IRIS-9, Göttingen, 25-29 June 2018

Poster

3. Magnetic coupling and mass flux through the atmosphere

Tracing the magnetic and dynamic evolution of photospheric supersonic flows

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Photospheric high-speed flows, some of them with supersonic velocities, have been observed in active regions and the quiet Sun. The origin of these flows is still not well understood. We analyzed observations of the AR12552 made in June 2016 at the 1.5 m German telescope GREGOR with the spectropolarimeter instrument GRIS. We also studied observations of the same region by HINODE/SP and followed the temporal evolution of the active region with SDO/HMI over 5 days. In addition, we combined IRIS and SDO/AIA observations to gather information about the transition region and corona. The spectropolarimetric data were inverted to obtain the magnetic field vector and LOS velocities in the photosphere and chromosphere. Furthermore, we used deep machine learning to enhance the HMI images, trace the evolution of the horizontal velocities of the plasma, and track the location of photospheric vortices. We found blueshifted (BS) and redshifted (RS) flows in the IR photospheric Ca I and Si I lines, as well as the Fe I lines observed by HINODE/SP. These velocities were supersonic and exceeded 15 KM/S in the deep photosphere. The chromospheric He I triplet, as well as the transition region and coronal channels did not present any resemble to the location of the supersonic flows. The first well formed BS flow region emerged on June 8 2016 at 04:35 UT and lasted for more than three days. The RS flows appeared on 05:05 June 8 2016 and had a duration of 18 h. At the time when RS flows reached their maximum, two vortices appeared right next to the location of the RS and BS flows. The presented multi-instrument analysis allows us to identify purely photospheric supersonic BS and RS flows that were orientated along the filament channels in particular related to Evershed and siphon flows.