



WIND TO SELECT THE RECREATION FLYING SITE

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ABSTRACT

Soaring is a recreational activity and competitive sport where individuals fly unpowered aircraft known as paragliders. Also soaring Pilots need to understand the sky to fly successfully and safely. Wind can be re-evaluated in the growth of soaring. This paper provides wind as an integral part of paragliding for: Beginner pilots, Regular pilots, Good pilots. In this research Surfer and GIS software (IDW Method) used in evaluation of prevailing Wind speed and direction to create maps to select recreation flying site in Esfahan, Iran. The results revealed that, the most area and prevailing wind speed frequent is appropriate to the Regular pilot class.

Keywords: Flying site, GIS, IDW, Surfer, Wind speed, Wind direction, Paragliding, Esfahan.

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Contribution/ Originality

This study is one of very few studies which have investigated wind speed and direction in advance to generate an optimal flight condition based on real-time case study data. An important use of the analysis is the possibility of predicting events in another location or at another point in time.

1. INTRODUCTION

Weather influences, especially outdoor activities what and when can be carried out. The pilots and tourists desire an activity should consider the weather when deciding whether the activity can be completed with satisfactory safety, enjoyment and comfort. The wrong combination of these conditions may more than suffice to cancel the scheduled program. Sports tourism can be seen as an important sub-set of tourism; it is growing rapidly, and offers some interesting research areas. Perry (2004) in "Sports Tourism and Climate Variability" reviews the whole field of sports tourism and climate variability and suggests where research activities might usefully be concentrated. Since most sporting events take place outdoors they are subject to the possibility of disruption, delay, postponement or cancellation due to adverse weather (Perry, 2004).

Dream about flying has been following in most of people through the years. Some people make this dream came true. Soaring is a recreation activity and competitive sport where individuals fly unpowered aircrafts known as paragliders (Araque *et al.*, 2006). The soaring community is very extensive. The pilot have had to sharpen up their good meteorological sense to maximize their soaring experience (Salguero *et al.*, n.d). But Tandem flight can be enjoyed by

anyone (less than 260 pounds) of any age with no prior experience necessary. Gomez (2005) in "Weather, Climate and Tourism a Geographical Perspective", examines the relationship among climate, weather, and tourism from the perspective of the geography of tourism and climatology.

Wind between climate parameters; have been rejected historically, although even these can be re-evaluated, as in the growth of gliding and wind surfing, which used to be exclusively practiced in a natural environment of mountains. Thus, new types of tourism have emerged, thereby turning previously rejected elements into the main "raw material" (basic tourism resource) of many recreation activities (Gomez, 2005). This, in turn, has helped to transform marginal areas with these elements into important resorts.

A good example of this is Tarifa (Spain). It is located between two leading tourism areas, the Costa del Sol (Coast of Sun) and the Costa de la Luz (Coast of Light), and has magnificent beaches, as well as other natural resources and interesting monuments, tourism has not until recently been an important activity in the local economy. This area appears to have remained undeveloped because of the wind, an element traditionally not highly valued by tourists. In fact, there were few tourists to this coast before the 90s, but recent changes in needs and tastes and the establishment of new types of activities have given rise to a tourist boom in Tarifa. The wind has enabled the development of tourism, and the people who previously depended on the area's natural resources for fishing and agriculture have found a new source of prosperity in this business. (Go'mez and Palomeque, 2001)

Flying on different kinds of gliders is what we call as a free flying. This paper focuses on paragliders. Because of some limit paraglider pilot's decisions are always based on large knowledge about flying in different conditions. The majority of Paragliding that takes place today is recreational and mostly on publicly accessible sites. Flying site remains a matter of locating a suitable piece of ground and then making the correct approach. This approach must dignify the sport; and show how aviation is a constructive, educational, and an excellent recreation activity that is governed by safety code (Hager and Stillman, 2011).

