passengers and they are ensured that the captain will do the best to get to the centerline consulting with weather experts (Nussbaum, 2016).

3.5 Solar eclipse observation

Solar eclipse, especially a total one can be really inspiring for many people and simply observing this spectacular event has changed some people's life. Percival (2015) describes a total solar eclipse as a great teachable moment. As an astronomy educator he believes that eclipse can be a perfect opportunity for kids to contribute to scientific research. Unfortunately, in some places people have forbidden and prevented children from observing total solar eclipses since they have heard of the injuries that can occur to their eyes. Percival strongly recommends safe observations and suggests: " *Go See the Eclipse and Take a Kid With You*".

3.5.1 Observing safely

Dennis di Cicco remembers that in 1976, Australian government was warning that people should stay in their houses to avoid the dangers of the eclipse. In 1979, Steve Edberg was in Canada remembers that students had to have notes from their parents to be allowed outside during the eclipse and many kids watched the eclipse on television. George lovi, Alan Fiala and others remember the eclipse of 1983 in Indonesia when school children on government orders, were kept indoors forbidden to see the eclipse except on television (Littmann, M., Espenak, F., & Willcox, K. 2008). The same authors explain that during the total solar eclipse it's completely safe to look directly at sun's face without any filters. However, all experts such as Bakich (2016), express that *"it's never safe to look at a partial or annular eclipse or the partial phases of a total solar eclipse, without a proper equipment and techniques."* The only time to see the Sun safely with the naked eye is during a total eclipse, when the Moon completely covers the Sun. Even when 99% of the Sun's surface is obscured during the partial phases of a solar eclipse, the remaining crescent Sun is still intense enough to cause a retinal burn, even though illumination levels are comparable to twilight (Chou 1981 and 1996, and Marsh 1982).

Jay A Pasachoff argues that in the days before a solar eclipse, media often covers, warning about the dangers of looking at the eclipse. Unfortunately, despite the good fact behind these messages, they often have misinformation, and may be designed to scare people from observing the eclipse at all. This tactic may backfire, however, particularly when the messages are intended for students. A school student who heeds warnings from teachers or other authorities not to see the eclipse to avoid injuries, and later learns that other students have observed it safely, may feel cheated out of the experience. Having now learned that the authority figure

was wrong on one occasion, how is this student going to react when other health-related advice about drugs, AIDS3, or smoking is given (Espenak & Anderson, 2008).

3.5.2 Best locations to see solar eclipses

Totality and annularity usually has a long narrow path on Earth. It's important to find the best locations within the path of totality. The width of the path often doesn't exceed 200 kilometers and the center line has the maximum length of totality or annularity. The eclipse won't be seen total/annular out of this path and people should try to find the best places within the path. Experts highlight the importance of being within the path of totality to see the glory of solar eclipse. Bakich (2016) argues that "*it's all about totality".* The eclipse will be partial out of the path of totality and only totality will reveal the true celestial spectacle. He compares a partial eclipse to a total eclipse like almost dying to dying. Also Jay M. pasachoff argues about the importance of being within the path of totality. He explains that: "*some people see a partial eclipse and wonder why others talk so much about a total eclipse. Seeing a partial eclipse and saying that you have seen an eclipse is like standing outside an opera house and saying that you have seen the opera; in both cases you have missed the main event."* (Littmann, M., Espenak, F., & Willcox, K. 2008).

Path of totality often crosses over remote areas on Earth. Eclipse maps show us where exactly the totality occurs on earth. Once the general area for observing the eclipse is determined, the next concern would be selecting a specific location free of tall buildings, trees, mountains etc. It is suggested to avoid wild life and grazing animals since they may react oddly to the eclipse (eclipse-chasers, 2015).

Observation site should be flat, as high above sea level as possible to avoid low-lying haze, clouds and fog. It is highly recommended to select a location accessible by roads and other means of transportation (Harrington,1997).

Cruising can be a unique opportunity and unforgettable experience for eclipse chasers when the path of totality crosses waters of the earth. Travelling to the heart of the path on cruise ships has become more common nowadays as a luxury travel. An eclipse tour can charter all or a part of a ship and that would be a perfect chance for hundreds of observers on a ship to observe this big event and keep it as a memory that you will not soon forget (Nussbaum, 2016).

However, it’s not all about the luxury; cruise ship can offer different features that are not available to land based observers: mobility and great weather information. Unless the weather situation is hopeless over a large area, there is a good chance that cruise ships can change location toward a clearer sky (eclipse-chasers (2015).

Although eclipse observation is much more recommended from land, however sometimes eclipse chasers try viewing from the air. Nussbaum (2016) discusses the advantages and disadvantages of solar eclipse flights. Professional eclipse chasers sometimes charter a large jet to chase the shadow appears in an inhospitable area. Moreover, such a flight can help observers have a longer totality, avoid cloudiness and have a wide panoramic view. The author mentions high cost of the flight as the main disadvantage of viewing from the air. On the other hand, limited space for observation, small windows and complicated photographing condition through the windows are other negative points.

3.5.3 Eclipse observation in cultural and natural sites

Cultural and natural sites along the path of totality and annularity can be considered as the specific potentials to as observation sites to host eclipse observers. They can offer good situations for observing the eclipse and photographing memorable photos next to the natural and cultural elements, moreover, the eclipse provides a unique opportunity to promote tourism there. UNESCO heritages, national parks, biosphere reserves and other local protected sites along the path of totality or annularity can be prepared to celebrate the event in the local communities. Especially when the eclipse occurs close to horizon astrophotographers will be motivated to capture the memorable moments next to the natural and cultural heritages.

Nussbaum (2016), mentions how interesting would be a low elevation eclipse to create a unique photograph that might be impossible with a high sun. Astrophotographers will plan to capture the eclipse and cultural or natural landscape in the same frame. The author also refers to the optical effects to be appeared in a very low altitude especially when the eclipse is happening by sunrise or sunset.

Since the three eclipse paths of this report crosses a great number of biosphere reserves in Spain, considering the relevant objectives of the Man And Biosphere program for tourism sustainable development, the further literature review addresses the role of biosphere reserves in organizing and hosting the eclipse events.

3.5.4 Biosphere reserves as eclipse observation sites

The UNESCO World Network of Biosphere Reserves (WNBR) covers internationally biosphere reserves to demonstrate a balanced relationship between people and nature. UNESCO (2017), defines Biosphere reserves as areas comprising terrestrial, marine and coastal ecosystems. *"Each reserve promotes solutions reconciling the conservation of biodiversity with its sustainable use. Biosphere reserves are 'Science for Sustainability support sites' – special places for testing interdisciplinary approaches to understanding and managing changes and interactions between social and ecological systems, including conflict prevention and management of biodiversity."*

The MAB Program contributes to global efforts for education and capacity building, particularly within the framework of the 2030 Agenda for Sustainable Development and its Sustainable Development Goals. Education, communication, and public awareness are essential elements in ensuring improvements in the quality of life of all people and their environment, eradication of poverty, reducing inequalities and promoting sustainable development and that's the main mission of the MAB program.

"The MAB Program develops the basis within the natural and social sciences for the rational and sustainable use and conservation of the resources of the biosphere and for the improvement of the overall relationship between people and their environment. It predicts the consequences of today's actions on tomorrow's world and thereby increases people's ability to efficiently manage natural resources for the well-being of both human populations and the environment." (UNESCO, 2017).

According to the UNESCO, the MAB Program strives to:

- identify and assess the changes in the biosphere resulting from human and natural activities and the effects of these changes on humans and the environment, in particular in the context of climate change;
- study and compare the dynamic interrelationships between natural/near-natural ecosystems and socio-economic processes, in particular in the context of accelerated loss of biological and cultural diversity with unexpected consequences that impact the ability of ecosystems to continue to provide services critical for human well-being;
- ensure basic human welfare and a liveable environment in the context of rapid urbanization and energy consumption as drivers of environmental change;

- promote the exchange and transfer of knowledge on environmental problems and solutions, and to foster environmental education for sustainable development.

3.6 Weather planning

Selecting a location based on weather statistics require a bit of research and looking at temperature or cloud cover maps may not be enough. A micro-climate can change seeing the eclipse to just watching the clouds go dark. Eclipse-chasers (2015) suggests observers to start with weather planning a year or so before the eclipse. After selecting the best locations within the path of totality the most important factor in choosing where to go and observe an eclipse is weather. Professional eclipse chasers stay flexible the night before the eclipse to change their location and avoid cloudiness (Nussbaum, 2016).

When it comes to weather planning for solar eclipses, Jay Anderson stands out. As a meteorologist he produces weather statistics and predictions for all the eclipses. Anderson helps eclipse chasers with climate patterns and long term cloud cover maps along the path of totality. Almost all eclipse chasers use his predictions to make their own plans and find their final location (Russo, 2012).

Proper internet connection in the observation site will give the opportunity to study the latest satellite maps and make decisions to change the location if weather condition is worsening. In this way observers should head off in the right direction trying to beat the clouds (Harrington,1997).

3.7 Community planning

Planning an event can be a daunting effort. Organizing a great eclipse event will be impossible without early, proper and comprehensive planning in the host community. Many local and international organizations and entities can be involved and cooperate in holding the event and a comprehensive, effective planning is necessary to further exploit the potential of relevant sectors. Kate Russo is an eclipse chaser and consultant that kindly helps host communities of the path of totality prepare for the event. Bakich (2016) mentions her three following core massages as the main points in community planning:

1. *Start early.*

2. *Focus on the community in addition to eclipse tourist.*
3. *Consult with eclipse experts to prepare for the unknowns.*

Russo describes that: "*Eclipse planning usually occurs in regions that have no living memory of seeing a total solar eclipse. Even the planners usually have never experienced the phenomenon. The community, therefore, will not know what an eclipse is, what it means for them and what they should do to prepare".* Moreover, she emphasizes that planning should start years before the event especially if the community is one of the main destinations on the earth to host eclipse chasers. Kate Russo addresses the difficulties to secure money for the relevant activities since most funding sources are unaware of glorious and important the eclipse will be. As an eclipses planning consultant she believes that the areas within the path of totality benefit significantly in short and long term from the sheer scale of visitors and huge media interest. Russo mentions the following needs to be fulfilled by founding in the host community: "*It can ensure a dedicated Eclipse Coordinator for the region; it can facilitate the wide promotion of the region; it helps to secure printed materials, signage, venues and other necessities related to eclipse viewing and celebratory events; and it can fund the purchase of eclipse glasses for the community."*

Although hosting an eclipse event can have substantial benefit for the public and private sector however it's pretty difficult to convince local organizers to cooperate and invest in the project because often they view the eclipse as a short tourist event only. Russo has already had the experience of being involved in community eclipse planning and consultant for two eclipses of 2012 and 2015 and she expresses that: "*Local council and government funding are essential to facilitate eclipse planning."* Moreover, she explains that "*The Eclipse Coordinator typically works in a tourism capacity but should have strong government links."* Bakich (2016).

Russo, strongly invites eclipse host communities to develop an Eclipse Task Force consist of a range of stakeholders such as representatives from tourism, government, policing, event coordination, creative industries, education, health, business, and local media. She highly suggests that a community supplements its Eclipse Task Force with expert advisors to reduce the unknowns and recommends the following key advisers to consider with their potential roles: Astronomy expert, science educator, weather expert and eclipse chaser.

According to Russo's experience the general public doesn't see how an eclipse is relevant and important for them. She argues the negative coverage of unrealistic numbers, traffic gridlocks, food shortage, outrageous prices, estimated figures for the local economy and scientist flocking

to the region can all be off-putting for locals to constantly hear about, and potentially damaging to the tourism reputation of the region (Bakich, 2016).

Russo describes that one of the greatest benefits for the host community can provide by media coverage before and during the event. Along with factual information about the eclipse, those people addressing the media must have right details about the tourism activities in the area, statistics of hotel reservations, weather forecasts etc.

As an expert the author mentions that a total solar eclipse imparts a long term legacy to the host community including a significant economic benefit, new strategic partnership, international exposure, new tourism connections and a feel-good factor that lasts a life time. Russo has started her eclipse chasing life since 1999 and finds total solar eclipse as an inspiring event for kids and adults. On her opinion planning for a total eclipse in the region is challenging but exciting and rewarding. "*A total solar eclipse provides a unique opportunity to promote your region to the whole world."* Says Russo. (Bakich 2016).

3.8 American great eclipse in 2017

In this part of the thesis, literature review addresses the great American eclipse due to its importance as good pattern for Spain to be prepared for its similar event in 2026, 2027 and 2028. On Aug. 21, a total solar eclipse will be visible from a vast area of United States. From Oregon to South Carolina, the eclipse will trace a 67-mile-wide path of totality across the country and millions of Americans will witness a once-in-a-lifetime event as the Moon passes between the Earth and the Sun and day turns to night for up to about two minutes. Pacific to Atlantic totality across the whole country is rare. It last happened in 1918. Also this eclipse is the first total solar eclipse visible from the contiguous United States in more than three decades. Bakich (2016), believes that this eclipse might be the most viewed sky event in history and probably the number one most-watched sky event so far and he mentions four reasons for that:

1. The attention it will get from the media.
2. The superb coverage of the highway system in US.
3. The typical weather throughout the country on august 21st.
4. The vast number of people who will have access to it from nearby large cities.

NASA works with a wide variety of means including museums, science centers, and planetariums, national parks, civic groups, amateur astronomy clubs, after school programs, and conferences to share its mission of exploration and discovery. For the 2017 Eclipse, NASA and its science education partners have developed numerous products and programs designed to teach the science of eclipses, as well as to share stories and insights into the human experience of a total solar eclipse (eclipse2017, 2017).

United States started early planning a couple of years before the event cooperating with relevant organizations. "*August 21, 2017, might seem a long way off, but for the astronomically astute the clock is ticking, and there's no time to waste. Between now and then, we need to figure out how to ensure a good experience for the estimated 500 million people across North America who will stand in the Moon's shadow that day."* (skyandtelescope, 2015).

local officials along the path of totality are planning ahead to ensure that visitors and local community members alike will be able to attend this once-in-a-lifetime event in a safe and enjoyable setting. Out of the path of totality visitors are encouraged to arrive at least a day early to avoid last-minute traffic on local and state highways. As an example Oregon is going to be one of the best states to host eclipse chasers and observers due to the weather forecasts and cloud cover maps. "*As part of its 150th anniversary festivities, Oregon State University will be hosting a fun, informative, family-friendly weekend to celebrate the eclipse. Packages that include on-campus lodging and meals are available. The three-day event will include an outdoor concert on Sunday, Aug. 20 on the Memorial Union quad. The entire community will be invited to a free viewing event on the quad on Aug. 21 to watch the eclipse."* (visitcorvallis, 2017).

To encourage people not to miss the event and promote it among people, public libraries across the United States will distribute more than 2 million pairs of free eclipse glasses to observers for the total solar eclipse that will sweep over the country on Aug. 21, 2017. The glasses will be provided by a major outreach program initiated by the Space Science Institute (SSI). "*Some 4,800 library organizations throughout the country will be giving away free glasses as part of an outreach project funded by a grant from the Gordon and Betty Moore Foundation to SSI, a nonprofit corporation focused on science research, education and outreach. The project is also supported by Google, the National Science Foundation (NSF) and NASA, according to a statement from the SSI*." (accuweather, 2017).

