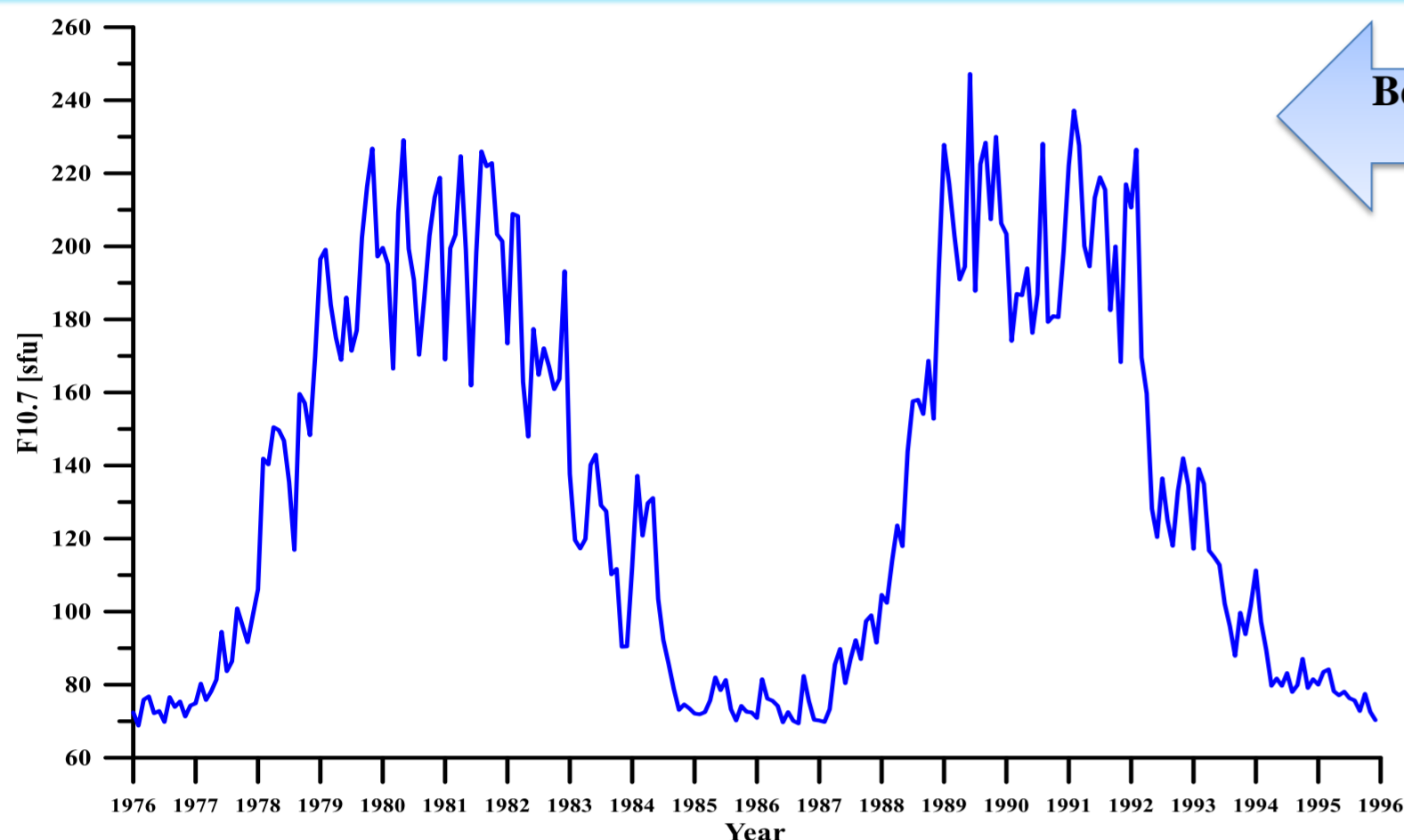


Preliminary results of methodology for forecasting of ionospheric virtual height for Rome, Italy

