

# A web application for monitoring cosmic rays and solar activity

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## Introduction

The flux of cosmic rays (CR) in the heliosphere shows a quasi-periodical behavior strongly correlated with the 11-year cycle of solar activity. This phenomenon is the so-called **solar modulation**.

Studying solar modulation is important to:

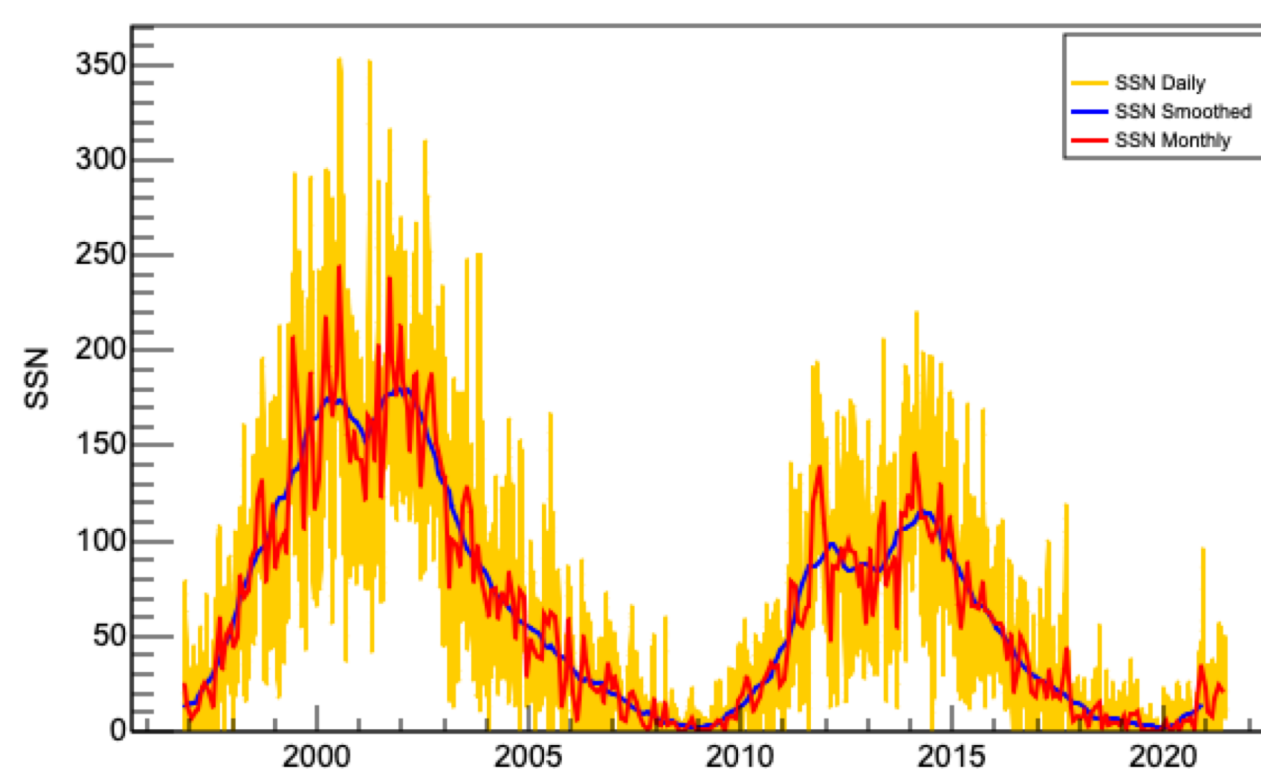
- Develop predictive models of CR radiation
- Understand physics of CR and searching for dark matter evidences
- Space weather and interplanetary space missions

A large amount of heterogeneous data are necessary. We have developed a web application **Heliophysics Virtual Observatory (HVO)** that stores daily updated data on solar activity, interplanetary plasma, and charged radiation from several space missions or observatories. HVO gives users the functionalities of visualizing, manipulating and downloading up to date data as machine readable text, CSV files, graphic objects in ROOT format or PNG images.