in "Wind Mapping in Malaysia Using Inverse Distance Weighted Method" spatial wind mapping had been showed distribution of wind speed of Malaysia (Yong *et al.*, 2011). "Research on assessment indices of safety and comfort for flight in wind fields" is written by HAN Guoxi and ZHANG Shuguang. This paper established models of mountain wave, turbulence and discrete gust, then use the vibration total value (VTV) to assess different wind by flight simulation. At last, they obtain some meaningful conclusions (Guoxi and Shuguang, 2011). In "Prevailing Wind Direction Forecasting for Natural Ventilation Adjustment in Greenhouses Based on LE-SVM", Yubing Yanga and Zhao (2011) Illustrated, Due to strong randomness of wind direction least squares support vector machine (LS-SVM) is applied to build a prediction model for a defined prevailing direction of wind for natural ventilation of greenhouse. The comparison results show that the proposed LE-SVM model is better than ANN model in forecasting of prevailing wind direction (Yanga and Zhao, 2011). As will be discussed later, the Recreation flying site requires more consideration of such things as prevailing wind and the direction and determination of the prevailing wind at different times of the year. Because it is also an integral part of soaring conditions, we devote this study to wind.

2. WIND CHARACTER TO FLY

"One sky, one world: the wind knows no borders, and the molecule that hits the kite today was probably flying over Chile yesterday and will be in Mongolia next week." (Chorier and Mehta, 2007) One aspect of weather that affects our lives and especially flying is the wind. Wind can carry various characteristics and so has an important role to play in weather (Pagen, 1992). Study of wind character is one of the important and primary aspects for selecting the suitable flying sites. However, flight weather conditions is decided by many factors, among them wind speed and wind direction have dominant influences. Wind speed and direction are always changing randomly (Yong *et al.*, 2011). This paper survey wind speed and direction in advance to generate an optimal flight condition based on real time data.

The glider flies because it has an air flow over and under it at 15km/h. The factors by which judge the winds are: speed, direction, gusts- variation in speed or direction. The speed and direction of the wind will influence glide path. Paraglider pilots always take off and into the

wind. They have the time to play with the wind, to do some tricks. Wind fields have adverse effect on fly safety and comfort. Prevailing wind direction is the most intensive wind direction within a certain time interval (Guoxi and Shuguang, 2011).

Flights will be in wind which is deflected upward by the mountain, ridge lift. Wind strength and direction affect the quality of lift: Stronger wind provides more lift and 90degree wind direction provides best lift. Pilots should be prepared for when they are far from the take-off or landing zone and need to check wind condition, so that activity can shift with the wind (Vargas and Wang, 2009).

3. METHOD

To fulfil the pilots and tourists request for an extensive data collection it is inevitable to make accumulated data from different sources accessible. Surfer and GIS software can describe and identify potential area geometrically, thematically, meteorologically and topologically. The objective of geographic analysis is to transform data into useful information to satisfy the requirements or objectives of decision-makers at all levels in terms of detail. In this research, interpolated wind speed in spatial mapping by the approach of Inverse Distance Weighted (IDW) method.

When wind data are available, IDW is used to interpolate between the point measurements. When there is no wind data then a general value of wind speed is used over the entire area (Allen *et al.*, 1998). To survey the value for any unmeasured location, IDW will use the measured values surrounding the prediction location. Those measured values closest to the prediction location will have more influence on the predicted value than those farther away (Luo *et al.*, 2011).

Surfer software used a grid file to create a vector plot. Hence, wind has created as grid directional data, and draw stick plots for monthly wind direction. Therewith, GIS tools are used for bringing the geo-referenced data of Esfahan province geographic location into digital maps. Each object is assigned to a thematic layer. Each layer combines related objects like Esfahan topography, classified prevailing wind speed and wind direction. Finally, exported the Esfahan Province soaring Wind classified maps for each month.

3.1. Define Standards

It is imperative that all flying sites, especially paragliding, be carefully chosen. Considerations include wind strength and direction, relative position of mountain, the starting area and the place where pilots are assumed to land after a normal flight, according to the wind (Hager and Stillman, 2011). It was common for the pilots to use their subjective judgment and previous experience when selecting the most appropriate place for soaring. To solve this problem we ask soaring experts to score a list of possible wind speed and direction conditions. This research information provides effective answers to queries such as what are considered to be light, moderate and strong wind speeds for average paragliding? We suppose this is likely to be subjective but what is general opinion?