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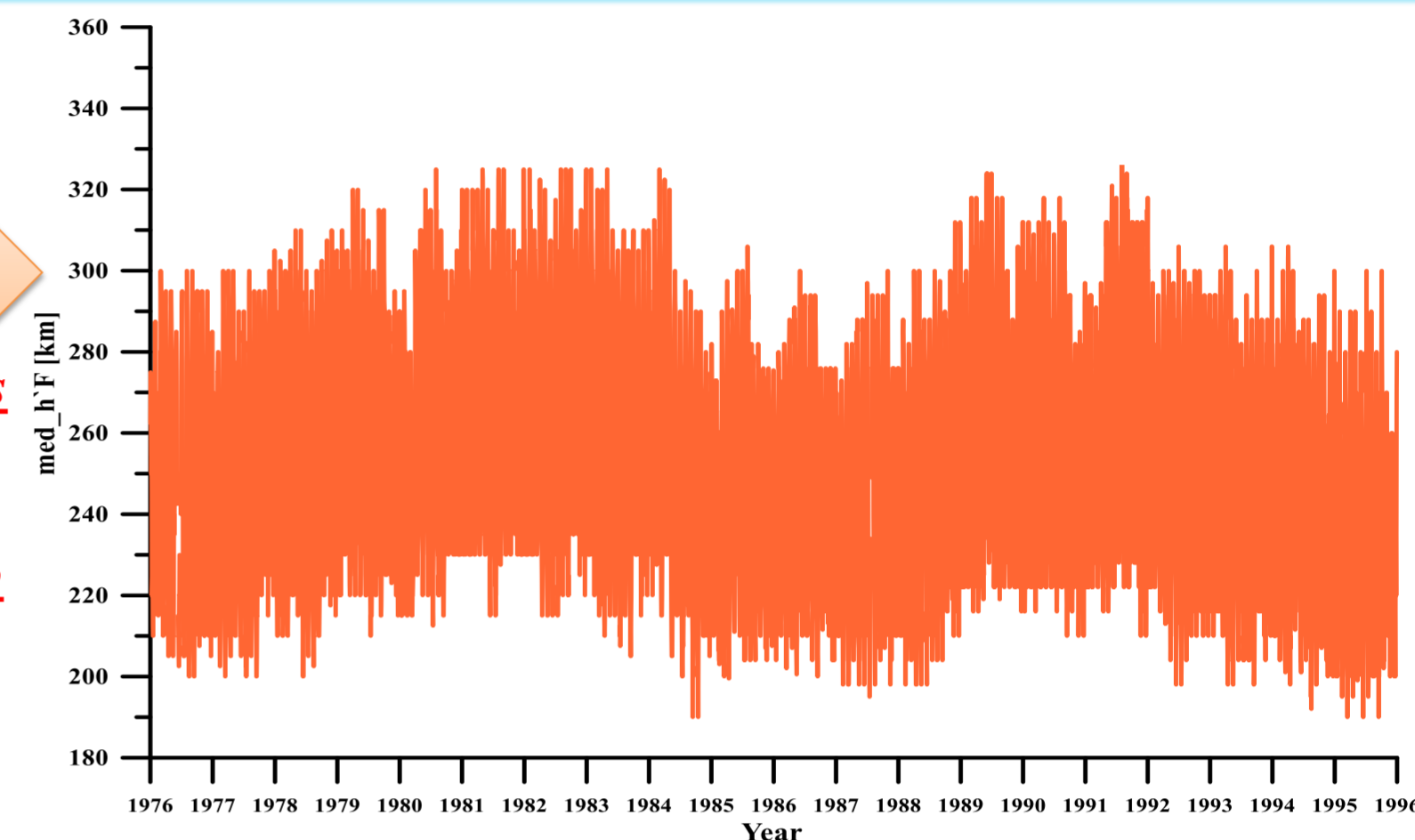
The basic aim of this study is to present a methodology for determining the values of the virtual height of the ionospheric F region. In order to analyze the dependence between the solar activity represented by F107 and h`F, a regression analysis was performed by months. The results show that the optimal dependence is close to linear. In addition, in order to study the seasonal dependence of h`F, the decomposition method was also applied. The amplitudes of the diurnal cycle and its harmonics, as well as the corresponding phases, are examined. As a result, an empirical median model for forecasting h`F for the territory of the Italy – Rome, depending on solar activity and season, is proposed. The resulting errors are ME=0.000 km and RMS=9.268km, respectively, which is accurate enough for practical purposes such as radio path prediction. It is well known to use the virtual height for the calculation of the minimum and maximum usable frequency of a given radio path. At the moment, the Sofia ionospheric station at the National Institute of Geophysics, Geodesy and Geography is not working, and therefore the research is applied to the Rome-Italy station. The choice of this ionospheric station is related to the fact that this station is located at the geographic latitude coinciding with the latitude of Sofia, which suggests similar characteristics of the ionosphere.



