

# Analysis of the plasma upflows and the global structure of the magnetic field lines using Hinode/EIS observation and PFSS extrapolation

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Plasma upwelling streams; i.e. upflows have been detected by Hinode's Extreme Ultraviolet Imaging Spectrometer (EIS), and they are observed mainly in the solar transition region and corona (Sakao et al. 2007; Doschek et al. 2008). It has been suggested that the upflow is a source of the slow solar wind because their elemental compositions are similar to that of slow solar wind (Brooks 2012). However, the relationship between upflows and slow solar wind remains an open question. One way to verify the hypothesis on the upflow as a source of the solar wind is to investigate the global structure of the magnetic field associated with plasma upflows. In particular, the information on whether the magnetic field lines above the upflow are closed or open will be an important point to examine the hypothesis.

In this study, we analyzed EIS data obtained from Hinode observations to identify plasma upflow events, and investigated the configuration of the coronal magnetic field around the plasma upflow region using the potential field source surface (PFSS) extrapolation. We calibrated the EIS data using the `eis_prep` routine available in the Solar SoftWare (SSW) library and obtained Doppler velocity maps from a single Gaussian fit of the FeVII 195.12 angstrom line with the `eis_auto_fit` routine. We used synoptic magnetograms of ADAPT model 0 in the PFSS extrapolation.

Our initial analysis of AR 12712 on 2018 May 29 (Carrington rotation 2204) showed that there may be a closed magnetic field above the upflow. There are two possible interpretations of this result: One is that the upflow is not the source of the solar wind. The other is that magnetic reconnection occurred above the active region and the plasma was ejected from the open magnetic field near the active region. If so, the upflow could be the source of the solar wind. We are analyzing the other nine active regions now. The result from this analysis allows us to statistically clarify the relationship between the upflow and magnetic field lines. Furthermore, by connecting the extrapolated magnetic field with IPS observations, we will discuss whether upflow is the origin of the slow solar wind or not.

## References:

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