A description of ideal wind conditions for first flight is no variation in wind speed or direction. And the wind speed is 12 km/h blowing straight up the 25 degree slope (Pagen, 1992). In other words, Suitable weather conditions combine clear sky with wind 10-20 mph (15-30 km/h). It depends on where the pilots fly. proverbially for dune soaring: light 10 km/h, mod 18 km/h, strong 25+ km/h; and for normal mountain flying it differs a lot 'cause the mountains slow the wind down so that's a question of wind at different heights, but above taking off can be nasty because of the mix of thermals and wind, and if that still is fun that depends on skill level. According to another opinion: for beginners (fresh out of school) zero to four m/s, for regular pilots four to six m/s, for good pilots six to seven m/s, and Up to seven m/s not fly.

Landing will be in steady winds. Ideal conditions for paragliding landing skills are steady winds of eight to 16km/h. this will allow pilot to gracefully step out of the air without having to run. landing is need primarily winds less than 12km/h. beginners should not fly in winds over 18km/h. for novice pilots wind speed should not over 25km/h (Vargas, 2008). The following species have been extracted and extrapolated from various sources including the USHPA instructors' manual. Regarded to these standards we'd have concluded:

- Beginner pilots (0-7 knots)

- Regular pilots (7-10 knots)
- Good pilots (10-13 knots)
- Not fly (Up to 13 knots).

The limit to safe flying comes when the speed of the wind, approaches that of the minimum flying speed so that pilots can no longer manoeuvre with respect to the ground. In Table (1) illustrated the effects of determined wind speed on land.

Table-1. Wind Speed Effects on land

Knots	m/s	Km/h	Label	Effects on land
1	0 - 0.2	1	Calm	Calm. Smoke rises vertically.
1-3	0.3-1.5	1-5	Light Air	Wind motion visible in smoke.
4-6	1.6-3.3	6-11	Light Breeze	Wind felt on exposed skin. Leaves rustle.
7-10	3.4-5.4	12-19	Gentle Breeze	Leaves and smaller twigs in constant motion.
11-15	5.5-7.9	20-28	Moderate Breeze	Dust and loose paper rise. Small branches begin to move.

Source: Pagen (1992)

3.2. Case Study Data

The success of tourism in any country depends on the ability to sufficiently develop, manage and market the tourism facilities and activities. This study was carried out in tourism destination Esfahan Province, which has a four season climate offers, a lot of ecotourism resources and actually potential flying sites. Esfahan province with an area of 10.7 million hectares is located in central situation of Iran, in the tile vicinity of the Zagros Mountains. It is located between 49 D, 15 M until 55 D, 45 M longitude and 31 D, 25 M until 34 D, 30 M latitude. Esfahan province consisted of 23 townships. The Geographical situation of Esfahan province is presented in Figure (1).



Figure-1.Esfahan Province Location Map

Regarding the natural and topographical situation, the climate of the province is changeable as well. although the province generally enjoys a dry and temperate climate, but it can be classified as some climatic regions depending on the distance with western mountainous area and desert (Kavir) plain in the east and northeast.

Wind speed and direction can be obtained. These parameters will determine the subgroup of possible flight areas appropriate to begin. wind Information gives the background wind speed and directional information at above level. It takes into account surrounding topography. It allows air paths and air mass exchange to be understood (Jovanovic and Njegus, 2008). For this study, simulated wind data monthly and annual, will be collated, evaluated and considered. We used normal climatologically Wind Direction (Prevailing) and Prevailing Wind Speed (Knots) data for the period 1976-2005, of 20 Synoptic Stations in and around the Esfahan province. Data has been employed from I.R Of Iran Meteorological Organization (IRIMO) to make primary Excels files. These Synoptic Stations is represented in Figure (2).

