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Seismic Modeling of Active Regions for Farside Imaging Applications

We propose a theoretical investigation of the basic mechanisms that contribute to seismic signatures of active regions for the purpose of characterizing active regions on the Sun's far surface. The investigation will have two substantial parts: (1) physical modeling of how magnetic fields together with thermal anomalies underlying magnetic photospheres reflect p-modes back into the solar interior, and (2) spherical acoustics of local seismic anomalies based on the results of (1). While this program is basically theoretical, it has immediate applications in a broad range of observational applications. The investigation proposed here is important for recognition of ways to improve of current farside imaging techniques. However, they are even more important, indeed essential, for the development of a useful interpretation of farside signatures with applications outside of helioseismology. Holographic signatures thus far has relied heavily on the relative compactness of active regions and the resulting compactness of their farside signatures. Active regions on the Sun's near surface project a nearside artifact into farside holographic maps. The artifact is so diffuse it does not impair the recognition of individual compact active regions on the Sun's far surface. However, a working assessment of diffuse magnetic regions, which are important for solar irradiance forecasting, for example (see target "d" of the LWS AO), an account of the near-side artifact is essential. Application of standard farside imaging techniques to control simulations representing localized anomalies that can be rotated to any position will accomplish this. The program we propose will be conducted with observational CoIs and collaborators doing closely related empirical modeling applied to near- and far-side seismic signatures computed from both GONG and SOHO/MDI observations. It will also involve collaborators at LASP working on irradiance forecasting and on the SOHO/SWAN project.