

SEASONAL VARIATION ANALYSIS OF SOME METEOROLOGICAL PARAMETERS FOR SOARING

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ABSTRACT

In this paper time series of meteorological parameters recorded in three soaring fields, Eskisehir, Aksehir and Selçuk have been analysed. Seasonal variations and trend analysis of temperature, wind speed and relative humidity observed in these stations between 1988 and 1992 have been presented. The purpose of this study is to compare the soaring conditions at three different regions: İnönü (Western part of Central Anatolia), Selçuk (Eagen Sea Region) and Aksehir (Southern part of Central Anatolia). Some local and large scale effects on soaring and climatological changes on soaring conditions have been investigated by using harmonic and some other statistical analysis.

1. INTRODUCTION

The structure of atmospheric convective boundary layer plays an important role for soaring. The development of the convective boundary layer is connected with the diurnal variations of temperature, humidity, precipitation and wind velocity, (Reference 8), Wallington (1986), Lindemann (1988). The favorable thermic conditions for gliding fundamentally depend on the incoming solar radiation. Temperature variation effects on atmospheric stability and strength of thermals. Precipitation and atmospheric turbulence cause some limitation on soaring. Higher wind speeds distort thermals close to the ground. The specific purpose of this study is to investigate the favorable area for soaring. For this purpose small and large scale effects on temperature, humidity, precipitation and wind speed are taken into account for three different areas. The meteorological data observed in Eskisehir (Inönü) ($39^{\circ}46'N - 30^{\circ}31'E$), Izmir (Selçuk) ($37^{\circ}57'N - 27^{\circ}22'E$) and Konya

(Aksehir) ($38^{\circ}21'N - 31^{\circ}23'E$) have been analysed, (References 5 and 6).

2. MATERIAL AND METHOD

The climatological data (the monthly averages of air temperature, relative humidity, precipitation, wind speed and insolation) in short - term (1988 - 1992) between April-September (during activity period of gliding school) have been analysed by using statistical techniques. The mean, maximum and minimum value of meteorological parameters for five years are compared to the data based on long-term observations between 1933 and 1970. Seasonal trends of meteorological parameters have been evaluated by using the time variation analysis.

One to six order amplitudes and phases of parameters have been computed by using Fourier Transformation Equation, (Reference 6). The lower order of harmonics are associated with the large scale effects and the higher order ones show the small scale effects on these parameters, (Reference 2). The phase of harmonics indicates by the month in which the maximum or minimum value occurs.

3. ANALYSIS

The temperature, relative humidity, precipitation, wind speed and radiation conditions are taken into account in İnönü, Selçuk and Aksehir where the gliding activity is carried on. In this study some results of harmonic and statistical analysis are described.

3.1 Statistical Analysis

Monthly averages of insolation and air temperature have decreased in Eskisehir in 1990 and 1992. The monthly averages of these two parameters are slightly higher than the long-term averages between 1988 and 1989. Total precipitation amount in 1992 is greater than the long-term

averages in 1988 and 1991, (Reference 6). Relative humidity values are greater than long-term averages between 1988 and 1992. The wind speed values are higher than the long-term data observed in 1991 and 1992.

Monthly average of air temperature is lower than the long-term value at Aksehir in 1990 and 1991. The short-term average value of temperature (18.7°C) is slightly higher than long term data (18.4°C). The maximum temperature values observed in short and long-term in August are 24.1°C and 22.7°C respectively. The minimum values of temperature in the two periods are 11.0°C and 11.2°C respectively, and observed in April. The monthly mean value of total precipitation (35.1 mm) between 1988 and 1992 is lower than the average value (40.1 mm) observed in long-term period. The maximum and minimum amount of total precipitation are observed in May and in August respectively.

The monthly average wind speed in the short-term is higher than in the long-term. Except 1989, the monthly average of relative humidity (54%) in short-term is higher than in the long-term (53.3%). The maximum values of average relative humidity for short and long-term are 65% and 60% in April and August respectively. The statistical evaluation of some meteorological parameters for Aksehir is listed in Table 1.

Average insolation is 9.26 hours/day and average cloud cover is 5.1/10 between 1933 and 1970.

In Selçuk, the monthly mean air temperature decreases from the beginning of 1989. The average value of short-term data (21.9°C) is slightly higher than average value of long-term

temperature (21.6°C), (Table 2).

The maximum values of average temperature for short (28.2°C) and long-term (25.9°C) data are observed in July. The minimum values for long (14.2°C) and short-term (14.6°C) are observed in April. The monthly average value of relative humidity in the short-term is lower than in the long-term except for 1988, at 58.8% and 63.5% respectively. The highest average of relative humidity is observed in April for the short-term data and in September for the long-term data. The lowest one (50.0%) is observed in June. Total precipitation is clearly higher than the long-term averages in 1990. The total precipitation for short-term (15.2 mm) is lower than the total precipitation for long-term (21.2 mm). The maximum and minimum value of

TABLE 1
Statistical values of some meteorological parameters in Aksehir between April and September

Parameter	Short - Term (1988-1992)	Long-Term (1933-1970)
Temperature (°C)		
T(average)	18.7	18.4
T(maximum)	24.1 (August)	22.7 (August)
T(minimum)	11.0 (April)	11.2 (April)
Relative Humidity (%)		
RH(average)	54.5	53.3
RH(maximum)	65.0 (April)	60.0 (April)
RH(minimum)	48.0 (August)	46.0 (August)
Precipitation (mm)		
P(monthly total)	35.1	40.1
P(maximum)	88.0 (May)	70.9 (May)
P(minimum)	0.3 (August)	9.4 (August)
Wind Speed (m/s)		
V(average)	2.0	1.8
V(maximum)	2.5 (April)	3.4 (April)
V(minimum)	0.7 (May)	0.5 (August)

TABLE 2

Statistical value of some meteorological parameters in Selçuk between April and September.