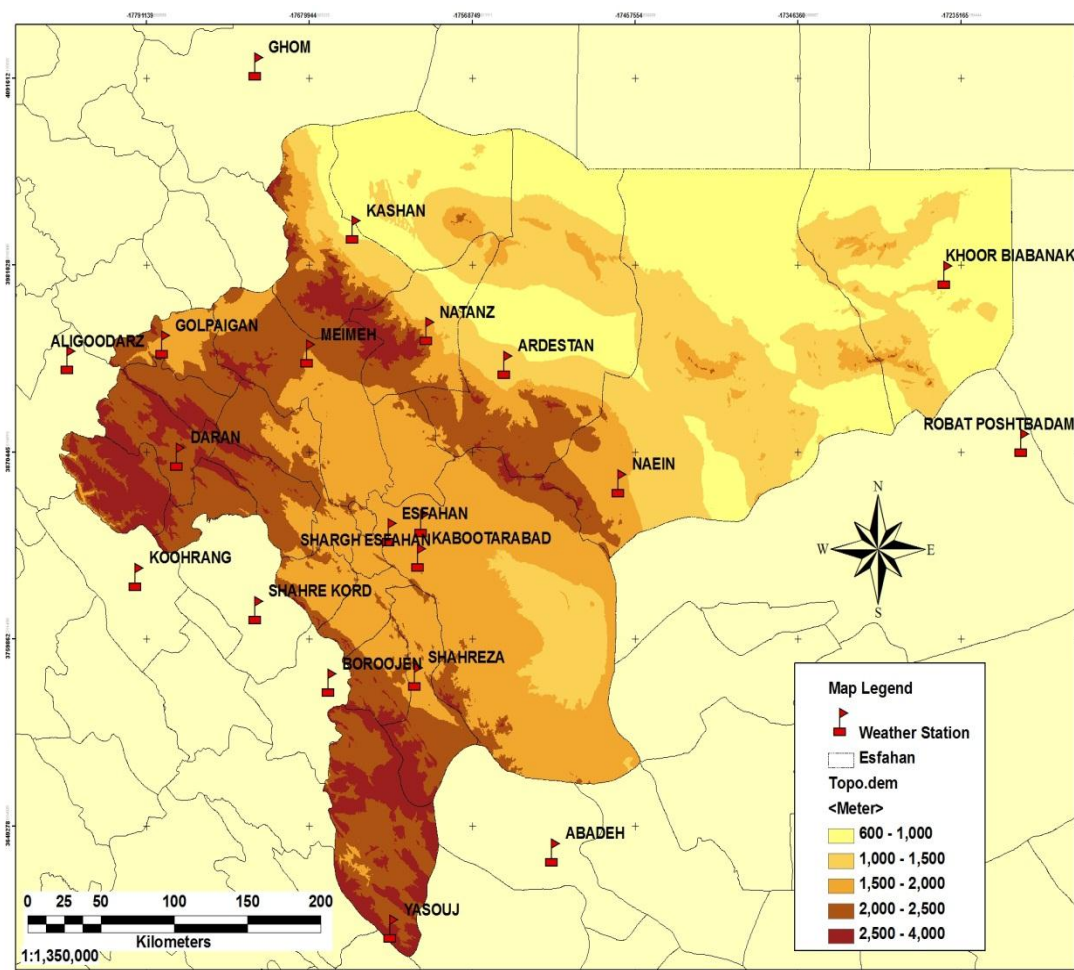


Figure-2. Location of Studied Synoptic Stations Map

Then wind direction primary maps created by surfer software in different angles for per month and saved in (.shp) formats which matches with GIS. Afterwards created wind speed maps and reclassified them in four classes for suitable soaring wind speed by Arc Map. Table (2) shows Monthly mean wind speeds in the study area is 8 knots.

Table-2. Descriptive Statistics prevailing wind

	Wind Speed (knot)	Wind Direction (Degree)
Mean	8	—
Minimum	4	45° (Northeast)
Maximum	14	360° (North)
Frequency class range	7-10	270° (West)

4. SURFER AND GIS MAPPING RESULTS

A picture can describe thousand words, the wind data, if described in an image (spatial mapping) can be more easily been understood. Wind data of 20 synoptic stations by month are available. In order to provide information for selecting suitable place and trends more convincingly or for analyzing a situation and planning more efficient, an integrated Map designed for this particular purpose is needed. Prevailing wind direction is the most intensive wind direction within a certain time interval. Direction of Esfahan monthly prevailing wind is described in Figure-(3) using maps to present information in an effective way. Jovanovic and Njegus (2008) Maps are a natural means of indexing and presenting flying wind related information. In the maps, symbol size indicates wind speed and orientation of arrows indicates relative direction of Prevailing wind. In the study of the potential recreation flying site, the surface wind orientation often has the angle change; howsoever The Maps show that, the prevailing West wind is accrued on most Esfahan province townships. Take-off and Landing are always done into the wind. If the wind is switching, split the difference on final landing approach. It is common to enchase wind indicators on both the landing and take-off zones.