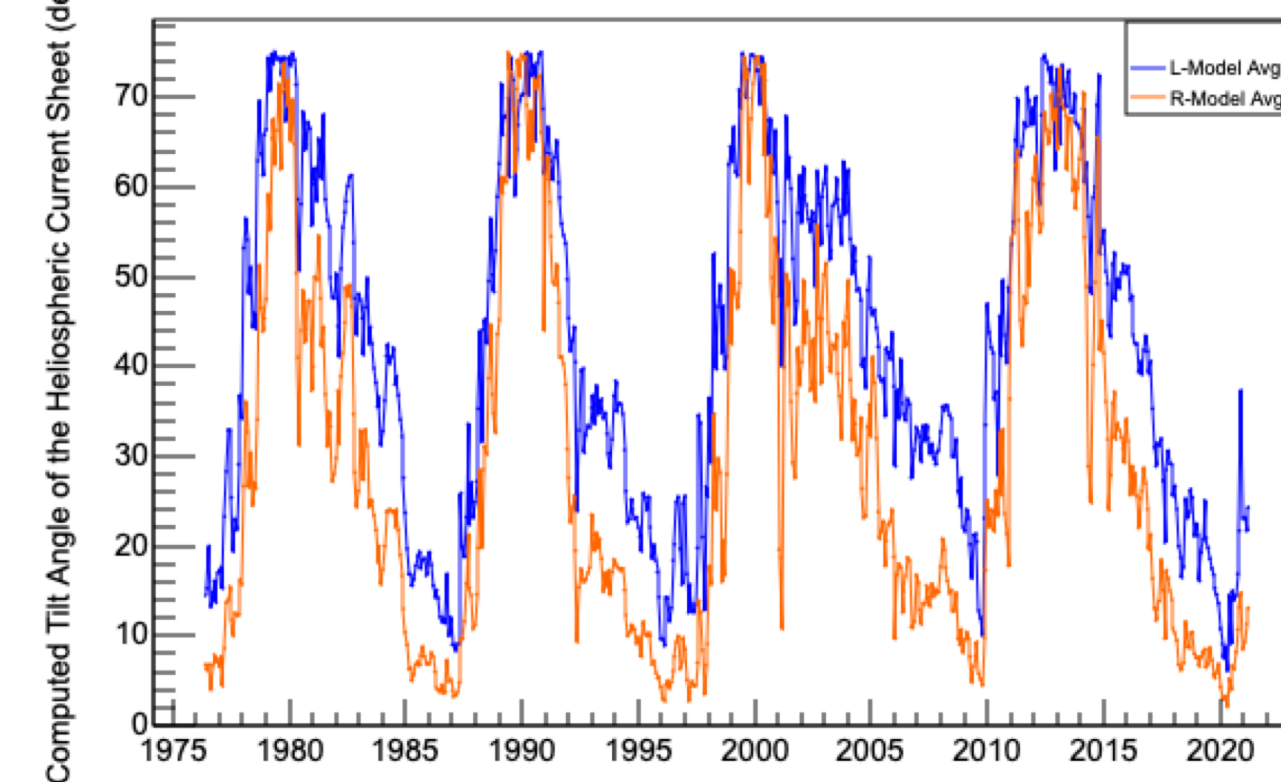
HVO is accessible [crisp.unipg.it/hvo](http://crisp.unipg.it/hvo)

