Poster

Splinter HiRes

Dynamics of vortex flows in the lower solar atmosphere

Yadav, N., Cameron, R. H., Solanki, S. K.

Max-Planck-Institut für Sonnensystemforschung, Justus-von-Liebig-Weg-3, 37077, Göttingen

Vortices are believed to be of fundamental importance in the photosphere as well as in the rest of the solar atmosphere. Vortex studies have become even more important in view of their role in coronal heating via both AC and DC mechanisms. In AC mechanisms, vortices excite a wide variety of MHD waves and in DC mechanisms, they produce twisting in neighbouring magnetic field lines that may lead to reconnection events. In the present work, we demonstrate the evolution of small scale vortices in near-surface regions and chromosphere. We have used the MURaM code to solve the MHD equations which includes radiative energy transfer and an equation of state that incorporates partial ionization. Performing eigen-analysis of the velocity gradient tensor, we find subset of regions with high vorticity which gives us locations of vortical features with high swirling strength. It is found that these vortices are associated with strong downflows in the chromosphere which is consistent with their occurrence in inter-granular lanes in previous photospheric MHD simulations in the literature. These vortices are also the sites of local heating in the solar chromosphere. These swirling structures extend from the photosphere to the solar chromosphere and maybe further to corona. Vortex sites are also the locations of locally bright points which is a result of the associated density depression in those subregions. We also found that at each time instance, though the velocity streamlines are showing swirling structures, the associated test particle pathlines are more consistent with wave-like motion.