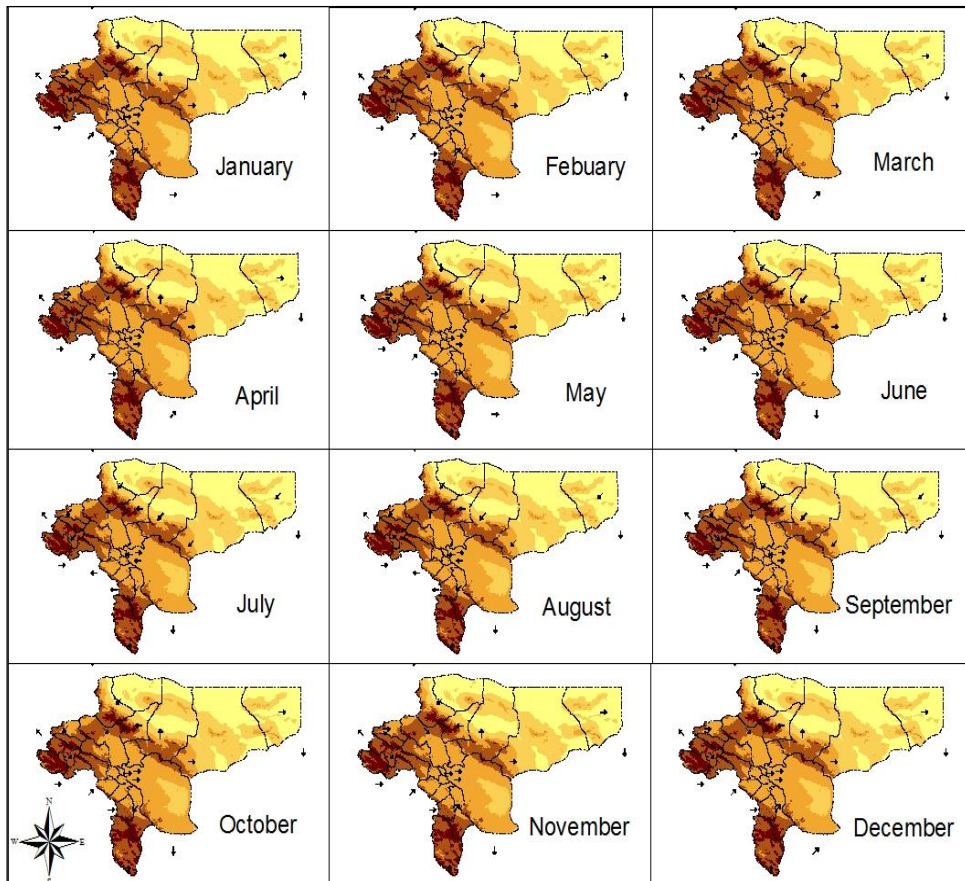


Figure-3. Esfahan Province Prevailing Wind Direction Maps (Monthly)