CHAPTER 4: EMPIRICAL STUDY

The following chapter of the thesis addresses the empirical study of the research. First of all, we will get to know how the survey was formed and designed according to the public and objectives of the research. We will review the answers of each question separately and then analyze the obtained results. Moreover, reliability and validity of the survey will be discussed and will are going to have an overall conclusion of the empirical study.

4.1 Questionnaire design

The survey was created as an online google questionnaire in two types. One for astronomy experts and eclipse chasers and the other one to offer to unprofessional people. The content of the both surveys was similar with some additional description and questions to ask experts. Both questionnaires were in English as an international language to present the research worldwide. The survey of experts contained seventeen questions and that of unprofessional people contained twelve. Both surveys begin with a short description to explain the event and this rare opportunity for Spain to observe three solar eclipses in three consecutive years.

In the following part important questions of the survey will be studied separately, presenting statistics, diagrams and the result analysis. Since there are two types of surveys each one will be evaluated separately.

4.1.1 Survey type (A), Respondents: Astronomy experts and eclipse chasers

The first three questions of the survey are about demographic data. First of all, it asks the name of the respondents to follow up the issue later. In other words, it was important how each of the famous experienced eclipse chasers answer to the questions.

The second question is about the age of the people. The average age of all respondents was 64 years, 56% of them were more than 50 years old and 44% were 50 years old or younger. 11% of the experts had more than 70 years old and there were no respondents younger than 29 years old.

The third question asks the country of residence of each person. 50% of the respondents are European Union residents, 33% from US and Canada and 17% from other countries.

The forth question addresses the eclipses of Spain. They were asked how interested they are to see these three eclipses (Figure 3).

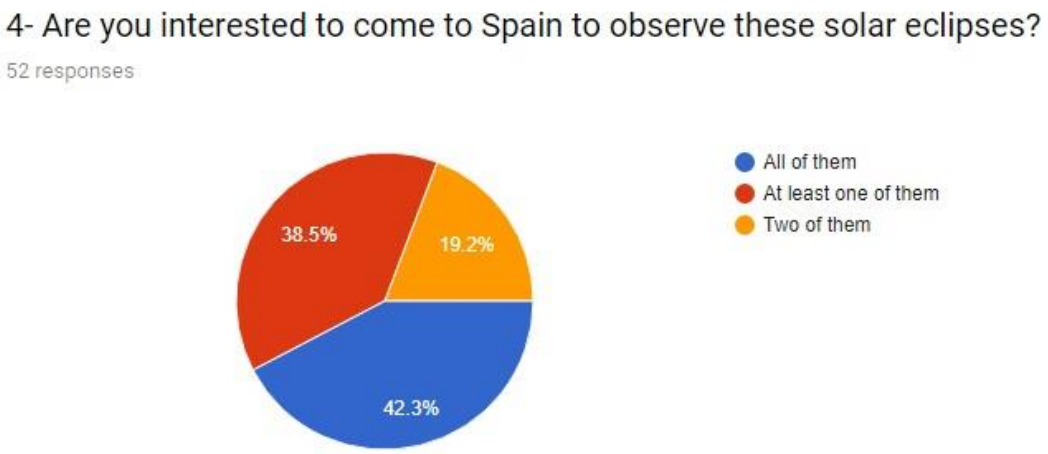

Figure 3: Are you interested to come to Spain to observe theses solar eclipses?

Almost 42% are interested to see all of them, 38% have voted for at least one of the eclipses and 20% express that they would like to come to Spain and observe 2 of the eclipses. As it was expected a good number of eclipse chasers and astronomers are interested to choose Spain to observe these eclipses. The reason can be the safety of the country, importance of geographic situation of Spain to observe the eclipses and ease of access for the majority of the people.
The next question is addressing **the most important factors to choose a final destination to observe an eclipse** and wants experts to evaluate each factor.

40% of the respondents evaluated **safety of the country** very important, 48% considered it important and the rest of them found it not important.

Selecting a cheaper destination was not important for 40% of them, important for 48% and very important for the rest.

Choosing an area with a longer totality, was very important for 30%, important for 56% and it was not a big concern for the others.

However, **a destination with better tourism facility** was not important for 44% of the experts, important for 46% and very important for the rest of them.

A place **where they can meet other experts** was not important for 73% of the respondents, important for 15% and very important for a couple of them.

Choosing **a destination where clearer sky will be more probable** was very important for almost 85% and important for 15% of the experts.

Selecting **a destination where they can have more activities a part from the eclipse observation** was important for 42%, very important for 25% and not important for the others.

As it's obvious, finding a clear sky is always the biggest and the most important concern for professional eclipse chasers, whereas tourism facilities and luxury is much less important for them. Eclipse chasing is normally an expensive adventure and eclipse chasers may pay as much as they can in order to obtain a good result. That's why having an economy trip is not a big concern for many of them. Although a longer totality will be really important for astronomers and eclipse chasers, however they are flexible to move along the path of totality and choose a destination that has a shorter totality but better safety and cloudiness condition. Sometimes professional astronomers organize common scientific projects cooperating with other experts so they may want to join and observe the eclipse in a group but some other people such as astrophotographers may prefer to be away from the crowd and take photos in a silent place. Other activities a part from the eclipse observation is not a big concern for the experts however they express that they are interested to join.

The question number 6 askes if experts prefer to observe the eclipse individually or in small or big groups. About 60% of the respondents prefer to observe the eclipse alone or in a small group away from others, 11% prefer to view it in groups of astronomers but not with unprofessional people and17% have mentioned that they don't care. Moreover, some respondents have answered to this question in different ways. For example, two of the experts have expressed that they usually lead or guide eclipse tours so they would prefer to view in a location away from other crowds but within their own crowd. A few respondents have mentioned that it's necessary to be away from others. They would like to see the eclipse in a small group of eclipse chasers or amateur astronomers but that may also include first time eclipse observers.

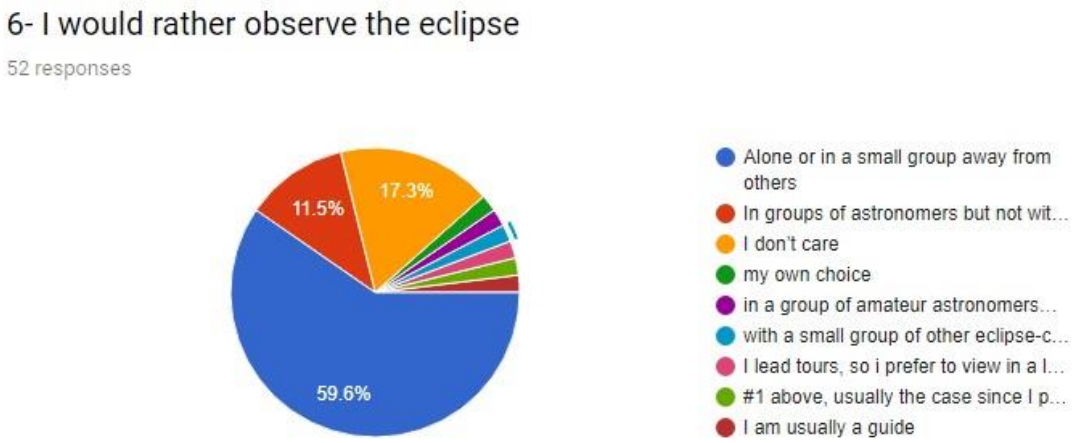

Figure 4: How would you rather experience observing a solar eclipse?

The result shows that most astronomers prefer to be away from the crowed preferably not to observe the eclipse in big and public groups (Figure 4).

The seventh question contributes to know If they finally choose Spain to observe the solar eclipse of 2026, where they would rather observe it? Respondents are supposed to choose one of these four answers: Big city, small city, village or a remote area.

52% of the experts have answered that there would prefer remote areas, 34% have voted for villages, 12% have chosen small cities and only 2% have commented big cities (Figure 5).

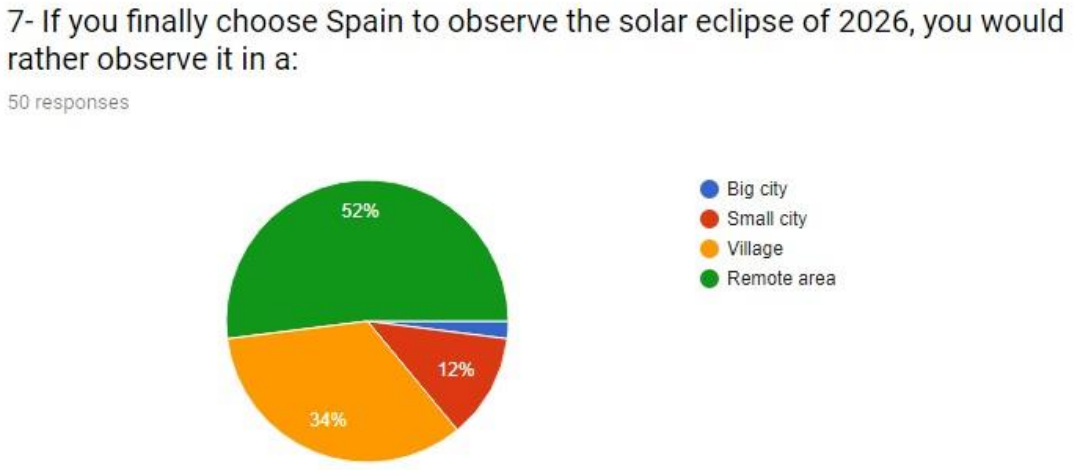

Figure 5: Where would you rather observe the eclipse of 2026 in Spain?

The answers are absolutely consistent with their most important concerns such as being away from public crowds and flexibility to move along the path of totality in order to find a better weather condition as well as a longer totality.

In the further question experts are asked if they would prefer to travel by own planning, buying travel packages or a combination of the both options. As seen in Figure 4.4, more than 71% expressed that they prefer own planning during the whole journey, 21% would like to try their individual plan and maybe some travel packages in some parts of their trip. No one would choose a whole travel package and some would like to be flexible.

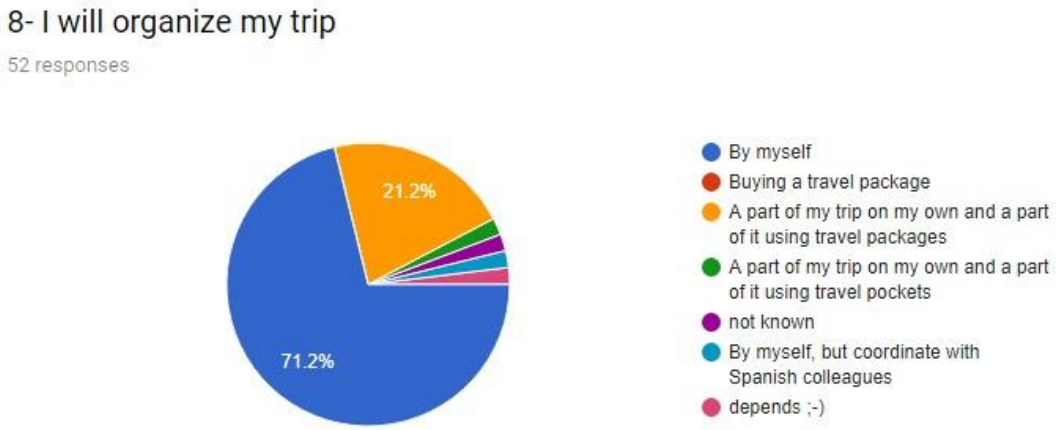

Figure 6: How will you organize your eclipse trip?

Eclipse chasing and solar eclipse trip is a very specific and unique adventure in which important scientific facts, weather conditions etc. have crucial influences on travel planning. That's why experts try to organize their travel by themselves. In other words, no one can understand eclipse chaser's serious concerns better than themselves. That´s why they usually avoid travel packages.

As previously mentioned marine trips for eclipse chasing are pretty expensive. It also doesn't cover one of the eclipse chaser's important concerns which is being away from crewed. In fact, eclipse chasers usually try cruise ships for the eclipse observation when the land condition is very bad because of the geographical limitations or bad weather condition.

In the 10th question we are trying to know if eclipse chasers would prefer to observe the eclipse of 2017 from Spain in the southern coast, from African countries, in cruise ships to go to the center line or if they have other opinions. As previously studied in this research, the eclipse of 2017 has the second longest totality of the century. Northern African countries have a better

situation in term of offering a longer totality, however Spain is the only European country in which the eclipse can be seen. That makes the trip somehow easier for the European residents. Although the central line will not even cross Spain, the totality is more than 4 minutes from the southern coast which is two times longer than the totality of 2026 in Spain or that of 2017 in the United States. Moreover, Spain seems to have great potentials to host eclipse chasers and in term of safety it can be one of the safest host communities along the path of totality, although still quite a long time is reaming.

The result shows that there is no general agreement on this regard among astronomers. 32% of experts have mentioned that its quite early to select a destination, they prefer to know more about cloud cover maps and have not suggested any area to see the eclipse. As seen in Figure 4.5, 30% of the respondents have voted for the southern coast of Spain whereas 30% of them have expressed that they might prefer the northern African countries. Also 8% may try cruise ships to go to the center line.

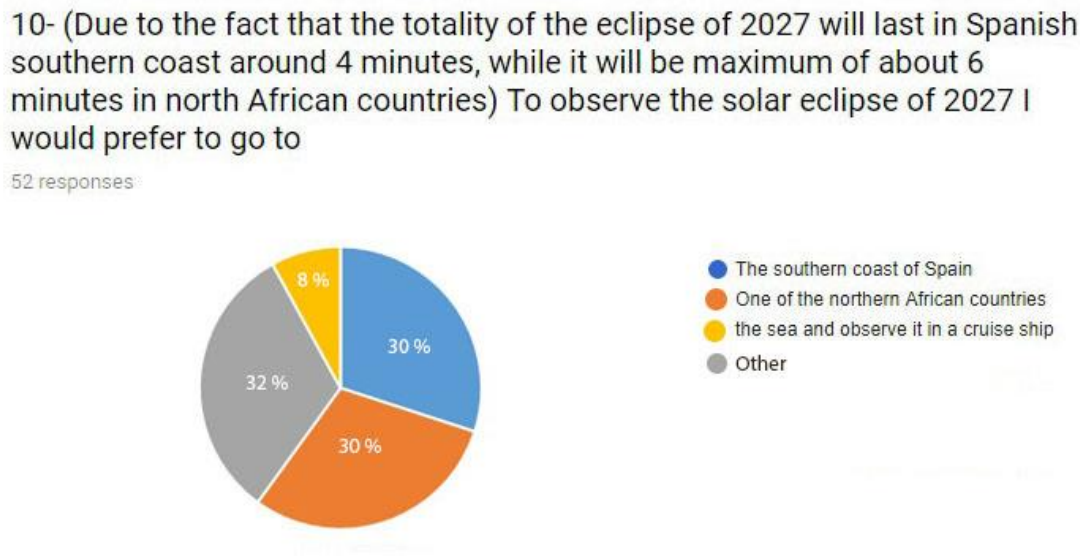

Figure 7: Where would you rather observe the solar eclipse of 2027?

In the next chapter we will see that cloud cover map predicts clear skies in both Spanish southern coast and northern African countries whereas, in the Mediterranean Sea morning cloudiness is predicted in August. Definitely it's quite early to select a final destination for this important eclipse since other variables such as political issues, safety of the area, new weather models etc. may overshadow the final decision.