Parameter	Short - Term (1988-1992)	Long-Term (1933-1970)
Temperature (°C)		
T(average)	21.9	21.6
T(maximum)	28.2 (July)	25.9 (July)
T(minimum)	14.2 (April)	14.6 (April)
Relative Humidity (%)		
RH(average)	58.8	63.5
RH(maximum)	70.0 (April)	70.0 (September)
RH(minimum)	50.0 (June)	58.0 (July)
Precipitation (mm)		
P(monthly total)	15.2	21.2
P(maximum)	91.3 (May)	51.8 (April)
P(minimum)	0.1 (July)	0.1 (July)
Wind Speed (m/s)		
V(average)	1.8	2.1
V(maximum)	2.1 (June)	4.1 (September)
V(minimum)	1.6 (August)	1.0 (June)

total precipitation for short (91.3 mm, 0.3 mm) and long-term (51.8 mm, 0.1 mm) are observed in May, April and July respectively. The monthly average wind speed for short term (1.8 m/s) is lower than long-term data (2.1 m/s) in Selçuk. The maximum wind speed value for short and long-term are observed in June and September. The minimum is recorded in August and June.

The insolation is 9.57 hours/day and average cloud cover is 2.8/10 in Selçuk between 1933 and 1970.

3.2. Harmonic Analysis

Harmonic analysis of meteorological parameters in Eskisehir indicate that seasonal variation of insolation is affected by small scale variations in 1988 and 1989, but large scale variations play an important role in 1991. The

small scale effects on the relative humidity variation have been observed between 1988 and 1992. Large scale variations highly affect on wind speed variations in the short term. The small scale phenomena have also played an important role on wind speed variations in 1991 and 1992.

The amplitudes and phases of temperature, humidity and precipitation observed in Aksehir are listed in Table 3. The higher small scale effects on temperature variations have been observed in long-term data in September. The large scale effects play an important role on temperature fluctuations between 1988-1992 in September and April. The large scale effects on humidity for the short-term in May are higher than the effects observed in the long-term data in April. The small scale effects on short-term data are slightly higher than the effects

observed in the long-term data. These effects have a great importance in April and May.

In recent years both the large and small scale effects play an important role on total precipitation. Large scale effects have been observed in June and September for short- and long-term data. Small scale effects have been observed in April for both periods.

The amplitude and phases for some meteorological parameters in Selçuk are listed in Table 4. Similar effects on temperature, relative humidity and total precipitation have been observed in Selçuk.

The small scale effects have a great importance on temperature fluctuation than the large scale one in short and long-term data. These effects are frequently observed

TABLE 3
Harmonics and phases of temperature, relative humidity (RH) and total precipitation (P) in Aksehir.

Harmonic No	Period (Month)	Short-Term Amplitude Phase Temperature		Long-Term Amplitude Phase	
1	18.0	0.72	6.86	0.0	0.79
2	9.0	0.12	17.42	0.0	0.87
3	6.0	26.63	16.37	27.77	16.33
4	4.5	1.07	15.95	0.0	0.28
5	3.6	0.17	0.17	0.0	0.56
6	3.0	0.37	17.50	2.53	17.47
Relative Humidity					
1	24.0	15.6	19.99	0.01	0.3
2	12.0	1.48	0.35	0.01	0.35
3	8.0	1.63	3.51	0.01	0.23
4	6.0	30.01	1.56	45.95	1.66
5	4.8	2.45	23.73	0.02	0.66
6	4.0	0.47	1.06	0.02	0.57
Precipitation					
1	24.0	114.44	21.02	0.01	23.6
2	12.0	3.07	2.88	0.01	23.45
3	8.0	121.29	20.74	0.02	23.12
4	6.0	812.61	2.02	1140.75	1.77
5	4.8	66.33	1.32	0.04	1.11
6	4.0	102.76	0.84	0.02	0.81

in September. But, the humidity variations are mostly large scale effects between 1988 and 1992 in April. Mesoscale effects have also great importance on humidity fluctuations in April and May in both periods. Large scale effects on total precipitation have been observed between 1988 and 1992 in August and September. The small scale effects played an important role on total precipitation in April in recent years.

TABLE 4
Harmonics and phases of temperature, relative humidity and total precipitation in Selçuk.

Harmonic No	Period (Month)	Short-Term Amplitude Phase Temperature		Long-Term Amplitude Phase	
1	18.0	0.72	6.86	0.0	0.79
2	9.0	0.12	17.42	0.0	0.87
3	6.0	26.63	16.37	27.77	16.33
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4. RESULTS AND CONCLUSIONS

Time series and harmonic analysis of some meteorological parameters show that the favorable thermal conditions for soaring is available in Selçuk (Izmir).

The main activities of the gliding school have been carried on for more than 55 years in Eskisehir. The industrialization and population growth negative effects on some meteorological parameters observed in İnönü (Eskisehir).

Insolation and air temperature decrease, and relative humidity and wind speed increase between 1990 and 1992. Total precipitation increases in 1991. The local scale effects play an important role during the Easterly wind conditions. These local factors have negative effects on the soaring conditions at İnönü (Eskisehir). These results are in good agreement with the pilots' reports. As a result of this study, it can be concluded that Aksehir (Konya) and İnönü (Eskisehir) will have less favorable conditions than Selçuk (Izmir) in spring, summer and autumn.

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