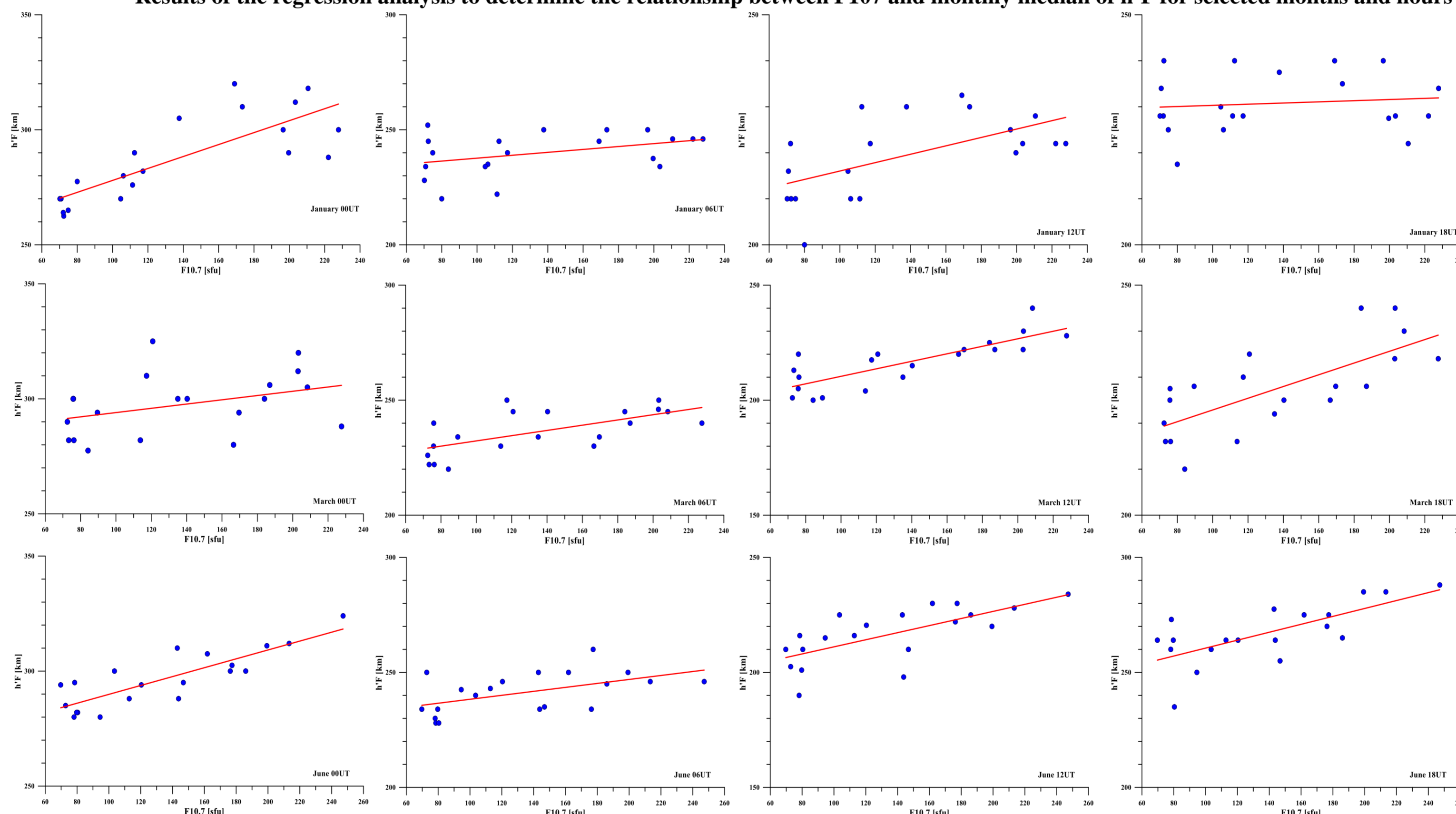
Behavior of the values of F10.7 by years for the entire considered period

Median values of h`F for ionospheric station Rome for the period 1976-1995

Comparing the two figures clearly shows the influence of solar activity on the virtual height. The next step is to find the optimal relationship between the two quantities through regression analysis.