The next two questions help us to realize how important would be the annular solar eclipse of 2028 among respondents including professional and amateur astronomers, eclipse chasers and astrophotographers. More than 46% of the respondents have stated that they are interested to see this eclipse but not sure if they make a serious plan for it. About 30% of them have answered that they are interested and definitely they will make a plan to observe it. Finally, the rest of the respondents including 23% of all have expressed that they are not sure if they make a plan to travel and observe this annular eclipse (Figure 8).

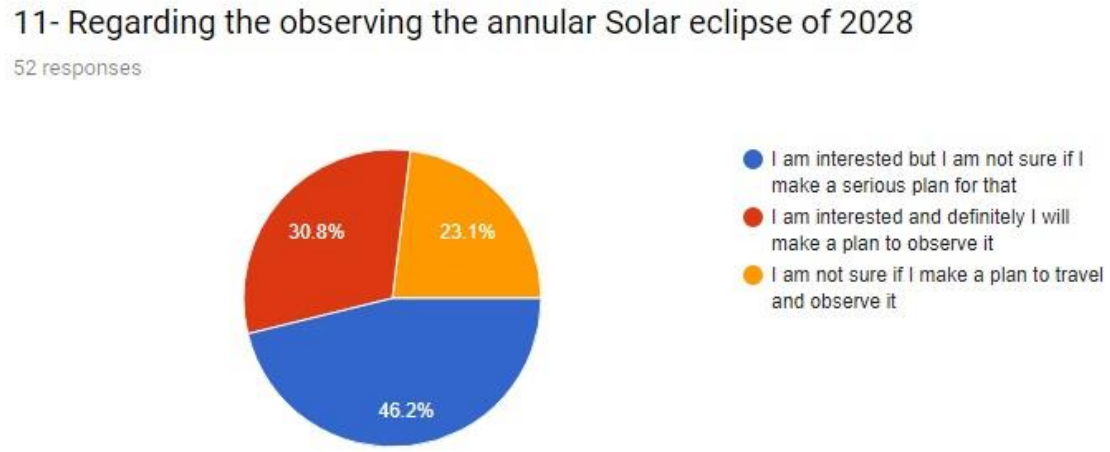

Figure 8: Will you plan to observe the annular solar eclipse of 2028?

As previously described, generally most astronomers and eclipse chasers don't travel faraway to observe an annular solar eclipse since annularity is not that important or spectacular for them. There are two interesting comments by two of the most famous eclipse chasers in this regard. *Much less people travel for annulars, so because Spain has two totals in two years' time.* Xavier Jubier, the French eclipse chaser states that: "*Those choosing Spain for the totals are unlikely going to choose Spain for the annular unless they live near and on a tight budget."* However, Jay Anderson, the Canadian astronomer have mentioned that: "*I'd like to see the annular at sunset."*

After that astronomers were asked where they might observe the annular solar eclipse of 2028 in case they are interested to observe it. 77% of respondents have preferred Spain, 8% have voted for southern American countries and the rest of them have stated that it's too early to decide for this eclipse (Figure 9).

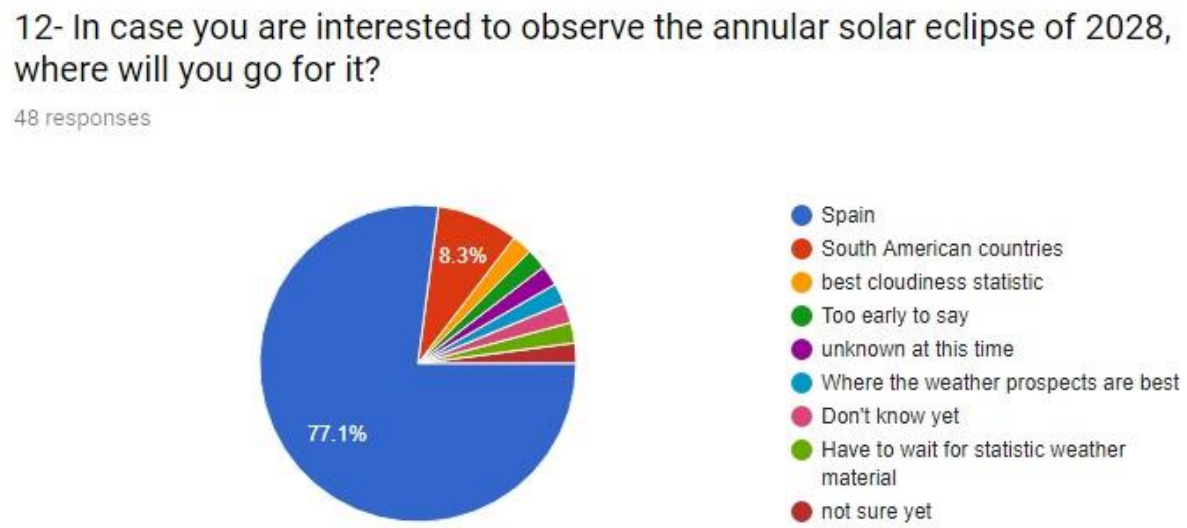

Figure 9: Where will you observe the annular solar eclipse of 2028?

However, analysis of the result of the 11th and the 12th shows that this annular solar eclipse offers much less opportunity to Spain for hosting international tourists.

In fact, this annular solar eclipse can be more important for the local habitants, educational and astronomical centers within or near the path of annularity or some astrophotographers to capture the remaining ring of the sun above the horizon.

The question number 13 asks the respondents If they come to Spain to see one of the solar eclipses and they have enough time would they spend more days in the country to enjoy their time? 60% of experts have stated that they will stay at a week or more to see the country and almost 40% have answered that they will stay at least a few days (Figure 10).

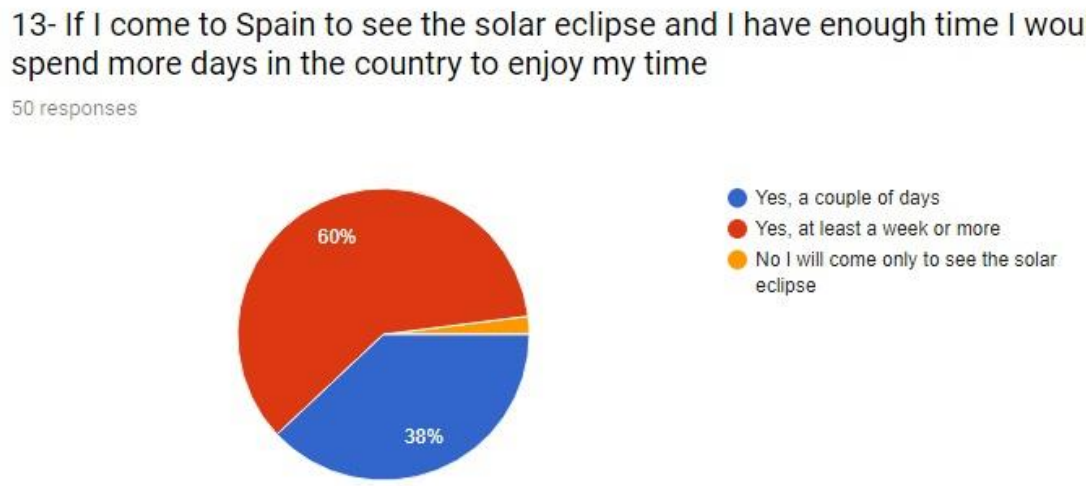

Figure 10: Will you stay more days in Spain a part from the eclipse day?

The result shows that most eclipse chasers will stay more days in Spain to have more activities enjoying the country. It shows that Spain should be well prepared to host a remarkable number of tourists not only during the eclipse day. The whole country especially the regions within or close to the path of totality should be ready in many ways to host the eclipse chasers and all observers traveling to see the eclipse. Moreover, that would be a great potential for the tourism sector and cultural entities to welcome to the travelers.

In the next question experts are asked if they would like to come to see the solar eclipse alone or with more people. Very few of the respondents have stated that they would prefer to travel alone whereas about 41% have answered that they are interested to come with friends and family, 25% with friends and 27% with their families (Figure 11).

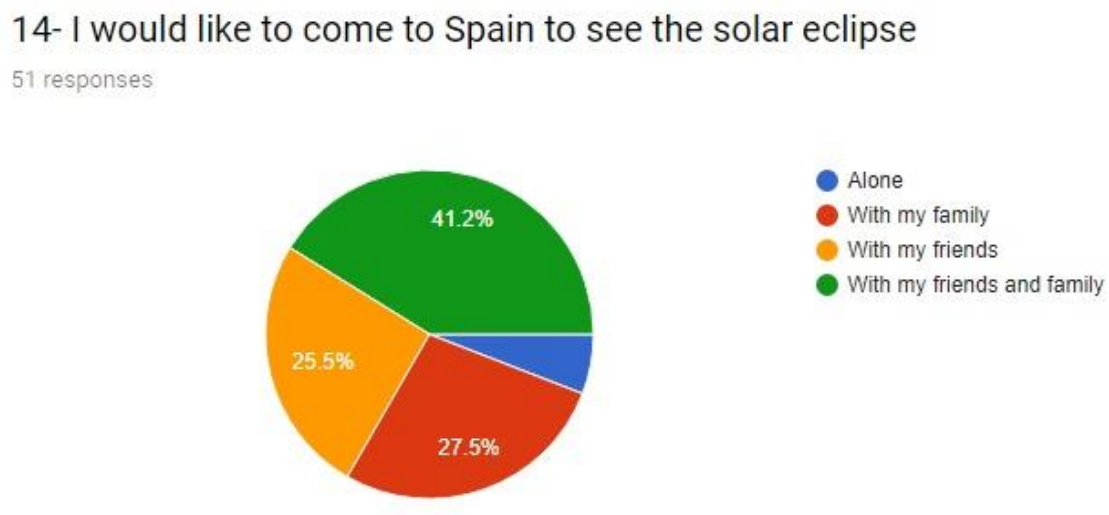

Figure 11: Will you come to Spain to observe the solar eclipse alone, with friends or family?

According to the reports of the eclipse chasers, they sometimes travel to the path of totality with some friends and families. Especially when the eclipse happens in a safe and interesting destination with ease of access, it motivates astronomers to travel with their couples, children or friends. In other words, eclipse chasers usually bring more travelers with themselves to the region in order to celebrate the unforgettable moments together. That gives a good opportunity to the tourism industry to welcome to more and more travelers.

When experts were asked about their most important requirements in the host country or the region, once again almost all of them have mentioned that having clear skies and safe locations will be the main important concerns for them. Moreover, some others have expressed the following items as their reqirnemts or concerns:

- Good food, good company, good environment
- Ease of access
- Interesting scenery and environment
- electricity, being far from the crowds
- Weather, duration of totality, other places of interest in the region, facilities (toilets, restaurants, accommodation etc.). In the case of Spain, I would also avoid any region where they have bullfighting!
- Nice landscape so that I can also take some wide angle shots.
- tourist visa procedure
- I would prefer somewhere which is clean with beautiful landscape. I'd like to observe the eclipse without stress. I mean somewhere which is rather calm which can have better concentration. It is also fine to have people around but not too many people.

In the next question experts are kindly asked to help the research with their suggestions according to their great experiences on eclipse chasing and observation. The following opinions were collected by experts that most of them are among the well-known eclipse chasers:

- The solar eclipses can be lively broadcasted on TVs during this decade till 2026. This will increase the awareness.
- I would propose a travel package with the eclipse.
- I came to Spain for the annular Solar eclipse of 3rd October 2005 and observed it in good conditions from Parque del Retiro, Madrid. Then I went on to spend 2 more days in Barcelona, making this a 6-day trip in Spain.
- Observing the effects of totality on the local environment is important. This is one of the reasons I tend to prefer to observe from land. On the other hand, when viewing from the ocean offers improved chances to see the eclipse, I am willing to go to sea to observe.
- The three consecutive eclipses certainly put Spain in the spotlight!
- I don't really go out of my way for annular eclipses, and so knowing what I am doing for the annular in 2028 is just too far in advance. The totals, however, I'm 100% there, and planning!
- I will be in my mid-80's during these eclipses, so I hope that I am still healthy enough to travel and observe them. My wife and I are mainly interested in recording Baily's beads, to analyze for studying possible small variations of the solar diameter.

- An important parameter for me is to be able to move some hours before the eclipse, according to the weather forecast; then it is important to try to avoid crowds, because it can generate traffic jams that can prevent you from moving just before the eclipse. It's also important that everyone (including Spanish people of course) can buy cheap eclipse safety glasses for the partial phases.
- Pre-planning is a very good idea.
- Tour guides should understand needs of eclipse observers as opposed to regular tourists; will be glad to comment further on needs of eclipse chasers.
- It's a good opportunity for tourism in Spain, an interesting an interested kind of tourism. It's interesting the research you have begun. Good luck.
- You might ask respondents to tell you the number of eclipses seen to date. Eclipse chasing has become a hugely capitalist enterprise for some parties over the years and some tours have evolved into a luxury offering for the rich. Try to separate the business interests associated with the eclipse community from the astronomers and the folks like me who just want to travel to a new part of the planet and see the marvelous event.
- Spain for the annular as I only observe these at sunrise or sunset.
- One of the most challenging parts for eclipse chasers are managing their photo and observation equipment. In this regard, the possibility to have specific facilities for the whole trip for a safe, easy and effective transportation with all those stuffs would be amazing!

At the end of the survey, experts are warmly invited to be in contact with the author and collaborate to develop the project.

4.1.2 Survey type (B), Respondents: Unprofessional people interested in astronomy

This survey is simpler than the first one since respondents are unprofessional people without any serious experience on eclipse events. So the questions are less than those in the previous survey, more limited and easier. The questions begin with asking demographic data. First of all, they are asked about their nationalities and ages. The average age of all respondents is 37 years, about 73% of them are younger than 40 years old and the rest of them are more than 40 years old. About 72% of the people are residents of the European Union and the rest of them from countries of all around the world. In order to inform Spanish people about the event and asking their opinions, an attempt was made to find a considerable number of Spanish

respondents. Finally, 34% of the whole respondents were Spanish and 38% from other European Union countries.

Then people were asked if they have ever seen any solar eclipses. More than 87% have answered that they have seen at least one from any types of the solar eclipses and the rest of them have never seen any.

In the further question Spanish respondents are supposed to answer if they are interested to travel to the path of the totality passing their country and see the eclipses. A half of the Spanish respondents have stated that they are interested to go to the central path and observe at least one of the eclipses.

After that, other respondents were asked a similar question. About 55% have answered that they are not sure if they come to Spain to see the eclipses, 34% have said that they would like to come to Spain and see at least one of them and about 8% are interested to come to Spain and see all the eclipses.

The important factors in site selecting to observe a solar eclipse is the next question they are asked. In the first survey, experts were asked a similar question. Definitely unprofessional people have different concerns than the astronomers so the result was predicted to be a bit different.

About 13% of the respondents have evaluated the **safety of the country** not important and the rest of them have expressed that it is important or very important.

Selecting a cheaper destination is very important for 37%, important for 48% and not important for about 15% of the people.

Choosing an area with a longer totality is an important concern for 52%, very important for 28% and not important for the rest of them.

Tourism facilities in the host country is not important for 57%, important for 35% and not important for about 10% of the respondents.

An observation site **where the respondents can meet experts** is not an important factor for 47%, important for 38% and very important for about 15% of the unprofessional people.