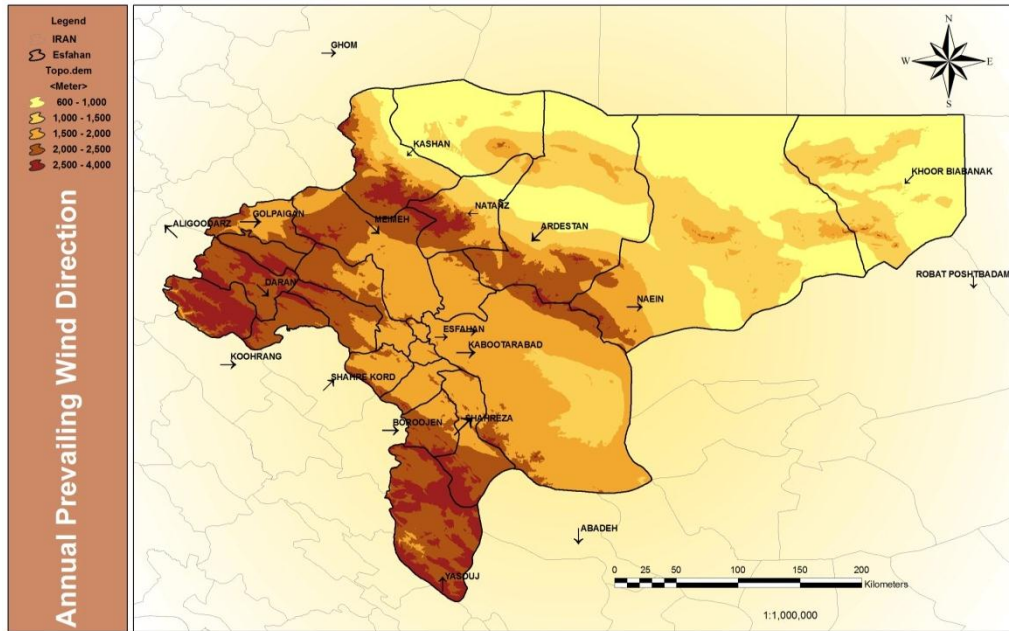


Figure-4. Studied Area Annual Prevailing Wind Direction

Esfahan has West prevailing wind between 4 to 14 knot speeds. There is a dramatic transition in both the wind speed and direction per month above Esfahan townships which is shown in Figure (5). And also In the Figure (6), colors indicate wind speed and orientation of arrows indicates direction of prevailing wind. In the maps Esfahan prevailing wind speed was classified, regarded to the standards which have been concluded:

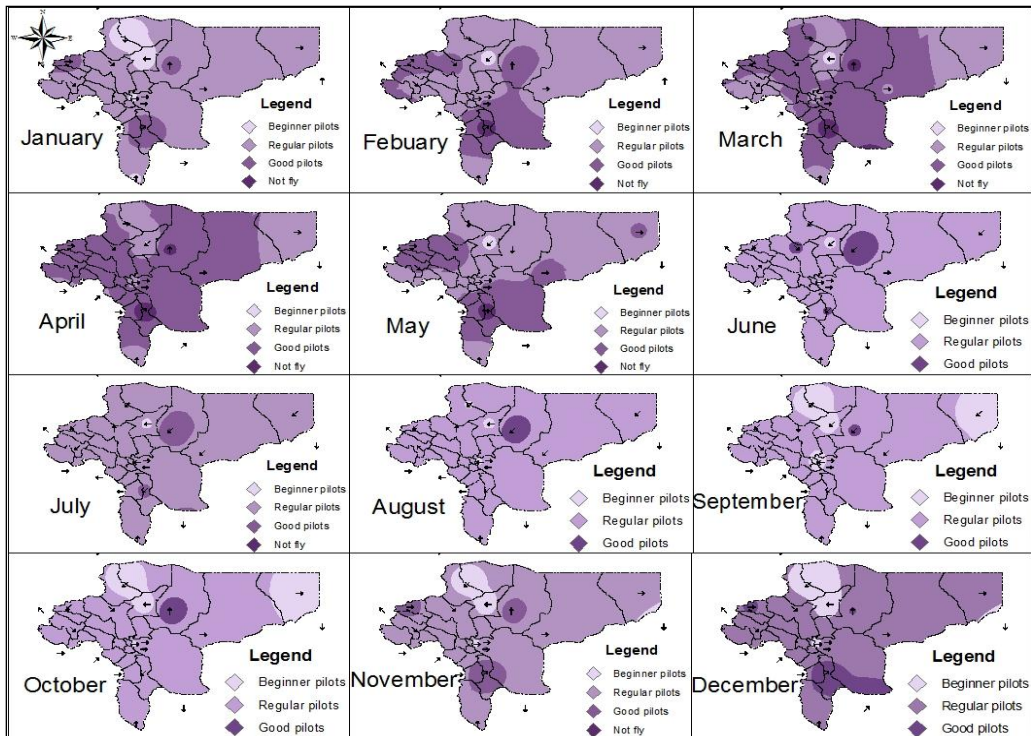


Figure-5. Esfahan Province Prevailing Wind Speed & Direction Maps (Monthly)

