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Axial AAM budget at diurnal and sub-diurnal periodicities

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The diurnal and subdiurdal variations of the mass and wind terms of the axial Atmospheric Angular Momentum (AAM) are explored using a 1-year integration done with the General Circulation Model (GCM) LMDz, and twelve 10-day forecasts issued from the European Center for Medium range Weather Forecast (ECMWF). In the GCM, we find that at diurnal and subdiurnal periodicities the wind and mass AAM, present oscillations of opposite sign that are very substantial: their tendencies far exceed the daily cycle in the model torques. We find that the mass AAM and the wind AAM predicted by the operationnal ECMWF forecast system have comparable behaviours.

To interpret dynamically these oscillations, we use a shallow water axisymmetric model, driven by a zonal force whith latitudinal and temporal variations mimicking the zonal mean barotropic pressure force produced by the mountains in the GCM.

If we assume that this force is redistributed uniformely over the tropophere, our shallow water model predicts diurnal and semi-diurnal motions that resemble to the first and second eigensolutions of the Laplace's tidal equations repectively. The first does not affect the mass AAM while the second does not. We verify that comparable Eigensolutions can be extracted from the GCM at the corresponding periodicities, which explains the semi-diurnal cycle in the model mass AAM.