COMPARISON OF CM-SAF SIS AND SURFACE RADIATION DATA IN TURKEY FOR THE YEAR 2006

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Abstract
In this study, CM-SAF remote sensing SIS (Surface Incoming Solar Radiation) and Turkish in-situ surface radiation data have been compared for Turkey for the year 2006. Due to the geographical location, Turkey is lucky country compared to the others in terms of solar energy potential. According to sunshine duration and radiation data measured by TSMS from 1971 to 2000, Turkey's annual mean total sunshine hours are 2573 (daily mean is 7 h) and mean total radiation is 1474 KWh/m²-year (daily 4 KWh/m²). Geographic variables are measured at certain points, and prediction map for the entire area is been obtained by Inverse Distance Weighted (IDW) spatial interpolation method.

Keywords: Turkey, CM-SAF SIS, surface radiation, comparison.

INTRODUCTION

- This study is related to comparison of annual radiation of CM-SAF SIS and Turkish in-situ surface radiation data for the year 2006.
- In this study 157 Turkish climatic stations' radiation data were used.
- CM-SAF SIS time series have been obtained by using IDL Virtual Machine software.
- Data have been designed and calculated by using Excel.
- ArcGIS 9.3 is used for spatial interpolation and mapping activities.
- To obtain descriptive information about the data, correlation coefficient and residual map have been calculated, imaging and interpolation studies were applied.
- Two maps have been generated by using ArcGIS 9.3 Spatial Analyze Inverse Distance Weighted interpolation technique. After that residual map have been generated by using raster calculation in spatial analyze.

MATERIAL AND METHODS

In this study 157 Turkish climatic stations' radiation data were used. CM-SAF SIS data have been obtained by using IDL Virtual Machine software. Data have been designed and calculated by using Excel. ArcGIS 9.3 is used for spatial interpolation and mapping activities.

To obtain descriptive information about the data, correlation coefficient and residual map have been calculated, imaging and interpolation studies were applied.

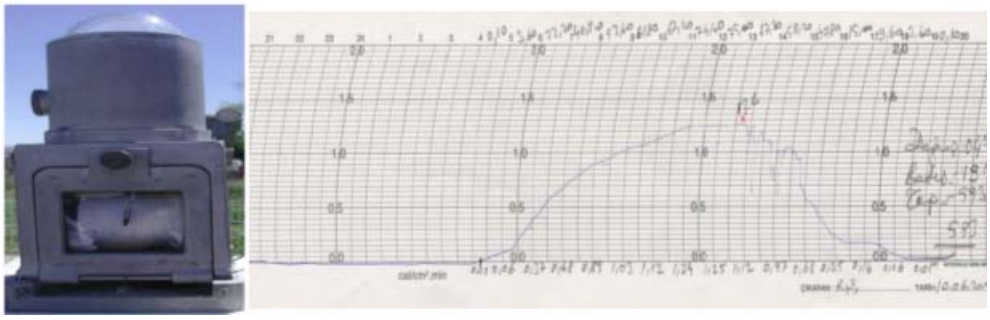

Fig. 1 Robitzch Actinograph and actinogram

Turkish radiation data has been observing via actinography (Fig. 1) which unit is cal/cm²/day. In Turkey there are 161 Actinograph to observe solar radiation.

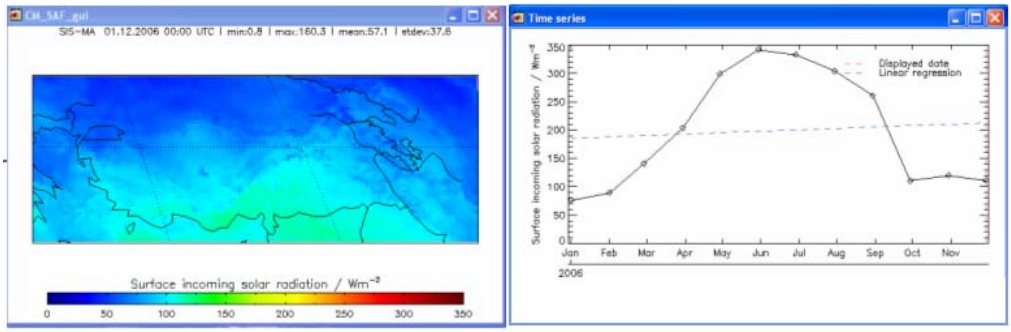

Fig. 2 IDL Software and CM-SAF Surface Incoming Solar Radiation (SIS) data

CM SAF SIS data unit is W/m² (Fig. 2). These two units have been converted to KWh/m²/year by using below formula (Url 4):

