Poster General

New results on supergranulation

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Supergranulation appears on the solar surface as a cellular pattern of horizontally diverging flows. Its characterization remains an important subject of solar physics since its discovery over fifty years ago. The depth of supergranules and their subsurface behavior are open questions and answering them could eliminate some scenarios of formation of the structure.

In particular, different hypotheses of convective origin place involve different vertical extents and driving scales for supergranulation. We aim to constrain the depth and subsurface velocity of supergranular flows for an average supergranule.

We design axisymmetric models of mass-conserving supergranular flows in spherical-polar coordinates and study their ability to reproduce photospheric observations from the Helioseismic Magnetic Imager (HMI) for an average supergranule. We obtain the radial flow from Doppler observations and the horizontal flow from local correlation tracking applied to intensity images.

Flow perturbations lead to changes in the wave propagation inside the Sun which are reflected in the value of travel-times. We simulate a flow perturbation to a solar-like reference model using the Montjoie finite element solver.

Models that are not separable in r (radius) and θ (heliocentric angle from the center of the supergranule) cannot reproduce the observations. For a separable model that fits the horizontal component, the radial χ^2_r is 52.

We show one example of flow perturbation to a solar-like reference model using a non-separable flow model that fits photospheric observations. The simulated cross-correlations for the reference model match observations. This is a first step to constrain flow models using time-distance helioseismology.