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Forecasting the weather
- ensemble techniques
in probabilistic weather prediction

Cross-analysis of solar soft and hard X-ray indices and the Earth's upper level air temperature

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Solar X-rays deposit energy in the Earth's upper atmosphere and increase the nitric oxide NO density in the lower thermosphere (100-110 km), which in turn plays a role in the radiative cooling mechanism by infrared emission.

In this work, we present and discuss a cross-analysis of the solar soft (SXR) and hard X-ray (HXR) emission and the air temperature at upper levels, aimed at identifying the solar signature in the atmospheric parameter time series.

We derived an index for the solar X-ray emission in the SXR (0.1-0.8 nm) band and an index for the emission in the HXR (0.05-0.3 nm) band as measured by the NOAA GOES satellites in the period 1986-2011. The indices represent the flux density integrated over 10-day time intervals for each energy band respectively.

The air temperature has been derived from NCEP (National Center for Environmental Predictions), where the data are defined on a 2.5°x2.5° grid every 6 hours at 17 pressure levels in the 10-1000 hPa range. The temperature has been averaged over 10-day intervals for the whole Earth and for the Polar and Tropical regions, respectively. Different pressure levels have been selected for the analysis, namely 10, 100, 200, 500 hPa. Furthermore, the time series of 10-day mean temperature have been filtered to remove seasonal variability.

The high variability of the X-ray indices determined by the impulsive flaring activity proved to be a major issue in this kind of analysis.