KWh/m²/ Year = ((Cal/cm²/day*365)/1000)*11.63 (for TSMS data)
KWh/m²/ Year = (W/m²*365*24) /(1000*12) (for CM-SAF SIS data)

Correlation coefficient has been calculated below formula:

$$\rho_{X,Y} = \frac{Cov(X,Y)}{\sigma_X \cdot \sigma_Y}$$

where;

$$-1 \le \rho_{XY} \le 1$$

and

$$Cov(X,Y) = \frac{1}{n}\sum_{i=1}^{n}(x_i - \mu_X)(y_i - \mu_Y)$$

Correlation coefficient has been found as 0.60 between two series.

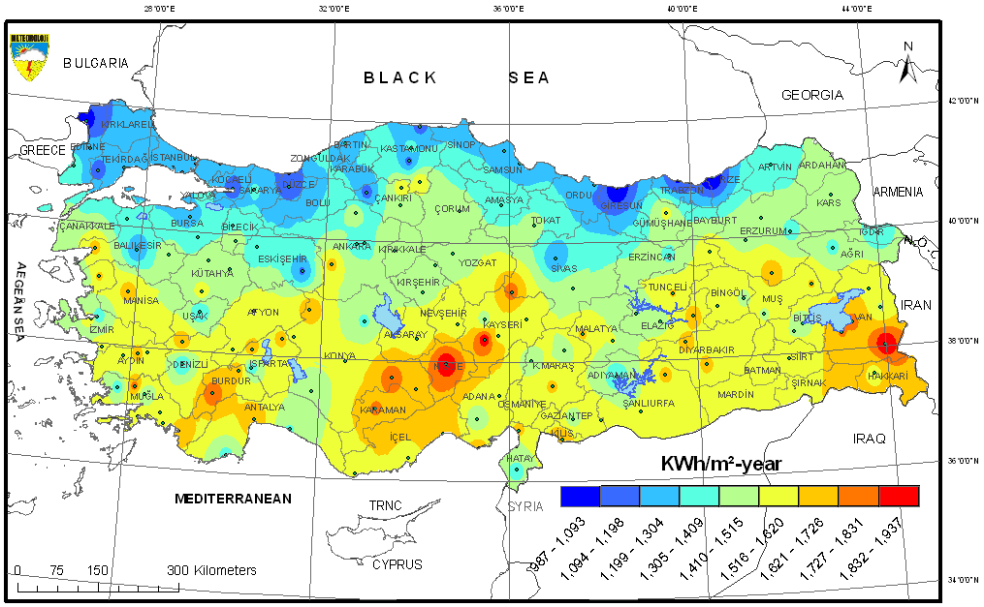

Fig. 3 Surface radiation map for the year 2006

Surface radiation map have been generated by using ArcGIS 9.3 Spatial Analyze Inverse Distance Weighted interpolation technique (Fig. 3).