74% of the people have answered that finding a location **where clearer sky is more probable** is very important for them, 22% have evaluated this factor important and very few people have considered it not important.

The last item to be evaluated by the people was finding a destination **where eclipse observers can have more experiences a part from the eclipse observation.** 48% have answered that it's very important for them, 39% have considered it important and it has not been an important concern for about 12% of them.

It is obvious that, clearer sky and finding a cheaper destination are the most important concerns for the unprofessional eclipse observers. Moreover, many of the respondents are looking for other activities as well as the eclipse observation to have more experiences during their adventure.

In response to the next question, about a half of those surveyed commented that if they finally choose Spain to observe the solar eclipse of 2026, they would rather observe it in a remote area. 25% have stated that they prefer a village, about 15% prefer small cities and only 8% have voted for big cities (Figure 12).

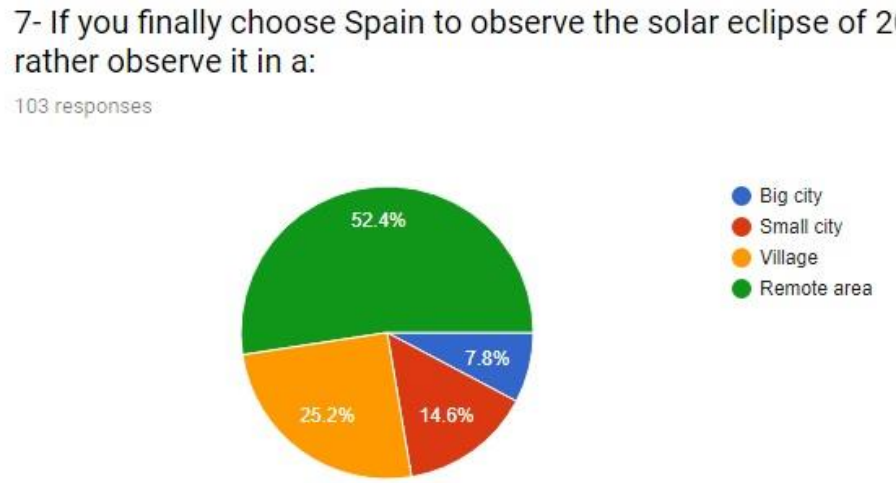

Figure 12: Where would you rather observe the eclipse of 2026 in Spain?

This result is very similar to what experts have expressed in the first survey. The overall response to this question indicates that remote areas are more popular for both astronomers and unprofessional people and it shows that a vast area in Spain should be very well prepared to host observers within the path of totality during the eclipse.

When people were asked how they prefer to organize their trip, the majority of respondents have commented that they will plan and organize it by themselves. About 16% have stated that they may organize a part of the trip individually and a part of it using travel packages. The rest

of respondents including only 5% of all have replied that they are interested to buy a travel package for the whole trip (Figure 13).

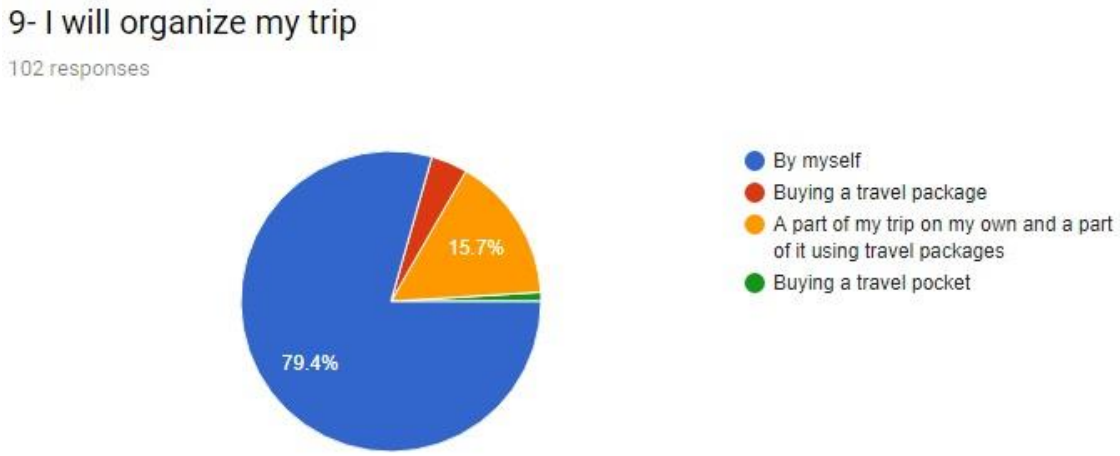

Figure 13: How will you organize your eclipse trip?

The next question wants to study if respondents may want to stay more days in Spain to enjoy their time. As it's illustrated in the diagram more than 60% have commented that they will stay in the country at least a week, 35% are interested to stay a couple of days and only 3% will come to see the eclipse only and don't have any further plans to stay more days (Figure 14).

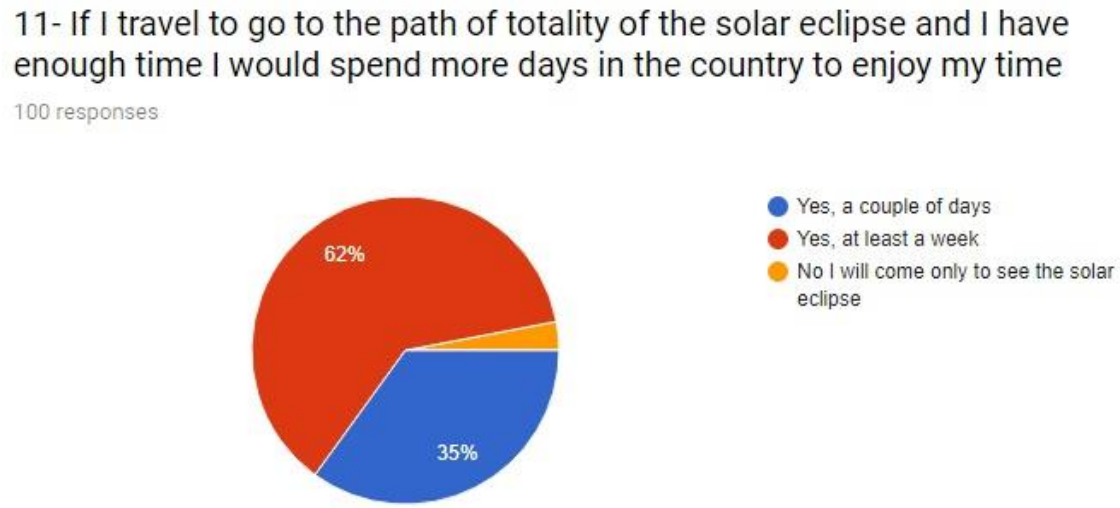

Figure 14: Would you spend more days in Spain a part from the eclipse day?

Finally, respondents were asked if they travel alone or with relatives or friends. More than 38% have commented that they would like to come with friends, 25% with friends and family, 19% alone and about 16% with their family (Figure 15).

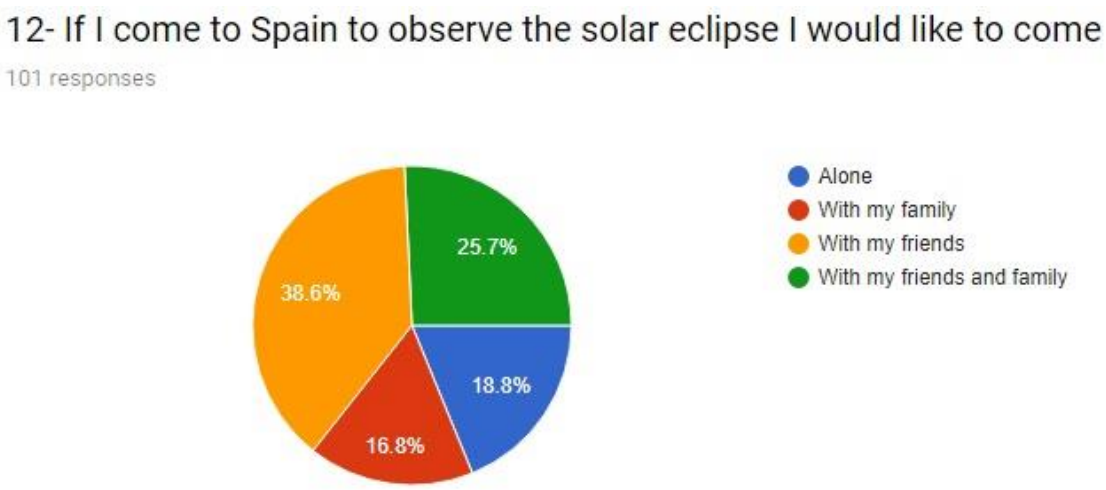

Figure 15: Will you come to Spain to observe the solar eclipse alone, with friends or family?

4.2 Reliability and validity:

To make the research more reliable and valid, sample selection, survey design and data collection was studied in a specific method consulting with the experts all around the world. Undoubtedly dedicating a separate survey to the experts including well experienced and famous eclipse chasers provides a very high level of reliability and validity in this research. Even some parts of the survey were modified by a couple of the experts in order to be more clear and sufficient for the respondents. As previously described, a good number of the experts are still collaborating in the research helping the author with essential information and required resources. In other worlds having a group of professionals as the respondents makes the result of the survey type (A), reliable and valid.

Regarding the survey type (B), since people were kindly invited to answer to the questions and they were not insisted to participate, it seems that the majority of the respondents have been interested in the issue and have filled out the survey patiently. Moreover, the result of the second survey is generally in line with what experts had previously stated in the survey (A).

4.3 Conclusion:

An attempt was made that each of questions above covers at least of one the specific objectives of the thesis.

The answers show that experts are more interested than unprofessional people to come to Spain and see the eclipses. It can be interpreted in two ways:

1. The events are much more important for the experts than the unprofessional people
2. Unprofessional people still do not have enough awareness about the events and they don't know how spectacular that could be

This question helps us cover a part of the second and the forth objectives of the research which is regarding the role of public awareness (the second) and providing information and knowledge for the early planning (the forth).

In a similar question both experts and unprofessional people were asked about their most important requirements and concerns. This part of the survey covers the third objective of the thesis.

Through a couple of questions respondents to the both surveys were asked about travel planning, selecting observation sites, using travel packages etc. Answers to these questions helps us step toward early planning as the forth objective and exploring the best locations to host eclipse observers as the first objective of the research.

CHAPTER 5: FINDINGS AND RESULTS

The following chapter offers the most important findings and results of the research necessary for early planning. The main result of this chapter is to explore the best locations to observe the eclipses of 2026, 2027 and 2028 in Spain considering the paths of totality or annularity, weather forecasts, biosphere reserves and other natural and cultural sites to host eclipse observers.

5.1 Location

As indicated previously, before everything eclipse observers must find a right location within the central path of eclipse. Observers outside the path of totality/annularity won't be able to see the most important moments of the event that are totality and annularity. After studying the regions under the path of the eclipse, most observers normally look for locations to have more totality or annularity getting closer to the central line. Even though you can only see a 100% total or annular solar eclipse from the path of totality or annularity, the duration of totality and annularity depends on your location within the path. In this part of the research we are trying to study each path of our three eclipses separately in order to find the best geographic locations in Spain for eclipse observation.

A. The total solar eclipse of 2026 august 12

The total eclipse of 2026 will be visible from north-eastern Greenland, west Iceland, Spain, and the Balearic Islands. The path of totality leaves Iceland about 17:50 UT to reach Iberian Peninsula from northern coast at around 20:30 local time. The Moon casts its shadow, on a vast area in Spain from the Atlantic coast to the Mediterranean coast as well as the Balearic Islands. This total eclipse will be visible from Valencia, Zaragoza, Burgos, Valladolid, Leon, Palma and Bilbao but both Madrid and Barcelona will be just outside the path of totality. The path of totality crosses right over Mallorca at around 20:32 local time and totality finishes in the Mediterranean Sea just moments later. The totality of this eclipse lasts about 1m 45s on average under the central line of the path. Referring to the previous arguments in the thesis, we consider a very specific situation

for Spain to observe this total solar eclipse in different aspects. As seen in the image although the totality can be seen from Greenland and Iceland as well, the central line doesn't cross the Iceland. Also Arctic and Greenland are remote and abandoned areas and most eclipse observers will prefer to see the totality from Spain. The figure 16 shows this special geographic situation of Spain to host eclipse observers of all around the world.

Figure 16: The path of totality of the 2026 Total Solar Eclipse in Spain, Greenland, Iceland and North Atlantic Ocean (Courtesy of Xavier M. Jubier)

The image below shows the same path of totality in territory of Spain. One of the specific properties of this eclipse is the width of the path. The path width of a total solar eclipse rarely exceeds 200 kilometers wide whereas, the path of totality of this eclipse in Spain is approximately 290 kilometers wide which provides a vast area for both local people and travelers to observe this eclipse and celebrate one of their unforgettable memories of life.

The image below shows the same path of totality in territory of Spain. One of the specific properties of this eclipse is the width of the path. The path width of a total solar eclipse rarely exceeds 200 kilometers wide whereas, the path of totality of this eclipse in Spain is approximately 290 kilometers wide which provides a vast area for both local people and travelers to observe this eclipse and celebrate one of their unforgettable memories of life.

Figure 17: The path of totality of the 2026 Total Solar Eclipse in Spain (Courtesy of Xavier M. Jubier)

In the table 1 eclipse information has been presented for some selected cities within the path of totality. The contact times have been calculated in local time (time zone +2h), considering daylight saving for summer.

Important note:

As seen in the table 1, the totality will happen in a very low altitude (less than 10º) throughout Spain. This means that an ideal horizon free of buildings, trees, mountains etc., is essential to observe the totality. To explore ideal areas with perfect horizon a group of experts should go and test locations, take photos and do relevant calculations. This action must be conducted years before the eclipse to present selected locations to eclipse observers and publish the results in scientific books, magazines, tourism brushers, media, etc.