## Data available on HVO

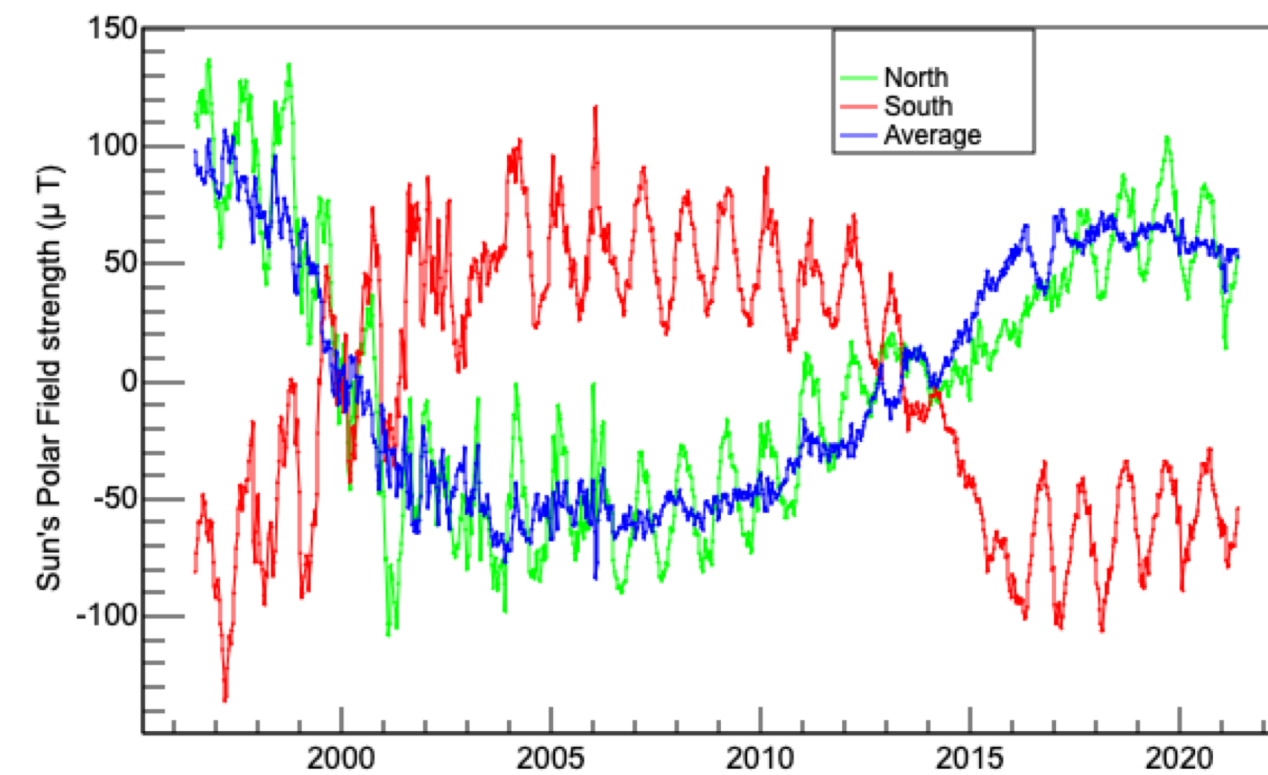
SunSpot Number



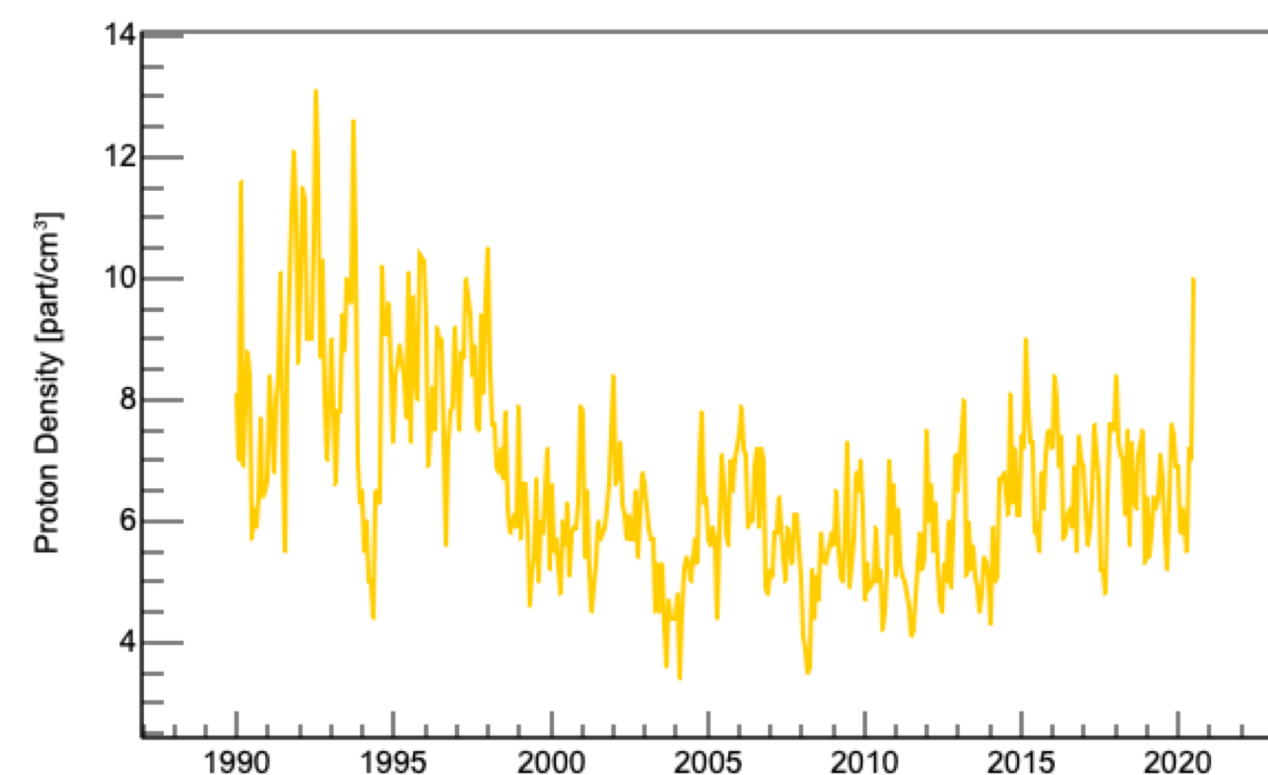
Tilt Angle of the Heliospheric Current Sheet



