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Thermosphere Winds from Champ Neutral and Plasma Density Measurements

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Meridional winds in the thermosphere are key to understanding latitudinal coupling and thermosphere-ionosphere coupling, and yet global measurements of this wind component are scarce. In this work, neutral and plasma densities measured by the CHAMP satellite between about 350-425 km during 2002-2009 are used to derive a new wind product for thermosphere studies. Starting with measured neutral total mass densities and an empirical model of the thermosphere (e.g., NRLMSISE00), we iterate on a convenient parameter (i.e. F10.7 solar flux) to derive the model exosphere temperatures, pressures and pressure gradients consistent with the measured densities. [N.B. Although some net model bias may exist, we believe the horizontal pressure gradients reflect measured gradients and not model gradients]. Using ion drag values derived from measured plasma densities along with the neutral pressure gradients, the 2-D momentum equations (neglecting viscosity) are used to solve for the zonal and meridional wind components. For validation purposes, the derived zonal winds are compared with winds measured by the cross-track accelerometer on CHAMP, as well as the HWM07 model. Climatological wind patterns in latitude vs. local time (longitude-averaged) and in latitude vs. longitude (at constant local times) formats will be presented and assessed. Future developments include solving the 3-D momentum equations to account for the viscous term, further investigating any dependences on the chosen empirical model, examination of the wind response to variations in geomagnetic activity, and comparisons with GOCE wind measurements near 250 km.