Table 1: Contact times for the 2026 Total Solar Eclipse in Spain, derived from Interactive Google Map - Xavier Jubier

City	Autonomous community	start of partial eclipse	start of total eclipse	End of total eclipse	Maximum eclipse	Sun altitude at Max eclipse	Duration totality
Valencia	Valencia	19:38:19	20:32:25	20:33:24	20:32:54	04.4°	58s
Peñíscola	Valencia	19:36:47	20:30:29	20:32:08	20:31:18	04.3°	1m 39s
Teruel	Aragón	19:36:50	20:30:59	20:32:32	20:31:46	05.4°	1m 33s
Zaragoza	Aragón	19:34:36	20:28:57	20:30:22	20:29:40	05.9°	1m 24s
Escucha	Aragón	19:36:04	20:30:08	20:31:49	20:30:59	05.4°	1m 41s
Jaraba	Aragón	19:35:23	20:29:47	20:31:30	20:30:38	06.4°	1m 42s
Tarragona	Catalonia	19:35:29	20:29:24	20:30:25	20:29:54	04.2°	1m 01s
Lleida	Catalonia	19:34:40	20:29:03	20:29:34	20:29:19	04.9°	31s
Guadalajara	Castile-La Mancha	19:36:18	20:31:16	20:32:22	20:31:49	06.9°	1m 05s
Soria	Castilla y León	19:34:21	20:29:00	20:30:42	20:29:52	07.1°	1m 42s
Lerma	Castilla y León	19:33:51	20:28:51	20:30:36	20:29:43	08.1°	1m 45s
Burgos	Castilla y León	19:33:16	20:28:19	20:30:03	20:29:12	08.2°	1m 44s
Valladolid	Castilla y León	19:34:25	20:29:48	20:31:14	20:30:31	08.6°	1m 27s
Palencia	Castilla y León	19:33:48	20:29:03	20:30:45	20:29:54	08.6°	1m 41s
León	Castilla y León	19:32:39	20:28:15	20:29:59	20:29:07	09.6°	1m 44s
Osorno	Castilla y León	19:33:06	20:28:20	20:30:06	20:29:13	08.7°	1m 46s
Ponferrada	Castilla y León	19:32:37	20:28:39	20:30:05	20:29:22	10.3°	1m 25s
Bilbao	Basque Country	19:31:43	20:27:17	20:27:49	20:27:33	08.2°	31s
Santander	Cantabria	19:31:18	20:26:52	20:27:56	20:27:23	08.8°	1m 04s
Gijón	Asturias	19:30:58	20:26:43	20:28:28	20:27:36	10.1°	1m 45s
Oviedo	Asturias	19:31:15	20:27:00	20:28:48	20:27:54	10.2°	1m 48s
Ferrol	Galicia	19:30:39	20:27:16	20:28:44	20:28:00	11.9°	1m 28s
Ribadeo	Galicia	19:30:46	20:26:53	20:28:41	20:27:47	11.1°	1m 48s
Alcobendas	Madrid	19:36:27	20:31:55	20:32:15	20:32:05	07.2°	20s
Palma	Balearic Islands	19:37:59	20:31:00	20:32:37	20:31:48	02.4°	1m 36
Ibiza	Balearic Islands	19:39:11	20:32:41	20:33:44	20:33:12	02.8°	1m 02

B. The total solar eclipse of 2027 August 2

The path of this eclipse will cross first over the Strait of Gibraltar between Spain and Morocco and then over all the countries of North Africa and the Middle East. As previously mentioned this eclipse has the second longest totality in the 21st century. The maximum duration of totality will be observed in Egypt, in the east of Luxor and will be 6min 22sec. The path of totality will cross along the southern coast of Spain. The total solar eclipse of 2027 in Spain happens in the morning of August 2, about 10 o'clock local time in the southern coast. People of almost whole European Union territory will see the partial solar eclipse whereas the glory of the eclipse which is totality appears in a small part of Spain only. Moreover, as seen in figure 18 some northern African countries have a perfect geographic situation under the path of totality. Although the central line of the path will not cross Spain, however, southern coast of Spain can offer more than four minutes of totality.

Figure 18: The path of totality of the 2027 Total Solar Eclipse in Spain (Courtesy of Xavier M. Jubier)

As seen in the figure 19 shows the path of totality around the strait of Gibraltar. The blue line is the central line of the path where the totality will be maximum and the red lines are the limits of the path. The total solar eclipse will visible from Malaga, Cadiz, Marbella, Gibraltar (British Overseas Territory), etc. However, It's obvious that heading toward the strait provides a longer

totality. The longest totality in the soil of Spain will be accessible in Tarifa where observers can see more than four minutes of totality.

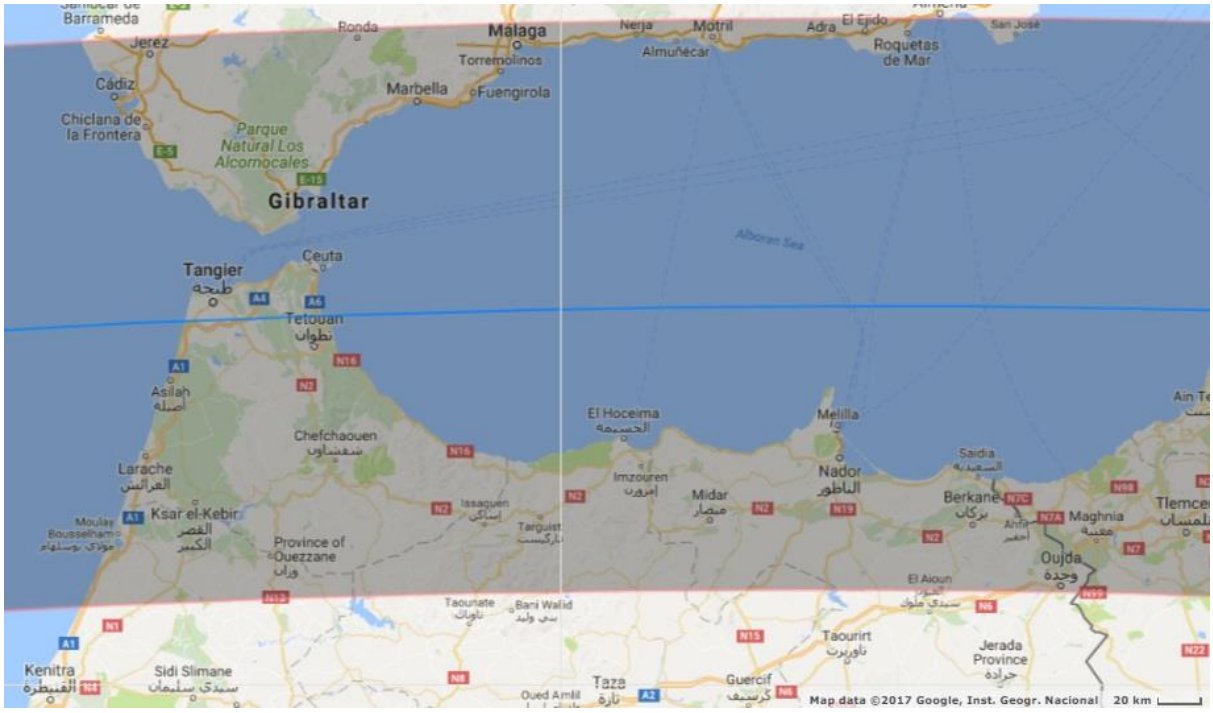

Figure 19: The path of totality of the 2027 Total Solar Eclipse August 2, around the Strait of Gibraltar (Courtesy of Xavier M. Jubier)

The map above shows the path of totality around the strait of Gibraltar. The blue line is the central line of the path where the totality will be maximum and the red lines are the limits of the path. The total solar eclipse will visible from Malaga, Cadiz, Marbella, Gibraltar (British Overseas Territory), etc. However, It's obvious that heading toward the strait provides a longer totality. The longest totality in the soil of Spain will be accessible in Tarifa where observers can see more than four minutes and thirty seconds of totality.

Figure 20: Tarifa provides the longest totality in Spain to see the total solar eclipse of 2027 (Courtesy of Xavier M. Jubier)

The table 2 offers eclipse data for some selected cities and areas within the path of totality. The contact times have been calculated in local time (time zone +2h), considering daylight saving for summer. This table will help eclipse observers select their observation sites according to the duration of totality, considering ease of access, infrastructures etc. Also organizers can use the further information to prepare observation sites in the southern coast, cover eclipse chaser's basic requirements and distribute observers along the coast.

Table 2:Contact times for the 2027 Total Solar Eclipse in Spain, derived from Interactive Google Map - Xavier Jubier

Region	start of partial eclipse	start of total eclipse	End of total eclipse	Maximum eclipse	end of partial eclipse	Duration totality
Tarifa	09:40:45.7	10:45:00	10:49:39.1	10:47:19	12:00:36	4m 38s
Paloma baja	09:40:42	10:44:56	10:49:29	10:47:12	12:00:24	4m 33s
URB. Atlanterra	09:40:40	10:44:53	10:49:20	08:47:06	12:00:14	4m 27s
Zahara	09:40:41	10:44:54	10:49:18	10:47:06	12:00:13	4m 24s
Barbate	09:40:39	10:44:53	10:49:09	10:47:01	12:00:04	4m 16s
El Palmar	09:40:35	10:44:49	10:48:56	10:46:52	11:59:49	4m 07s
Conil de la Frontera	09:40:36.4	10:44:52	10:48:52	10:46:51	11:59:47	4m 00s
Cádiz	09:40:38	10:45:17	10:48:11	10:46:44	11:59:27	2m 53s
Jerez	09:40:50	10:46:09	10:47:47	10:46:58	11:59:42	1m 38s
Algeciras	09:40:56	10:45:19	10:49:46	10:47:32	12:00:50	4m 26s
Gibraltar	09:41:00	10:45:26	10:49:53	10:47:39	12:01:00	4m 26s
Estepona	09:41:18	10:46:11	10:49:48	10:47:59	12:01:18	3m 37s
Torre del mar	09:42:13	10:48:31	10:50:10	10:49:20	12:03:00	1m 38s
Malaga	09:41:58	10:47:58	10:49:54	10:48:56	12:02:27	1m 56s
Nerja	09:42:23	10:48:51	10:50:22	10:49:37	12:03:22	1m 31s

C. The annular solar eclipse of 2028 January 26

The last solar eclipse which is an annular one, happens on January 26th in 2028 just before sunset the remaining ring of the sun will appear in a great area of Iberian Peninsula. As previously described generally annular solar eclipses offer much less opportunity to host international tourists such as eclipse chasers and astronomers. Regarding our 2028 annular eclipse in Spain there are important reasons for that:

1- Annular solar eclipses are much less important for astronomers scientifically.
2- This eclipse is occurring in winter after the Christmas holidays and many people might be busy on their jobs.
3- Later in this chapter we will see that weather models predict cloudiness in a vast area of the path of annularity in Spain.

However, this astronomical event can be a great pretext for the local communities along the path of annularity or even nearby areas to increase public awareness about such rare and

spectacular natural events. Astronomical centers will have a crucial role to cover this phenomenon and prepare infrastructures to show it to people. Once again it is mentioned that this eclipse has the second longest annularity in the 21st century and will be memorable and spectacular for people. On the other hand, since the path of annularity crosses along the most beautiful natural and cultural sites and heritages of Spain just above western horizon, photographers might be interested to capture the eclipse and cultural or natural landscape in the same frame. Also setting the ring of the sun in the Mediterranean Sea can be very unique and spectacular for observers in Balearic Islands such as Ibiza.

Figure 21: The path of annularity of the solar eclipse of 2028 in Spain (Courtesy of Xavier M. Jubier)

As seen in the image above, the central line of the path crosses Sevilla and Cordoba and just next to Valencia. Also southern coast is lucky to see this annular solar eclipse just six months after the great total solar eclipse of 2027.

Important note:

The table 3 offers eclipse data for some selected cities along the path of annularity. The contact times have been calculated in local time (time zone +2h).

As seen in the table 3 the annularity will happen in a very low altitude (less than 8º) throughout Spain. This means that an ideal horizon free of buildings, trees, mountains etc., is essential to observe the annularity. To explore ideal areas with perfect horizon a group of astronomers should test locations along the path, take photos and do relevant calculations. This action must be conducted years before the eclipse to present selected locations to eclipse observers and publish the results in scientific books, magazines, tourism brushers, media, etc.

Table 3: Contact times for the 2028 Annular Solar Eclipse in Spain, derived from Interactive Google Map - Xavier Jubier

city	start of partial eclipse	start of annular eclipse	End of annular eclipse	Maximum eclipse	Sun altitude at Max eclipse	Duration totality	Obscuration
Sevilla	17:34:22	18:52:14	18:59:29	18:55:52	07.2°	7m 15s	82.661%
Cordoba	17:35:31	18:52:33	18:59:46	18:56:10	06.1°	7m 12s	82.609%
Cádiz	17:34:08	18:52:37	18:59:18	18:55:58	07.8°	6m 41s	82.687%
Malaga	17:36:00	18:54:07	18:59:07	18:56:37	06.3°	4m 59s	82.619%
Jaén	17:36:28	18:53:05	18:59:58	18:56:32	05.3°	6m 52s	82.577%
Granada	17:36:44	18:54:04	18:59:28	18:56:46	05.4°	5m 24s	82.582%
Mérida	17:33:56	18:53:54	18:56:34	18:55:14	06.8°	2m 40s	82.641%
Toledo	17:35:55	18:54:09	18:57:15	18:55:42	04.6°	3m 06s	82.546%
Albacete	17:35:55	18:54:09	18:57:15	18:55:42	03.4°	3m 06s	82.546%
Murcia	17:38:46	18:54:51	18:59:37	18:57:14	03.3°	4m 45s	82.484%
Valencia	17:39:00	18:53:21	19:00:23	18:56:52	02.1°	7m 02s	82.432%
Tarragona	17:39:41	18:53:22	18:59:31	18:56:27	00.4°	6m 08s	82.352%
Ibiza	17:40:35	18:55:17	18:59:41	18:57:29	01.0°	4m 23s	82.382%

5.2 weather forecasts

As mentioned in the previous chapters, obtaining a clear sky for the eclipse day is one of the most important and serious concerns for the eclipse observers. Although that would be difficult and complicated to have a clear image how the weather during the eclipse will be, however, long term weather models and studying the climate of the region can be useful for early planning.

As explained before, Dr. Jay Anderson produces weather statistics and predictions for all eclipses of near future. Anderson helps eclipse chasers with climate patterns and long term cloud cover maps along the path of totality. Almost all eclipse chasers use his predictions to make their own plans and find their final location. Since it's still a bit far out to our three eclipses (about one decade from publication of this thesis), no early weather forecast or cloud cover maps were available.

Jay Anderson kindly accepted the author's request to help the research with his cloud cover maps for each of those three eclipses. It should be mentioned that each cloud cover map consists of more than ten years of satellite cloud cover images and it takes a while to be prepared. In other words, each of the following maps, shows the probability of clear skies for a particular territory in a specific date, based on recent annual cloud cover maps. As it's illustrated on the map, the areas under blue color are more likely to have clear skies but those under red color are more likely to be cloudy during the eclipse day.

In the following part each eclipse will be studied according to its relevant cloud cover map made by Jay Anderson.

A. The total solar eclipse of 2026 august 12

The total solar eclipse of 2026 in Spain happens in the evening before sunset on August 12th. The following images show the August afternoon average cloud cover map. This cloud cover map uses 15 years of data from 2002 to 2016 as explained by Jay Anderson. The path of totality of the solar eclipse of 2026 has been marked on the map. According to this map the whole of Spain is predicted to be very sunny except for the north coast where the moisture from the Bay of Biscay and France presses against the Sierra de Cantabria and the Pyrenees. Clear skies in a

vast area of Spanish territory according to the map below is a very good news both for Spain as the host country and eclipse observers as travelers.

