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Wave dynamics in high Rossby number regime and their implication to the superrotation problem of Venus and Titan

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The superrotation of Venus and Titan's atmospheres requires a complex dynamical process that involves convergence of momentum at the equatorial region in both bodies. It has been argued that the existence of specific wave patterns in lower- and higher-levels of the atmosphere promotes the momentum fluxes necessary for the acceleration/maintenance of the mean zonal flow. However, it is not clear so far how these waves interact among themselves and with the mean flow. In this study, the dynamics of waves in an idealized superrotating atmosphere in the higher Rossby number regime are investigated. The simulations were performed by using the Weather Research and Forecast (WRF model) numerical core coupled with a simplified treatment of radiation and friction. Spectral and filtering analyses were used in order to obtain both spatial and temporal characteristics from the main modes. The results showed that global scale equatorial and high-latitude Rossby waves promoted the accelerations at the equatorial region. Resonant interactions of these waves are likely possible to be present in the superrotating atmosphere since coherent modulation of their amplitude was observed.