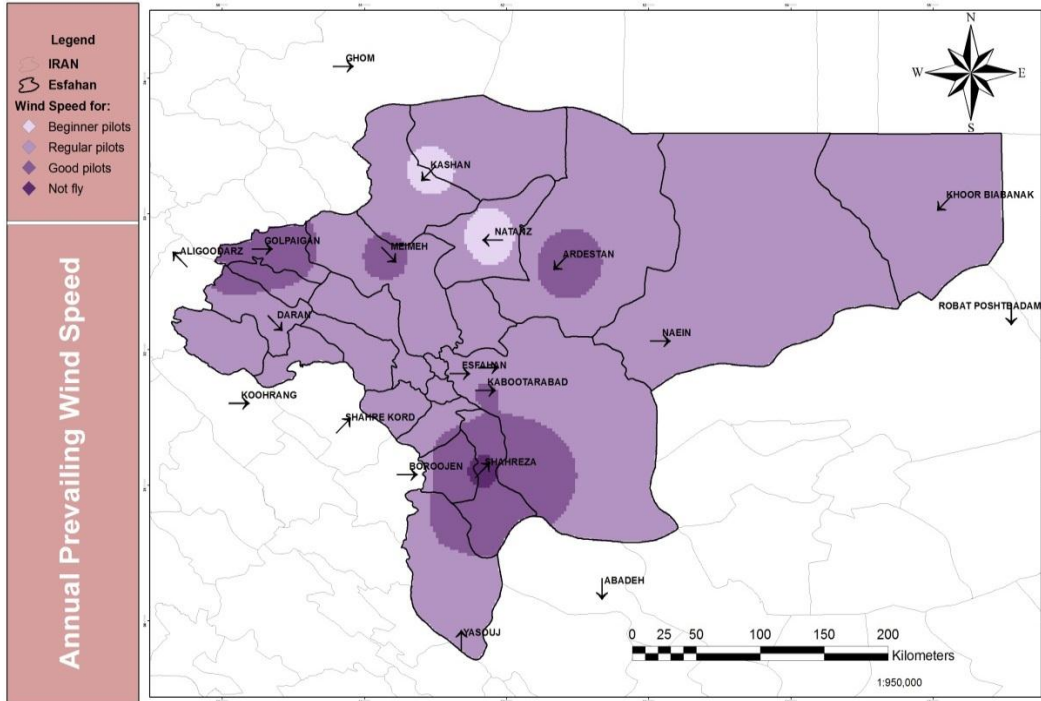


Figure-6. Esfahan Province Annual Prevailing Wind Speed & Direction Map

- Beginner pilots (0-7 knots)
- Regular pilots (7-10 knots)
- Good pilots (10-13 knots)
- Not fly (Up to 13 knots).

5. DISCUSSION

The glider flies because it has an air flow over and under it. Despite not using an engine, paraglider flights can last many hours and cover many hundreds of kilometers. Many things which help pilot with his trip are necessary, especially when the flight is cross county type (Rzucidło, 2009). The way of crossing area where the fly is made is an individual tactic of flight. The factors that influence the suitability for flight are dynamic. These criteria are flexible. For example, in lighter wind one can tolerate little more gusting. With a steady airflow one can stand little more cross wind.

“Weather and Climate Information for Tourism” provides a synopsis of the capacities and needs for climate services in the tourism sector, including current and emerging applications of climate services by diverse tourism end-users, and a discussion of key knowledge gaps, research and capacity-building needs and partnerships that are required to accelerate the application of climate information to manage risks to climate variability and facilitate successful adaptation to climate change (Scott and Lemieux, 2010).

GIS software is especially convenient for planning and positioning of locations for recreation zone. In this paper, it also serves to choose preparing location for the recreation flying site in Esfahan Province. Table (3) Esfahan Wind Calendar to fly created refers to the time (monthly), available Area (square kilometer) and class to fly. This Matrix illustrated the most area is appropriate to the class of Regular pilot (7-10 knot wind speed). Between the determined classes to fly, due to Esfahan prevailing wind speed, most frequency were in two the Regular then Good pilot classes. April is recommended to Regular pilot. Popularly all Esfahan Province townships have suitable time for Flying, whenever prevailing wind speed in March was too strong, so recommendable to Good pilot and in October it was generally weak which is recommended to Beginner pilot.