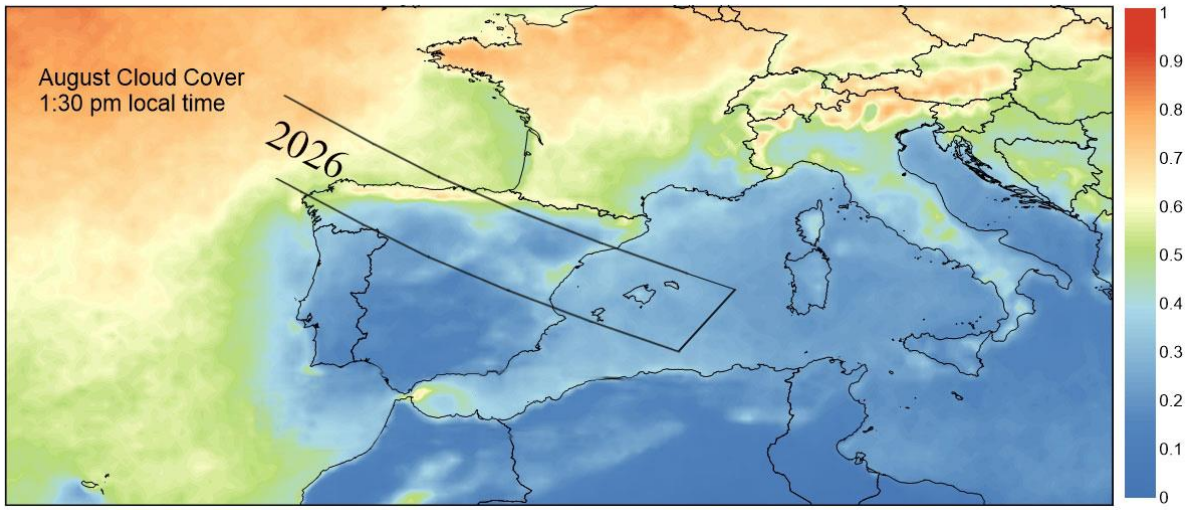

Figure 22: August afternoon cloud cover map for the total solar eclipse of 2026 in Spain (courtesy of Jay Anderson)

Now it seems that we can start an early site selection based on the eclipse track and the cloud cover map. According to the cloud cover map northern coast seems to be cloudy during the eclipse time and it is suggested to avoid heading to north.

B. The total solar eclipse of 2027 august 2

The total solar eclipse of 2027 in Spain happens in the morning of August 2, before midday about 10 o'clock local time in the southern coast. The morning cloud cover map (Figure 23) shows a small area of cloudiness against the Strait of Gibraltar where there is a high frequency of fog and low cloud in summer. This shows that in this area, observing from land will provide a better chance since cloudiness is witnessed in the sea. As discussed in chapter 2, most astronomers and eclipse chasers preferred to check the early weather forecast in order to choose their first probable destination to observe this eclipse. As seen in the image below, clear sky is predicted during the eclipse in both south of Spain and northern African countries such as Morocco, Algeria and Tunisia. The other concerns of eclipse chasers such as obtaining a longer totality, safer destination and geopolitics, updated weather models etc., will overshadow their decision to choose the final observation site.

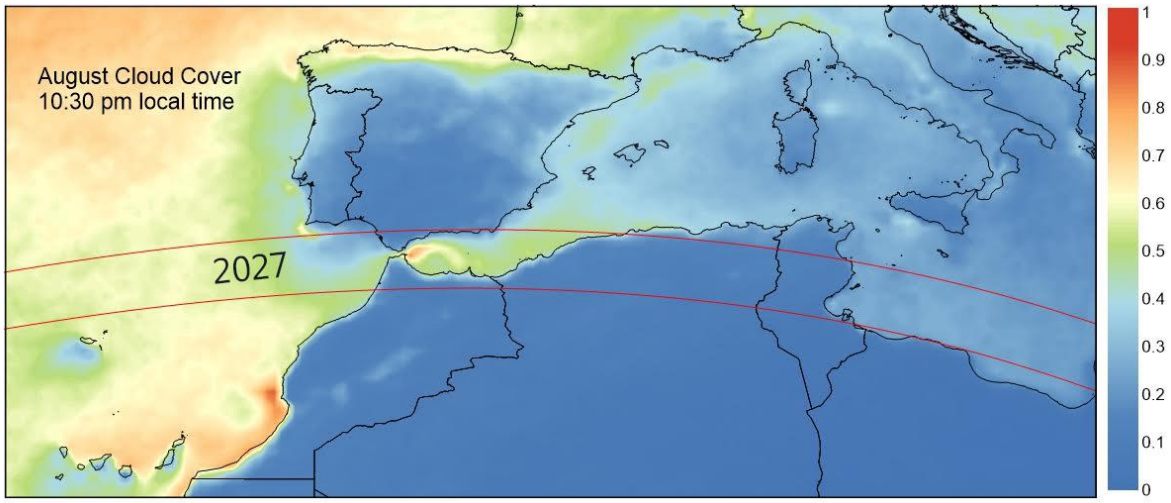

Figure 23: August morning cloud cover map for the total solar eclipse of 2027 in Spain (courtesy of Jay Anderson)

C. The annular solar eclipse of 2028 January 26

The annular solar eclipse of 2028 occurs just before sunset in Spain. The cloud cover maps show that January is much cloudier than for the two eclipses in August. Jay Anderson explains that there is a clear distinction between the north and south of Spain, as the north has more of an Atlantic climatology, while the south is influenced by the Mediterranean. Interestingly, in the central and southern regions, the mountains tend to be sunnier than the lowlands, so that better cloud climatology lies over the Sierra Nevada in Granada and Almerida and the Sierra Morena in Sevilla and Andalusia. The area around Valencia and on Ibiza is also promising, though the Sun is very low for the 2028 eclipse.

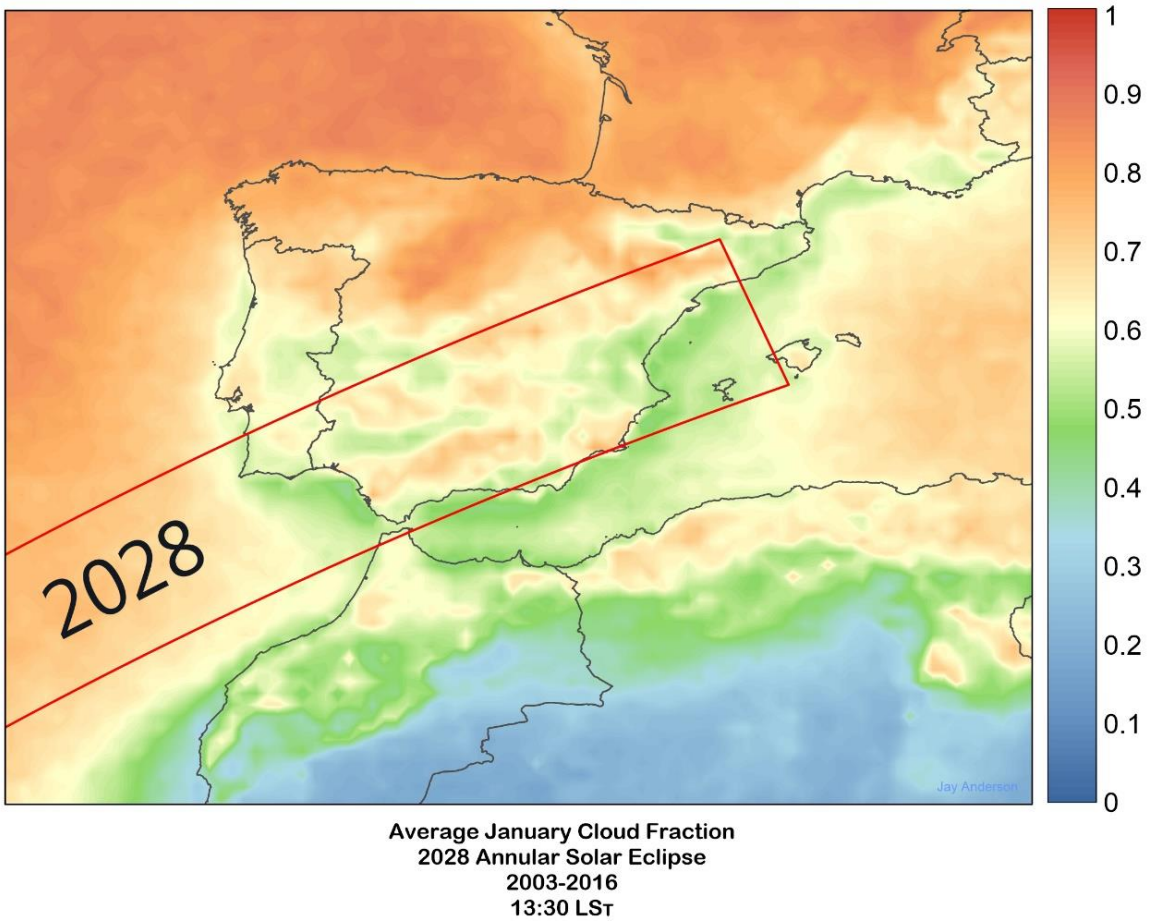

Figure 24: January afternoon cloud cover map for the annular solar eclipse of 2028 in Spain (Courtesy of Jay Anderson)

5.3 Biosphere reserves as eclipse observation sites

In chapter 3 we discussed how biosphere reserves can play a significant role to host eclipse chasers along the path of totality and annularity. Also we reviewed that Spain is a successful country in environmental programs with the most biosphere reserves in the list of UNESCO. This thesis suggests biosphere reserves as observation sites due to the important findings and results obtained in this research:

1. Since the mission of theses protected areas follows sustainable tourism development, eclipse events can cover the objectives of biosphere reserves to develop tourism in these regions in a scientific way.
2. Early planning for eclipse events can provide direct benefit to the local community of biosphere reserves in both short term and long term.
3. In chapter 2 we found out that both experts and unprofessional observers would rather see the eclipse in silent and abandoned areas away from crowd. Biosphere reserves provide nice areas to view the eclipse according to observer's opinion.

4. Biosphere reserves are beautiful natural regions with cultural values. Selecting biosphere reserves as observation sites in the eclipse day offer scenic views to everybody especially photographers to take unique and spectacular photos.
5. A good number of biosphere reserves are located within the paths of totality and annularity in Spanish territory. This gives a good opportunity to organizers to distribute observers along the eclipse track in different parts and avoid crowd in few locations.
6. Our solar eclipses are good pretexts for people to view the events in these areas and be informed of Biosphere reserves mission and objectives.

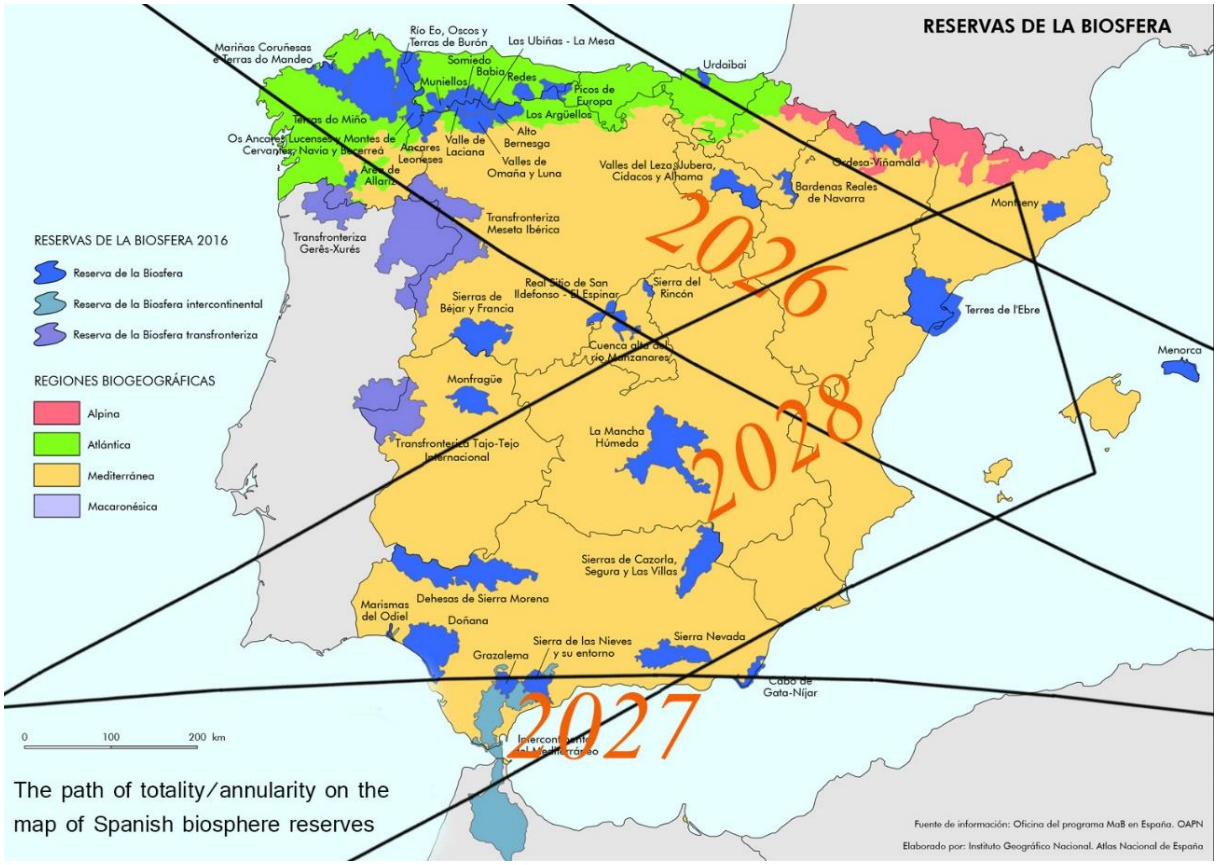

Figure 25: The paths of totality and annularity on the map of Spanish Biosphere Reserves (Source: Own design based on Solar Eclipse - Interactive Google Map - Xavier Jubier and The Spanish biosphere reserves map derived from the Spanish Committee of MAB, 2016)

The Figure 25 shows the eclipse tracks on Spanish biosphere reserves map. The paths of our three eclipses cross a great number of biosphere reserves in Spanish territory. In the following part the biosphere reserves within each path of totality/annularity has been listed. Definitely the MAB National Committee in Spain can collaborate in the project cooperating with other relevant entities toward an early and effective planning in order to host observers in three consecutive years.

5.3.1. Spanish biosphere reserves within the path of totality of the eclipse of 2026:

1. Picos de Europa
2. Menorca
3. Cuenca Alta del Manzanares
4. Muniellos
5. Somiedo
6. Redes
7. Valles del Jubera, Leza, Cidacos y Alhama
8. Sierra del Rincón
9. Valles de Omaña y Luna
10. Alto Bernesga
11. Argüellos
12. Babia
13. Os Ancares Lucenses y Montes de Cervantes, Navia y Becerreá
14. Ancares Leoneses
15. Río Eo, Oscos y Tierras de Burón
16. Ubiña-La Mesa
17. Valle de Laciana
18. Terras do Miño
19. Mariñas Coruñesas y Tierras de Mandeo
20. Terres de l'Ebre
21. Sitio real de San Ildefonso-El Espinar
22. Meseta Ibérica
23. Bardenas Reales de Navarra

5.3.2 Spanish biosphere reserves within the path of totality of the eclipse of 2027:

1. Intercontinental reserve of Mediterranean
2. Grazalema
3. Sierra de las Nieves y su entorno
4. Cabo de Gata-Níjar

5.3.3 Spanish biosphere reserves within the path of annularity of the eclipse of 2028:

1. Grazalema
2. Sierra Nevada
3. Doñana
4. Mancha Húmeda
5. Sierras de Cazorla, Segura y las villas
6. Marismas del Odiel
7. Dehesas de Sierra Morena
8. Sierra de las Nieves y su entorno
9. Terres de l'Ebre

5.4 Observatories along the path of totality

Astronomical centers, observatories and starlight reserves can play a significant role in holding the eclipse events. They will be able to promote the eclipse events years and months to the event and host some observers during the eclipse day for the research programs. In the table 4 a number of these areas and centers located along the path of totality of the eclipse of 2026 are being presented:

Table 4: Some Astronomy centers and observatories along the path of totality of the eclipse of 2026 in Spain

Observatory or astronomy center	**Autonomous community**
Valderredible observatory	Cantabria
Tiedra astronomy center	Castile y León
Javalambre observatory	Aragón
Castillo observatory	Castile y León
Yebes astronomy center	Castilla-La Mancha
Mantiel observatory	Castilla-La Mancha
Mallorca observatory	Balearic Islands

5.5 The Spanish Great Eclipse, August 12, 2026

According to what we have studied so far in this research, the author claims that the total solar eclipse of 2026 august 12 can be known worldwide as The Spanish Great Eclipse due to the important further reasons:

1. This is the first total solar eclipse to occur over the Iberian Peninsula in nearly 120 years.
2. This eclipse is the first total solar eclipse to occur over the Europe mainland (the main European Union territory without considering Iceland, Greenland and remote European islands) since 1999.
3. This total solar eclipse will be visible also in the Arctic, Greenland, a small part of Iceland, Atlantic Ocean, and a very small area in north of Portugal, however it is pretty clear that Spain can be the main destination to host eclipse chasers of all around the world due to de ease of access for most observers.