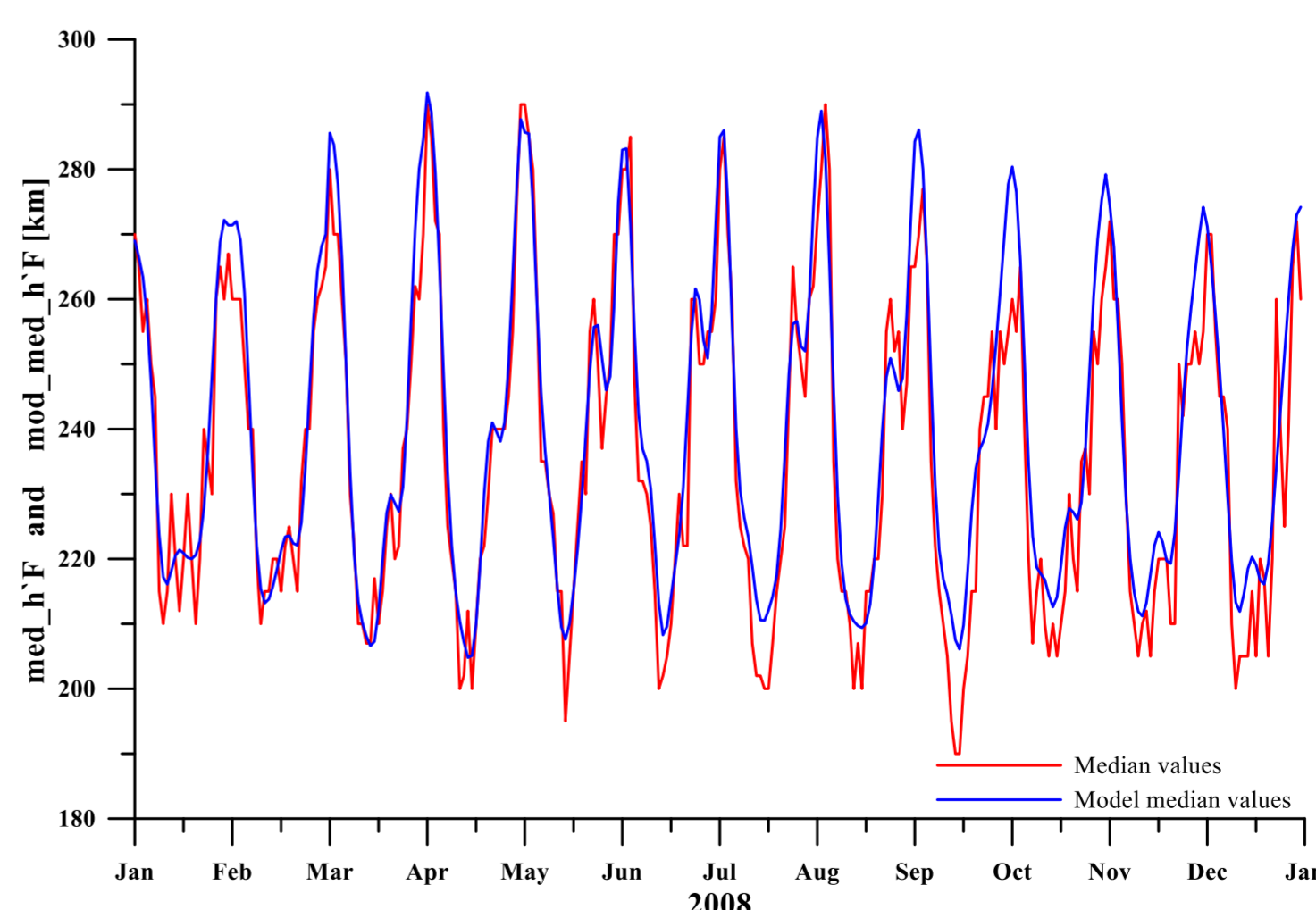
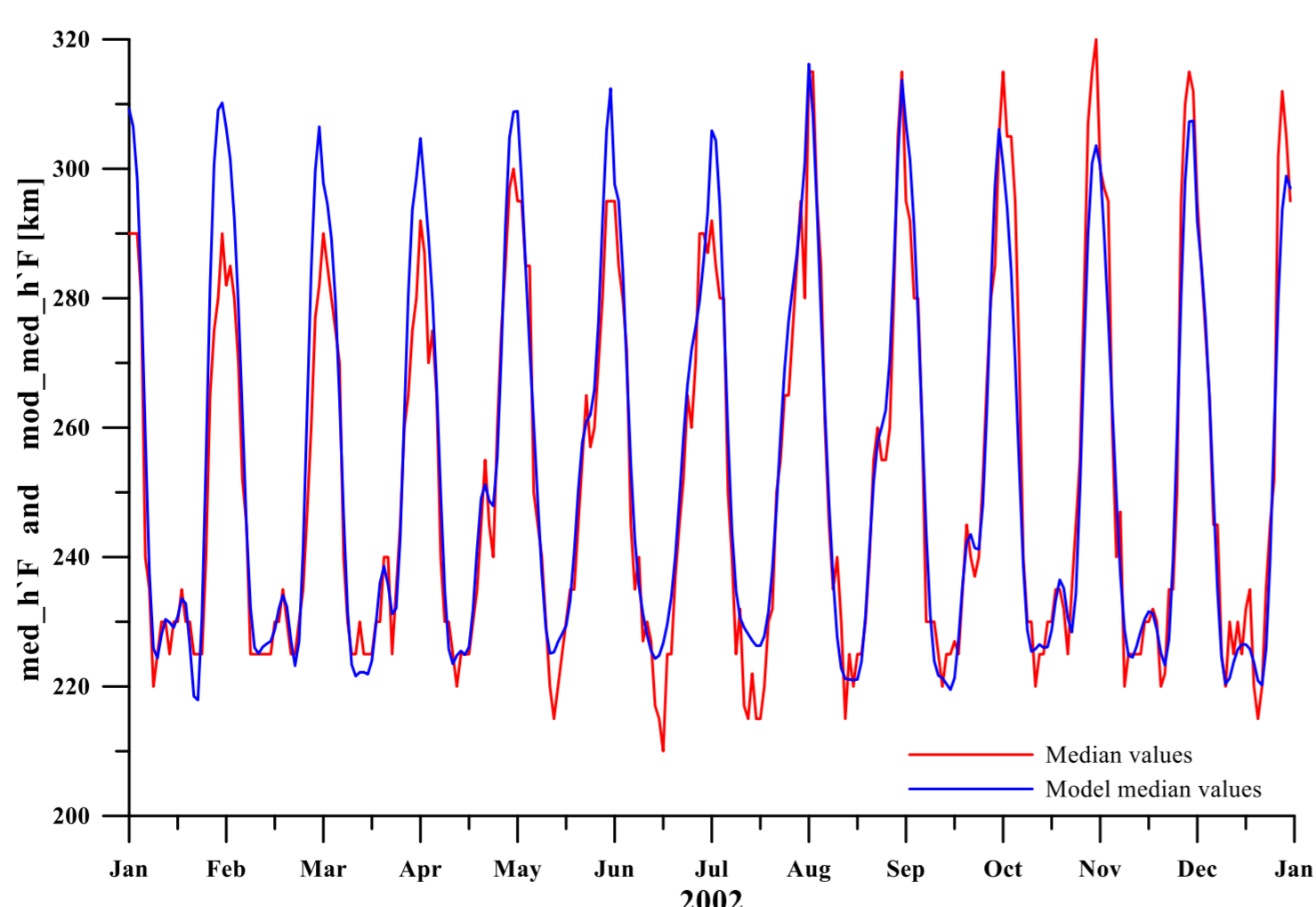


Results of the regression analysis to determine the relationship between F107 and monthly median of h`F for selected months and hours



Synthesis of the model is performed according to the following formula:

$$h`F = (a_0 + a_1 F107) \left(b_0 + \sum_{k=1}^4 \left(b_{ck} \cos \left(k \frac{2\pi}{12} (\text{month} - 1) \right) + b_{sk} \sin \left(k \frac{2\pi}{12} (\text{month} - 1) \right) \right) \right) \times \left(c_0 + \sum_{k=1}^4 \left(c_{ck} \cos \left(k \frac{2\pi}{24} ut \right) + c_{sk} \sin \left(k \frac{2\pi}{24} ut \right) \right) \right)$$



The figures show a comparison between the medians, derived from measurements in ionospheric station Rome (RO041) and the obtained analogous values according to the proposed methodology for two years of high and low solar activity. The plots show that there is a satisfactory fit between data and model. Seasonal changes are clearly visible, as well as the influence of solar activity.