Atmospheric Angular Momentum from reanalyses: an index relevant to studying climate variations.

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Global Atmospheric Angular Momentum (AAM) mirrors many aspects of the signature of climate and weather, and as such is an important index pertaining to climate systems, on time scales from interannual to intraseasonal and synoptic. Along with global temperature, an index of the energy cycle, and global moisture, an index of the hydrologic cycle, the diagnosis of the origin and transport of angular momentum, an index of the atmospheric circulation, is also fundamental to the climate. Furthermore, how angular momentum is exchanged across its lower boundary, by means of the interactive torques with the oceans and solid Earth below, is important to quantify so that one can understand how the Earth acts as a system. As angular momentum is conserved in a closed system, small but measurable changes in the Earth's rotation rate are a consequence of the exchanges of angular momentum between the solid Earth and its fluid envelope, with the atmosphere being the most important component on many time scales. The relevance of atmospheric angular momentum changes to geodesy and many fields in geophysics has been recognized by the formal organization of the Special Bureau for the Atmosphere (SBA) of the International Earth Rotation and Reference System Service (IERS) to quality test and supply such atmospheric data to geoscientists for purposes of studies of Earth properties, and for reference frame purposes involving navigation.

As part of the 20th century reanalyses project, we are evaluating how well the current set simulate relative atmospheric angular momentum (AAM) about the Earth's mean axis, a fundamental measure of the atmosphere's circulation that depends on the strength and distribution of the zonal winds. We will diagnose the mean climate and variability of the angular momentum of the atmosphere, and assess errors on mean, seasonal, and interannual time scales by concentrating on past reanalyses as a benchmark, principally the NCEP-NCAR and ECMWF sets.