4. August afternoon cloud cover map for this total solar eclipse shows that Spain will be likely to have the clearest skies along the path of totality.
5. The 2026 eclipse is especially unique because of the uninterrupted land masses it will pass over Spain and the path of totality covers approximately one third of the entire Spanish territory.
6. The total solar eclipse of 2026 happens in august when a great number of tourists come to Spain during the summer vacations every year.
7. Considering great tourism infrastructures, cultural and natural heritages along the path of totality and flourishing astrotourism industry in Spain, this country can host on observers from all around the world and hold one the biggest eclipse events in history.
8. Eclipse chasers have stated that they will likely travel to Spain where the duration is shorter and the weather prospects better.

CHAPTER 6: ACTIONS AND ACTIVITIES

The total solar eclipse of 2026 is the first total solar eclipse in Iberian Peninsula since 1905. That is to say that there is no living memory of seeing a total solar eclipse in Spain. Also organizers and planners have no experience about the event and how to organize it. In other words, planners of The Spanish Great Eclipse should study a lot about the event, must know more about the eclipse facts and eclipse events and be aware of direct and indirect benefits for the country in short and long term. Organizers must start early planning as soon as possible by studying how to prepare conditions and infrastructures for the event.

At first sight, planners and local authorities may find it too early to start planning for The Spanish Great Eclipse, nine years before the event. However, eclipse chasers believe that planners in Spain should be aware of what is going to happen and realize the importance of pre-planning. As previously discussed The American Great Eclipse in August 2017 can be a clear example to show how the United Stated started planning for this eclipse years in advance through a comprehensive plan.

On the other hand, few people have ever experienced a total or an annular solar eclipse, therefore organizers need to educate the public and inform them about the event. This can involve simple radio and television announcements, social media participation, articles of newspapers and more. All above will help to sensitize the public attention about the importance of the upcoming unique phenomena and its vast impacts on tourism, education, local community's life etc. They should be aware that, it would be the first total solar eclipse in their region in nearly 120 years and that won't repeat in short term in the same area. That is to say that probably this eclipse would be the first and the last total solar eclipse in many people's lives.

Teachers must have access to the newest and correct information and teaching materials. In addition, organizers can schedule lectures, information events, and develop citizen science projects to educate and involve the public about the eclipse.

The following part of the thesis addresses the most important actions, programs and activities to prepare Spain organize three solar eclipse events in three consecutive years. The proposals can be studied in tourism and educational sector.

6.1 Actions

6.1.1 Fundamental action: Founding an eclipse task force

Founding and developing an eclipse task force as soon as possible in Spain including a diverse range of stakeholders can be one of the most important actions to be conducted in order to start an early, effective and comprehensive plan for three eclipses of 2026, 2027 and 2028. This task force should include representatives from tourism, MAB committee in Spain, autonomous communities and local governments, policing, event coordination, creative industries, International Astronomy Union (IAU), European Space Agency (ESA), educational sector, health, business, and local media. The eclipse task force is supposed to make general decisions and indicates main strategies to start planning and prepare the infrastructures to host this great eclipse event. Planners and members of eclipse task force should always consider that Spain will be the focal point of the celebrations in the whole world for the total solar eclipse of 2026 and they should start planning as soon as possible.

The eclipse task force should consist of a number of subgroups to focus on specific fields about the solar eclipse events. The task force may found subgroups such as advertising and sponsorship, education, logistics, tourism and more. Each subgroup will organize monthly or weekly meetings to make decisions about the most necessary plans and activities. They will present their reports to the eclipse task force.

It is suggested that the eclipse task force organizes official meetings every few months at the beginning. Two years before the first eclipse meetings will be more important for effective planning and members of the task force should have monthly gatherings to make important decisions and review how actions and programs go on.

The eclipse task force need to organize meetings inviting local relevant authorities of Spanish autonomous communities within the paths of totality. That may include representatives from municipalities, local tourism offices, local astronomy centers, authorities of biosphere reserves and local NGOs. That meeting aims at informing local organizations about the event, evaluation of potentials, infrastructures and requirements in each community and making a more effective plan in each region according to strategies of the eclipse task force.

Other actions, activities and programs can be developed through the guidelines and strategies ratified in the eclipse task force. In the following parts we will consider some actions suggested by the author.

Before everything, education and awareness about the upcoming event will be necessary to inform the public about the eclipse facts and its importance. When it comes to kids, this awareness will be very important since young kids of nine years old will be high school graduates or university students during the Spanish eclipses. Moreover, these young adults can play an important role in organizing the eclipse events if they have been trained well before the eclipse. This awareness can be provided through different actions such as below:

1. Spanish Eclipses in educational resource

Entering a brief relevant information in educational resource when the teachers are presenting astronomy lessons to students will be a great starting point for kids to think about their rare upcoming opportunity to observe such unique and spectacular sky events in Spain. Teachers training programs will be helpful to present right and clear information to teachers using creative educational method, activities, games and material. Students may create their own simple eclipses in the classroom using very basic materials. Definitely teachers can motivate students in a good way to be prepared for the eclipses, doing scientific projects, observe the eclipse safely and more.

On the other hand, these eclipses can be a great pretext for the kids to enter the world of astronomy, astrotourism, eclipse chasing etc. and that would be also a perfect opportunity for Spain to train its new young generation of astronomers and tourism activists.

2. Creating an official website for the Spanish eclipse events

Creating an official website can be one of the earliest and the most important actions to be developed by the eclipse task force in Spain. This webpage will be considering as the main source of information for both locals and travelers. General information about the three eclipses in Spain must appear in the homepage. Other information such as eclipse data for each event, suggested observation sites and locations, weather forecast, list of events, road closures, introduction of organizers and more can be added in interior pages.

3. Creating newsletters and eclipse packages

The eclipse task force should create newsletters and eclipse packages. Each eclipse package may include published articles, eclipse catalogs and brushers consist of eclipse information,

relevant tourism and scientific programs, recent news about eclipse activities and more. newsletters and eclipse packages will be necessary to be covered on the website and to be distributed among educational centers and tourism organizations. The published information can be general years before the event but, including more details since 2025 a year before The Spanish Great Eclipse 2026.

4. Offering eclipse packages to astronomy centers

Astronomy centers such as observatories, planetariums, amateur astronomy centers can have a significant role to provide correct information to professional and amateur astronomers as well as public and local communities of all around Spain. The eclipse task force will help astronomy centers to know more about solar eclipse events of 2026, 2027 and 2028. This awareness can be established by sending eclipse packages to astronomy centers both within or outside the paths of totality.

5. Site selection

As discussed in the previous chapter, The Spanish Great Eclipse 2026 will appear just above the western horizon. That makes previous site selection very important for the eclipse observation. If the observation site has not been tested before, low eclipsed sun might be easily covered by buildings, trees, mountain etc. The author suggests to the eclipse task force to develop site selection professional groups. Each group must consist of at least two astronomers (amateur or professional), one professional photographer (preferably an astrophotographer), a representative of local NGOs on environmental issues or a local tour guide. Suggested regions presented in the previous chapter including cities, villages and biosphere reserves can be priorities to be evaluated by site selection groups and their mission might be developed in nearby areas.

Site selection in big cities such as Valencia and Zaragoza can be conducted a few months before the eclipse date since new buildings might be constructed and disturbs the view. In other regions within the path of totality site selection should be managed years in advance since suggested locations need to be published and presented in scientific and tourism articles, eclipse website, medias etc. In some regions such as protected areas and biosphere reserves site

selection group should provide official permission to enter and test right locations. The selected sites should involve the following factors:

- Providing lower horizons free of trees, mountains and buildings at the point of sunset of August 12th.
- Flat grassy areas for tripods and chairs
- Without big lights or signs

Moreover, site selection group should consider basic tourism facilities in the region such as nearest accommodations, public toilets, internet and electricity access, cultural heritages and natural attractions etc.

Astronomers will measure eclipse parameters and confirm that the location can be a good observation site or not. Photographer will take photos of this program including sunset photos, cultural and natural attractions, tourism facilities etc.

Each site selection group should present their accurate report to the eclipse task force and the result of the whole groups will be published in the eclipse website, brushers, tourism packages, media and more.

Regarding the total solar eclipse of 2027, site selection would be easier since the totality will appear in a high altitude in the sky in Spanish northern coast. However, the same factors and activities should be considered by site selection groups. There are some protected areas within the path of totality such as the Mediterranean biosphere reserve and Parque Natural Del Estrecho and organizers should provide necessary permission to enter the protected regions. On the other hand, Isla (peninsula) de Tarifa which has the longest totality of soil of Spain to observe the eclipse of 2027 is closed to public nowadays. This small peninsula will be very interesting for many observers and can be opened the day of eclipse to observers and view the maximum totality in Spain.

Finally, for the las eclipse in 2028, site selection group should do the same. Although this annular solar eclipse will be less important for public, accurate data and reports by site selection groups will help photographers record unforgettable moments and capture the ring of fire and cultural and natural heritages in a frame.

6.2 Activities

The eclipse task force should make a serious attempt to cover the three eclipses of Spain nationally and internationally. This coverage might be limited during the first years of planning but should never be forgotten. A year before the first eclipse, activities must be very well organized to inform the public and encourage both locals and travelers to join the events. In the next part, the author suggests a number of activities to be conducted years and months before The Spanish Great Eclipse in order to promote the events using local, national and international potentials.

1. Holding eclipse lectures and workshops all around Spain

In preparation for the eclipses, each region within or even outside the path of totality can host a series of public and professional events focusing on Spanish eclipses, in line with the strategies of the eclipse task force. These workshops can be sponsored by local universities, astronomy centers and tourism offices in the regions, inviting one or some members of the eclipse task force and local authorities. Public gatherings must be free and open to everyone including children. It is suggested to hold at least one scientific meeting every year in different cities and even small towns within the paths of totality. A year before the Spanish great eclipse, gathering must be organized more frequently inviting solar eclipse experts, tourism planners etc.

In a higher level, professional talks and workshops must be presented in local universities, tourism conferences and educational centers, inviting professional and amateur astronomers, eclipse tour organizers, tourism activists etc. Before or after meetings, planners and experts may have the opportunity to evaluate the current actions, infrastructures, eclipse observation sites, tourism facilities and upcoming programs and activities.

2. Annual cycling tours along the path of totality to promote the events

Cycling is unique amongst sports. it is accessible to all as a leisure activity and means of transport. Over two billion people use bikes throughout the world, from all sorts of backgrounds, ages and physical ability.

Spain is a cycling friendly country with an impressive cycling heritage. A country of tremendous diversity and scope, it has everything a cycle-tourist loves: quiet roads, cycle paths, great weather, ever changing landscapes, flat valley bottoms to challenging mountain climbs, genial people, world famous cultural and architectural sights and of course the hearty food and drink!

La Vuelta is an annual multi-stage bicycle race primarily held in Spain, while also occasionally making passes through nearby countries. Inspired by the success of the Giro d'Italia and the Tour de France, the race was first organized in 1935 and is considered as the 3rd most prestigious bike race in the world.

Considering the potentials above, the author (that is a cycling coach as well), suggests great annual cycling tours along the paths of the eclipses. These events can be organized each year before 2026, at the same date as the eclipse and the day before. Local and international cyclists are supposed to be invited and participate in cycling events. The eclipse task force should make an effective plan to organize these cycling events, cooperating with the Spanish ministry of education, culture and sport, local cycling groups, organizers of important bicycle races and more. They may invite famous cyclists, artists, local authorities, tour guides, astronomers and tourism activists to join other cyclists. Moreover, each cycling team is supposed to hold eclipse flags, symbols and banners along the path and a documentation team including photojournalists, movie makers, broadcast representatives etc., should accompany each group. Cyclists would stop at indicated locations to promote the event among local communities. Before starting cycling, people must be informed of the mission and objectives of the activity and organizers must talk to cyclists about what they are or they are not supposed to do during the cycling adventure. Final destinations will host cyclists and organize public gatherings and lectures about the eclipse. Designing same cycling jerseys with eclipse symbols and the logo of the event is absolutely necessary. Such common clothing helps to promote the eclipse events, host organizations, sponsors and further activities in general.

Each cycling team may have about 20 cyclists and they will cycle a part the path of totality during two days. The table 5 offers cycling routes suggested by the author to promote The Spanish Great Eclipse.

Table 5: Suggested cycling routes to promote the solar eclipse 0f 2026 in Spain

Team	Start	stops	ends	distance
1	Tarragona	Alcover, Montblanc, Vinaixa, Les Borges Blanques , Juneda,	Lleida	97km
2	Lleida	Alcarràs, Fraga, Bujaraloz, Osera de Ebro	Zaragoza	146km
3	Zaragoza	Bárboles, Borja, Ainzón, Matalebreras	Soria	159km
4	Valencia	Sagunto, Nules, Vila-real, Castellón de la Plana, Oropesa del Mar,	Peniscola	145km
5	Peniscola	Vinaròs, Les Cases d'Alcanar, Sant Carles de la Ràpita, El Perelló, Cambrils	Tarragona	132km
6	Valencia	Sagunto, Segorbe, Portal de Teruel, La Puebla de Valverde	Teruel	144km
7	Teruel	Torre Baja, Cañete, Torcas de Palancares y Tierra Muerta	Cuenca	149km
8	Madrid	Guadalajara, Gajanejos,Saúca,Medinaceli	Almazán	193km
9	Madrid	Torrelodones, Collado Villalba, Guadarrama, Segovia, Cuéllar	Valladolid	200km
10	Madrid	Real Sitio de San Ildefonso, Turégano, San Miguel de Bernuy, Valtiendas, Roa, Villafruela	Burgos	265km
11	Bilbao	Artziniega, Oña, Salas de Bureba, Lences, Sotopalacios	Burgos	149km
12	Bilbao	Barakaldo, Portugalete, Muskiz, Castro Urdiales, Playa Ostende, Laredo, Astillero	Santander	120km
13	Burgos	Celada del Camino, Revilla Vallejera, Palencia, Aguilarejo, Cabezón de Pisuerga	Valladolid	132km
14	Valladolid	Simancas, Tordesillas, Riberas de Castronuño-Vega del Duero, Toro	Zamora	100km
15	Burgos	Osorno, Carrión de los Condes, Sahagún, Sanfelismo	León	178km
16	León	La Pola de Gordón, Moreda, Caborana, Figaredo, Mieres del Camino, Oviedo	Gijón	149km
17	Santiago de Compostela	Guitiriz, Cercedo	Vivero, Lugo	147km

3. Eclipse product design and merchandising

Eclipse products and merchandising can be a valuable means of connecting with customers, raising awareness of our eclipse events and boosting sales. The eclipse task force must design and produce branded merchandise to achieve its specific objectives such as encouraging people to travel to the path of totality and observe the solar eclipse.

