Geophysical Research Abstracts
Vol. 16, EGU2014-910, 2014
EGU General Assembly 2014

Real-time solar wind forecasting based on coronal hole data

Thomas Rotter, Astrid Veronig, Manuela Temmer, and Bojan Vrsnak
Austria (thomas.rotter@gmx.net)

Coronal holes (CHs) are low density plasma regions in the solar corona visible as dark areas on the disk due to their lower temperature and density compared to the surrounding coronal plasma. They are associated with rapidly expanding open magnetic fields and the acceleration of high-speed solar wind streams (HSSs).
The rotation of the Sun, approximately 27days, and the fact that large CHs may exist over several months on the solar surface, make it possible to estimate the in-situ solar wind parameters at Earth from the solar CH observations up to 4 days in advance.
We developed an automated coronal hole detection algorithm for Extreme Ultra Violet (EUV) images of the Sun.By using a histogram-based intensity thresholding technique we analyze the relationship between the CH characteristics on the Sun (area, position) and the corresponding solar wind parameters measured in-situ at Earth with a 1-h time resolution.
A self-adjusting algorithm for improving real-time solar wind forecasts based on coronal hole observations has been applied to and tested on SDO/AIA -193 Å observations. 34 Carrington Rotations were studied in detail, for the time beginning at October 2010 till July 2013, focusing on the solar wind velocity v and total magnetic field strength B. We found solar wind speed delays of 4.02 ± 0.5 days to reach Earth. The magnetic field strength shows an average delay of 2.01 ± 0.05 days. The algorithm produces good forecasts for the solar wind speed peaks with correlation coefficients of $cc \sim 0.67$. Smaller correlation coefficients are obtained in predicting the peaks in total magnetic field strength.