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Nonlinear Interaction between Solar Tides

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Atmospheric solar tides are large-scale waves driven by the absorption of solar radiation, mainly due to water vapour and ozone, in the troposphere and stratosphere. Because tidal amplitudes increase roughly as $\frac{1}{\sqrt{\rho}}$, ρ being the density, tides play a major role in the dynamics of the mesosphere/lower thermosphere region.
In the present work a linearised primitive equation model is used to describe the tidal signal. We take a linear regression approach for determining optimal profiles of Rayleigh friction, newtonian cooling and horizontal diffusion to account for interactions with small-scale structures, mainly gravity waves, which cannot be resolved by our model. The nonlinear interaction between stationary planetary waves and solar tides is also included. The amplitude and phase structure of the diurnal tide is shown to be reproduced in accordance with the state-of-the-art general circulation model HAMMONIA if we take the imaginary parts of Rayleigh friction and newtonian cooling into consideration. The results for the diurnal tide are shown to be further improved by adding a forcing term to the linear model that contains nonlinear contributions to the diurnal signal from the semidiurnal and terdiurnal tides. Corresponding analyses are also done for the semidiurnal tide. Annual cycles for both the diurnal and the semidiurnal tides will be discussed.