

Cyclic Thermal Signature in a Global MHD Simulation of Solar Convection

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Global magnetohydrodynamical simulations of the solar convection zone have recently achieved cyclic large-scale axisymmetric magnetic fields undergoing polarity reversals on a decadal time scale (Beaudoin et al. 2013; Racine et al. 2011; Ghizaru et al. 2010). We find that these simulations also display a thermal convective luminosity that varies in-phase with the magnetic cycle, and trace this modulation to deep-seated magnetically-mediated changes in convective flow patterns. Within the context of the ongoing debate on the physical origin of the observed 11-year variations in total solar irradiance, such a signature supports the thesis according to which all, or part of the variations on decadal time scales and longer could be attributed to a global modulation of the Sun's internal thermal structure by magnetic activity.