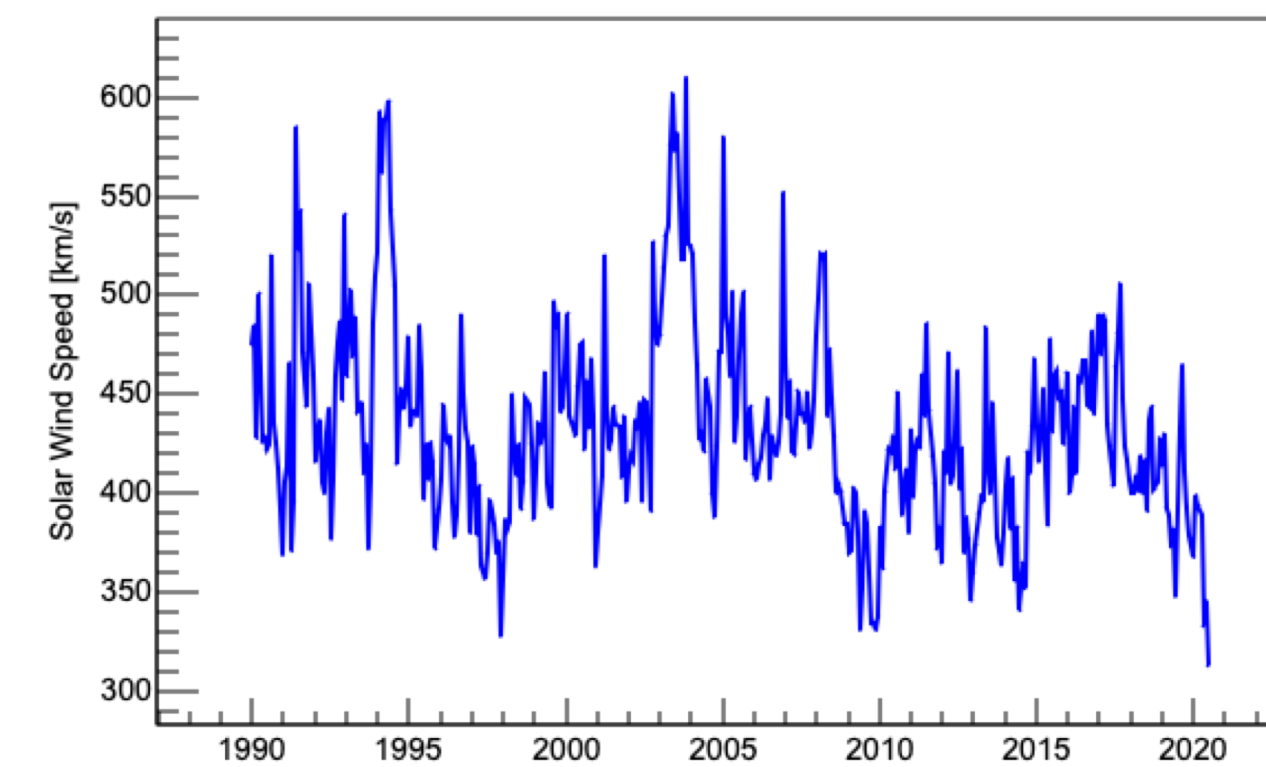
Sun's Polar Field strength



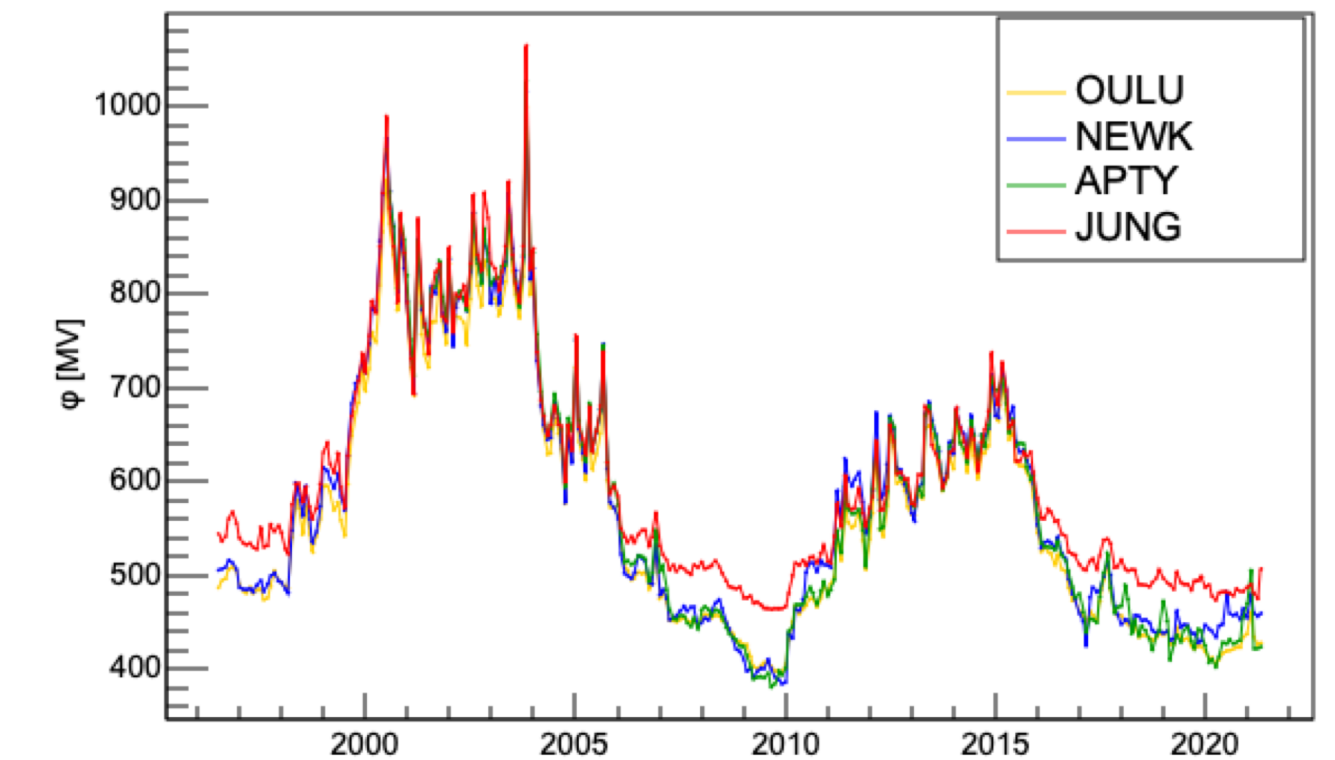
Proton Density



Solar Wind Speed



φ modulation potential



J modulated flux: E = 1 GeV



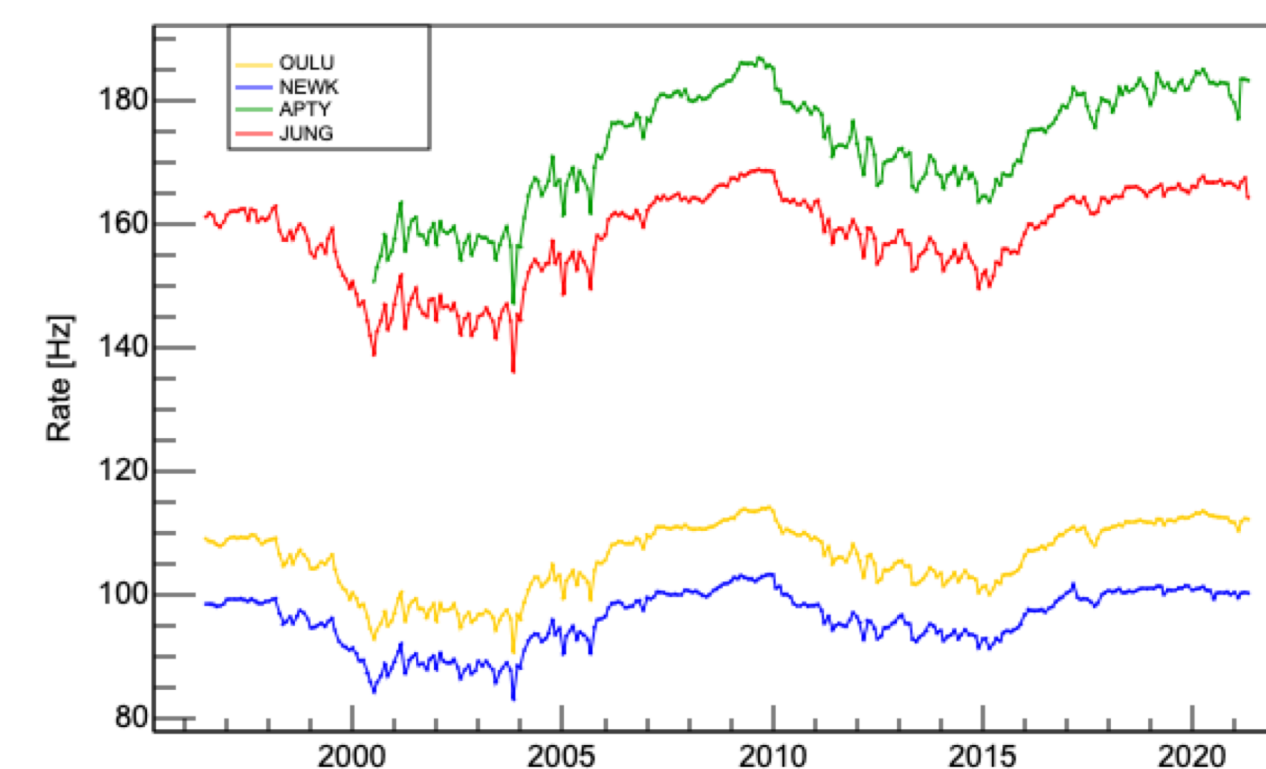
## Real-Time Model

HVO can also be used to implement direct calculations and predictive models of CR fluxes near-Earth.

As example we have integrated a simple real-time model for the flux of CR protons based on the Neutron Monitor counting rates and an estimation of the modulation potential  $\phi$  [1].

$$J(E, t) = \frac{(E + M_p)^2 - M_p^2}{(E + M_p + \frac{Z}{A}\phi(t))^2 - M_p^2} J_{LIS}(E + \frac{Z}{A}\phi(t))$$

Neutron Monitor Rate Time Resolution: 1 Month



## References

[1] I. G. Usoskin, *et al.*, *J. Geophys. Res. – Space Physics*, 116 (2011) A2

## Acknowledgement

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