Processes that Cause Solar Irradiance Variability

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Convection transports energy from the deep solar interior to the photosphere where it is then radiated into space. The structure of solar convection therefore has important implications for solar irradiance variations on both local and global scales. Furthermore, baroclinicity induced by convective momentum and energy transport is now thought to play an important role in the maintenance of the solar differential rotation and meridional circulation, giving rise to a weak but persistent temperature increase of several Kelvin toward the poles. Finally, convection and the mean flows it maintains play an essential role in the solar dynamo, establishing patterns of magnetic activity which dominate solar variability on time scales of days to centuries. I will review recent insights into solar convection and dynamo processes obtained from high-resolution numerical simulations within the context of photospheric measurements and helioseismic inversions. I will also discuss other aspects of solar dynamo theory of relevance to solar irradiance observations including tachocline instabilities, torsional oscillations and longer-term solar variability.