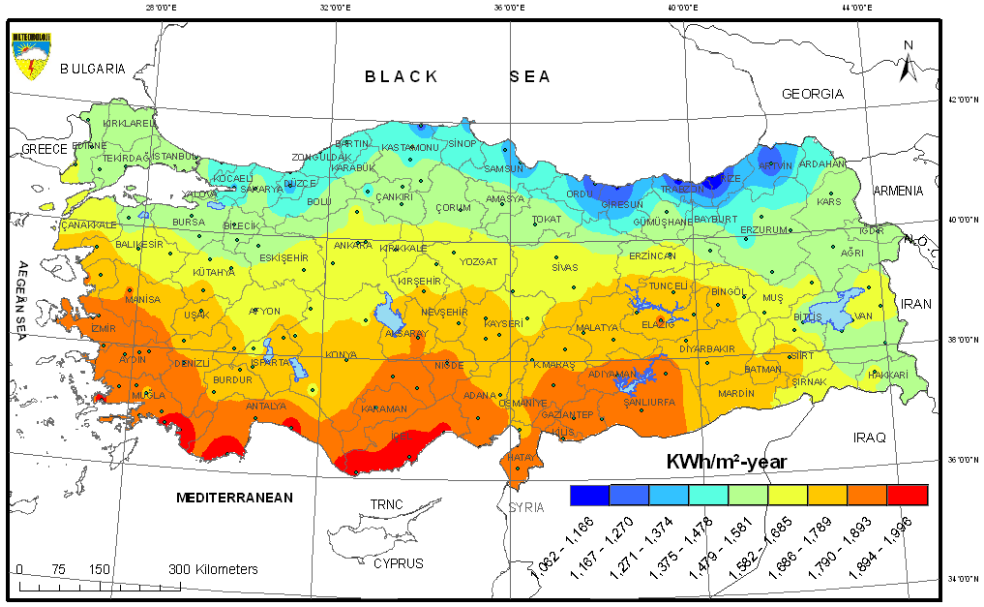

Fig. 4 CM-SAF SIS map for the year 2006

CM-SAF SIS map have been generated by using ArcGIS 9.3 Spatial Analyze Inverse Distance Weighted interpolation technique (Fig. 4).

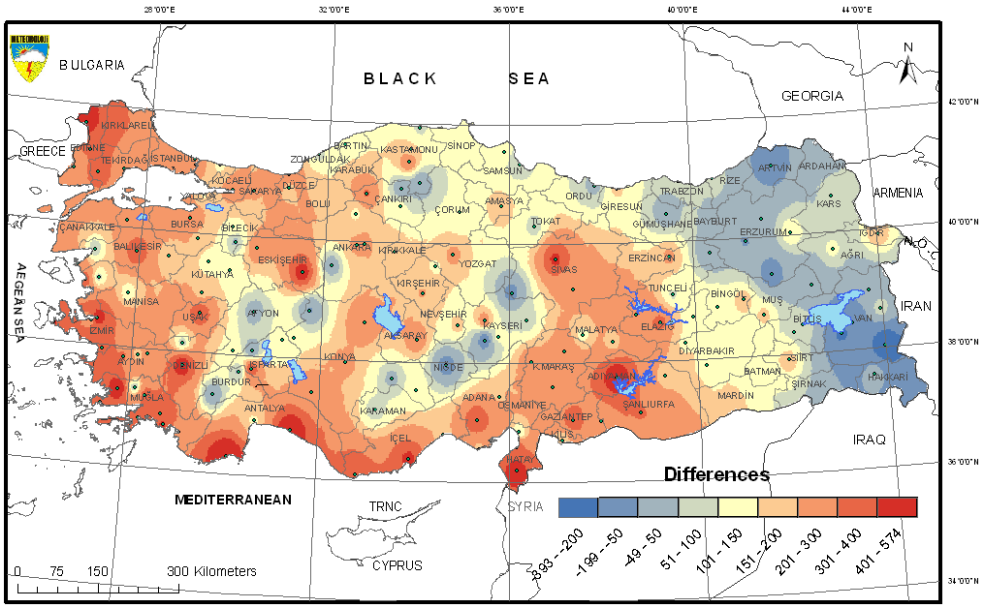

Fig. 5 Differences between CM-SAF SIS and surface radiation data for the year 2006

Residual map have been generated by using raster calculation in spatial analyze (Fig. 5).

RESULT AND DISCUSSIONS

1. Correlation coefficient has been found as 0.60 between two series.

2. According to residual map, while satellite observation values are greater than in-situ observation western parts of the country, mountainous eastern part and around Afyon, Burdur, Cankırı, Kayseri, Nigde and Karaman values are smaller (Fig. 5).

3. While surface radiation values are in between from 987 to 1937 KWh/m²/year, satellite observation values change from 1062 to 1996 KWh/m²/year in 2006.

4. The reason of high differences between two data series could be not calibrated Actinograph which they are very affected from relative humidity and land surface of Turkey.

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