Table-3. Esfahan Wind Calendar to Fly

	Beginner pilots	Regular pilots	Good pilots	Not Fly
January	11973.7	128393.12	11515.59	195.66407
February	1156.1522	104817.22	44451.378	1621.0589
March	862.03054	50426.762	97214.158	3493.5242
April	71.024007	36632.218	112231.96	3140.182
May	1091.8311	100148.82	49117.574	1716.02
June	766.29429	143192.06	8171.2287	
July	620.7961	143196.57	8235.7478	67.936475
August	1316.1288	146167.08	4646.3723	
September	25314.417	125901.08	958.59466	
October	25447.867	122631.85	4090.0905	
November	10497.256	129209.74	12318.767	69.786904
December	16291.591	123734.07	12060.422	
Annual	2828.0707	130587.22	18144.723	537.27604

Source: authors

Pilots can increase the rate of learning by flying under smooth conditions with light to moderated winds. Stronger winds will require skills to prevent being dragged. Although stronger wind provides more lift. If pilots landing in strong wind sometimes there is a danger of getting dragged (Vargas and Wang, 2009). In general spring and summer seasons are suitable time for sport tourists and pilots have recreation flying above Esfahan province.

Esfahan local mountains often provide an excellent tandem opportunity. The launches used range from 800meter to 4000meter. Fly above the landscape getting a true bird's eye view of the world below. The basic requirements are: a properly oriented (with respect to prevailing wind) takeoff and landing strip of sufficient size to accommodate the largest paraglider wings (Hager and Stillman, 2011). If the length of the slope is longer pilot can tolerate a lighter wind.

These Maps and results will have two different kinds of users: expert and novel ones. By expert we mean those (pilots) who will be able to use maps for an easier choice of the appropriate area for a precise location and time. They will be able to select the adequate parameters according to their own experience, and depending on the kind of flight they intend to perform.

Novel ones are Tourism planner, tour operators and travel agencies. They are supposed to use a much simpler map, with which they will be able to generate predefined or simple reports without having deep knowledge in soaring. Actually, they can use map in order to the conditions for soaring areas will be favorable also when and in which geographical areas they could be performed (in our example the data correspond to Esfahan province). In this way, trips can be arranged and tourism project activities can be organized with great reliability.

Interviews and analyses with relation to the mentioned centers and other international initiatives demonstrate that commercial motives lie behind all the innovations in sport facilities that they achieved. In this regard, they were not only able to profit from the politics or market deregulation and liberalization in general, but also the increasing receptiveness of the public, government and sports organizations to commercial aviation sports facilities in countries where these facilities were traditionally financed and managed by a coalition of national sporting organizations, local sporting clubs and national and local governments.

6. CONCLUSION

An important use of the analysis is the possibility of predicting events in another location or at another point in time. As flight routes influenced by different atmospheric status, the ideal conditions for every flight area could be determined. This paper survey wind speed and direction in advance to generate an optimal flight condition based on real time data. The spatial wind mappings leave a visual determination tool to the decision makers. This study was carried out in the tourist destination Esfahan Province, which has a four season climate offers, a lot of ecotourism resources and actually potential flying sites.

GIS software is especially convenient for positioning of locations for the recreation flying zone. Things that make a good site are also things that make a site safe. It is imperative that all flying sites, especially Paragliding, be carefully chosen. Considerations include wind strength and direction, relative position of the mountain, the starting area and the place where pilots are assumed to land after a normal flight, according to the wind. In this research, interpolated wind speeds in spatial mapping by the approach of Inverse Distance Weighted (IDW) method. Therewith, Surfer software used to draw stick plot for wind direction.

Regarded to various sources we'd have devoted four classes to wind speed flying: Beginner pilots (0-7 knots) Regular pilots (7-10 knots) Good pilots (10-13 knots) Not fly (Up to 13 knots). The Esfahan province has West prevailing wind between four to fourteen knot speeds. The results revealed that, the most area and prevailing wind speed frequency are appropriate to the class of Regular pilot. These Maps results will have different kinds of users, including expert and novel ones. In this case study, Esfahan province's local mountains often provide an excellent tandem opportunity.

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