Many products can be used and designed to promote the Spanish solar eclipses such as glassware, pottery, Caps, T-shirts, painted, printed or carved with eclipse motifs, messages, mottos, logos, symbols etc. Solar eclipse stamps will be also memorable reminders of the Spanish solar eclipses and eclipse trips over the years of 2026, 2027 and 2028.

4. Eclipse promotion along the Roads to Santiago

The Caminos de Santiago or Roads to Santiago are the pilgrimage routes, known as pilgrim ways, lead to the shrine of the apostle St. James the Great in the Cathedral of Santiago de Compostela in Galicia in northwestern Spain, where tradition has it that the remains of the saint are buried. Many follow its routes as a form of spiritual path or retreat for their spiritual growth. It is also popular with hiking and cycling enthusiasts as well as organized tours. The local authorities try to restore many of the ancient routes, even those used in a limited period, in the interest of tourism. Every year a great number of travelers come to experience hiking and cycling along the roads and it has helped tourism industry to be flourished in that area. There are well-organized activities and good facilities along the Roads to Santiago such as accommodations for the people. Albergues and Refuges are hostels giving service to pilgrims only. Therefore, Pilgrims Passport is needed to stay in one.

Coincidently, the path of totality of The Spanish Great Eclipse 2026, passes where the main routes of Santiago lead to Santiago de Compostela in Galicia. The author suggests to use the great potential of the Roads to Santiago to introduce the Spanish eclipses pilgrims and raise awareness among pubic. The eclipse task force can design programs and activities for targeting Roads to Santiago public. The upcoming solar eclipse events can be presented to the pilgrims by brushers, catalogs and more. Also the event will be promoted along the roads by selling eclipse products in the official places where people sign their Pilgrims Passport. The eclipse task force may organize eclipse lectures in accommodation centers cooperating with local authorities, tourism offices and astronomy centers. In suitable opportunities, when a clear dark

sky is available a short public sky observation would be nice and memorable for the public and a way not to forget the upcoming Spanish solar eclipse.

Months and weeks before the Spanish Great Eclipse would be more important to promote the eclipse of 2026 along the Roads to Santiago and recent information must be presented to people. This information might consist of the final best locations to observe the eclipse, tourism and educational activities and eclipse celebration programs, eclipse mas and data etc.

6.3 Conclusion

As previously discussed probably local authorities find it too early to start planning for the Three Consecutive Years of Eclipse Chasing in Spain. However, we should not forget how rare and important is this opportunity for Spain. The Spanish Great Eclipse can be as important and great as Olympic games or football world cup. The author which has years of experience as an amateur astronomer, tourism activist and astrotourism event organizer, believes that the following opportunity will be a great investment for Spain and even Europe on tourism, education and more. Moreover, organizing these events won't overshadow Spain only during the eclipse days. An early and comprehensive planning will offer great opportunities to Spain before, during and after the events.

That will be crucial for tourism sector of Spain to promote tourism in a new and creative form throughout the country to host eclipse chasers and observers. On one hand, this sector should know eclipse observers as a specific public with special requirements, on the other they should plan to cover their needs considering their concerns. Also the solar eclipse provides an awesome opportunity to promote tourism in less known tourism destinations along the path of totality or annularity and both tourists and local community can take advantage of this promotion. In addition, organizers should notice that the audience of a solar eclipse event won't be only astronomers. Holiday tourists, backpackers, cyclists and adventurers can be also involved in the event and be considered as public of eclipse celebrations.

In conclusion, Spain can organize one of the biggest eclipse chasing events in history and present its valuable results to the world as a pattern for similar events. Planers and organizers of The Spanish Great Eclipse will be able to use their experience to hold the second and the third event in the country. Moreover, after these three eclipse events they can publish their achievements and suggest it as a strategic plan to other host countries and communities.

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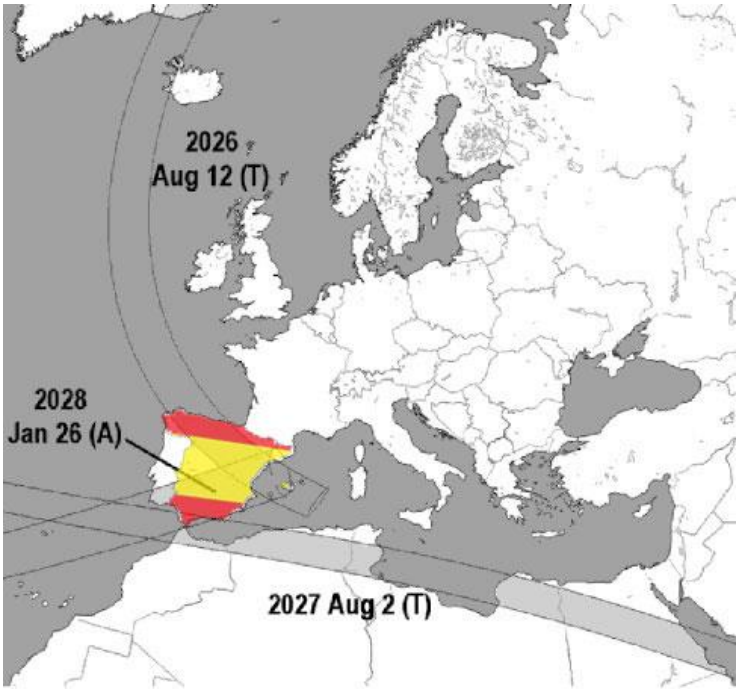
APPENDIX 1: Survey types (A), Respondents: Astronomy experts and eclipse chasers

Three consecutive years of eclipse chasing in Spain

In 2026, 2027 and 2028, the paths of 3 solar eclipses will cross Spain. (The eclipses of 2026 and 2027 will be total and that of 2028 will be annular). Those are the first total solar eclipses to occur over the Europe mainland (the main Europe territory without considering Iceland, Greenland and remote European islands) since 2000 and Spain will be the only European country in which the path of totality passes. There won't be any further totality in Europe till 2053, in which, once again Spain will be the only European country that hosts the path of totality! That situation gives a great opportunity to Spain to host a good number of solar eclipse chasers, professional and amateur astronomers and astrophotographers and anybody interested to see a solar eclipse as a memorable adventure in his/her life. Undoubtedly, Spain is one of the best places in the whole world to observe the total eclipse of 2026 according to the visibility map. After another year, once again the path of totality of another solar eclipse will cross the southern coast of Spain. The totality of this eclipse (2027) is one of the longest in the century and will last about 6 minutes. Although that totality wont last more than 4 1/2 minutes on the Spanish southern coast, cruise ships could take people to the part of the path of totality where the total phase of the eclipse would last about 6 minutes. Finally, six months later the path of a great annular solar eclipse crosses a vast area of Spain and the remaining ring of sunlight will appear above the horizon before sunset.

My work is research regarding these three solar eclipses in Spain, trying to study the conditions and situation of Spain and its capacity to host eclipse chasers. Please read the questions below and answer according to your own situation after considering the solar eclipse maps.

Thank you for your cooperation Mohammad Soltanolkotabi, amateur astronomer and astrophotography. Master student of Cultural Tourism in the University of Girona, Spain



1- What is your name?

2- In what year were you born?

3- What is your country of residence?

4- Are you interested to come to Spain to observe these solar eclipses?

○All of them

○At least one of them

○Two of them

5- What are your most important factors in selecting your destination country where you go to observe the solar eclipse

	Very important	**Important**	**Not important**
Safety of the country?	○	○	○
Selecting a cheaper destination?			
Choosing an area with a longer totality?	○	○	○
Where there is a better tourism facility?	○	○	○
Where I can meet experts?	○	○	○
Where clearer sky would be more probable?	○	○	○
Where I can have more experiences and activities apart from observing the eclipse as well?	○	○	○

6- I would rather observe the eclipse

〇Alone or in a small group away from others

〇In groups of astronomers but not with unprofessional people

〇I don’t care

〇Other:

7- If you finally choose Spain to observe the solar eclipse of 2026, you would rather observe it in a:

〇Big city

〇Small city

〇Village

〇Remote area

8- I will organize my trip

〇By myself

〇Buying a travel package

〇A part of my trip on my own and a part of it using travel packages

〇Other:

9- I prefer to observe a solar eclipse

〇at land

〇in a cruise ship if I can afford it

〇I don't care if I try to see it in the land or in cruise ships

〇Other:

10- (Due to the fact that the totality of the eclipse of 2027 will last in Spanish southern coast around 4 minutes, while it will be maximum of about 6 minutes in north African countries) To observe the solar eclipse of 2027 I would prefer to go to

〇The southern coast of Spain

〇One of the northern African countries

〇the sea and observe it in a cruise ship

〇Other:

11- Regarding the observing the annular Solar eclipse of 2028

〇I am interested but I am not sure if I make a serious plan for that

〇I am interested and definitely I will make a plan to observe it

〇I am not sure if I make a plan to travel and observe it

12- In case you are interested to observe the annular solar eclipse of 2028, where will you go for it?

〇Spain

〇South American countries

〇Other:

13- If I come to Spain to see the solar eclipse and I have enough time I would spend more days in the country to enjoy my time

〇Yes, a couple of days

〇Yes, at least a week or more

〇No I will come only to see the solar eclipse

14- I would like to come to Spain to see the solar eclipse

〇Alone

〇With my family

〇With my friends

〇With my friends and family

15- Are you planning to photograph the eclipse?

〇Definitely

〇Maybe

〇No

16- What are your most important requirements in a destination you choose to observe an eclipse?

17- Please kindly let me know if there is anything else (comments, suggestions, your experiences, etc.) you would like to mention regarding this research?

18- If you are interested to collaborate in this project please feel free to write your email address here. I will be glad to be in contact with you

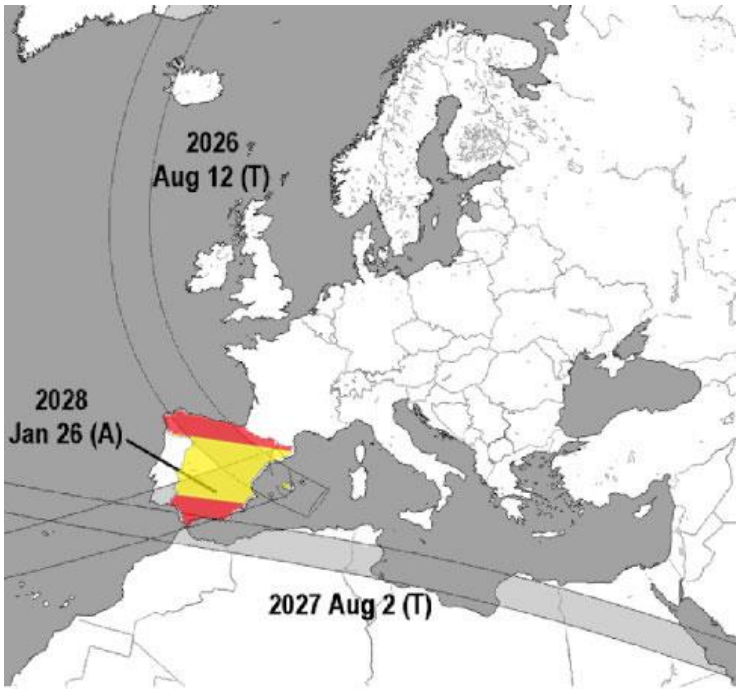
APPENDIX 2: Survey type (B), Respondents: Unprofessional people interested in astronomy

Three consecutive years of eclipse chasing in Spain

In 2026, 2027 and 2028, the paths of 3 solar eclipses will cross Spain. (The eclipses of 2026 and 2027 will be total and that of 2028 will be annular). Those are the first total solar eclipses to occur over the Europe mainland (the main Europe territory without considering Iceland, Greenland and remote European islands) since 2000 and Spain will be the only European country in which the path of totality passes. There won't be any further totality in Europe till 2053, in which, once again Spain will be the only European country that hosts the path of totality! That situation gives a great opportunity to Spain to host a good number of solar eclipse chasers, professional and amateur astronomers and astrophotographers and anybody interested to see a solar eclipse as a memorable adventure in his/her life. Undoubtedly, Spain is one of the best places in the whole world to observe the total eclipse of 2026 according to the visibility map. After another year, once again the path of totality of another solar eclipse will cross the southern coast of Spain. The totality of this eclipse (2027) is one of the longest in the century and will last about 6 minutes. Morover cruise ships could take people to the part of the path of totality where the total phase of the eclipse would last about 6 minutes. Finally, six months later the path of a great annular solar eclipse crosses a vast area of Spain and the remaining ring of sunlight will appear above the horizon before sunset.

My work is research regarding these three solar eclipses in Spain, trying to study the conditions and situation of Spain and its capacity to host eclipse chasers. Please read the questions below and answer according to your own situation after considering the solar eclipse maps.

Thank you for your cooperation Mohammad Soltanolkotabi, amateur astronomer and astrophotographer Master student of Cultural Tourism in the University of Girona, Spain.



1- What is your country of residency?

Your answer

2- In what year were you born?

Your answer

3- Have you ever seen any solar eclipses in your life?

○Yes

○No

4- If you live in Spain, would you like to make a plan and travel to the central path of the solar eclipse to observe it?

○All of them

○At least one of them

○Two of them

○I am not sure

○Other:

5- If you don’t live in Spain are you interested to come to Spain to observe these solar eclipses?

○All of them

○At least one of them

○Two of them

○I am not sure

6- What are your most important factors in selecting your destination country where you go to observe the solar eclipse?

	Very important	Important	Not important
Safety of the country?	○	○	○
Selecting a cheaper destination?			
Choosing an area with a longer totality?	○	○	○
Where there is a better tourism facility?	○	○	○
Where I can meet experts?	○	○	○
Where clearer sky would be more probable?	○	○	○
Where I can have more experiences and activities apart from observing the eclipse as well?	○	○	○

7- If you finally choose Spain to observe the solar eclipse of 2026, you would rather observe it in a:

○Big city

○Small city

○Village

○Remote area

8- I would rather observe the eclipse in a public place with other people, friends and families

○Yes

○I don't care

○I would like to see it in a place where there are some astronomers and experts

〇I absolutely want to observe it alone or in a very small group

〇Other:

9- I will organize my trip

〇By myself

〇Buying a travel package

〇A part of my trip on my own and a part of it using travel packages

10- I prefer to observe a solar eclipse

〇at land

〇in a cruise ship at sea if I can afford it

〇I don't care if I try to observe it at land or at sea

11- If I travel to go to the path of totality of the solar eclipse and I have enough time I would spend more days in the country to enjoy my time

〇Yes, a couple of days

〇Yes, at least a week

〇No I will come only to see the solar eclipse

12- If I come to Spain to observe the solar eclipse I would like to come:

〇Alone

〇With my family

〇With my friends

〇With my friends and family

13- If you are interested to collaborate in this project please feel free to write your email address here. I will be glad to be in contact with you!