

3D Measurements of Atmospheric Gravity Waves, in Observations and Reanalyses

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Gravity waves (GWs) transport momentum and energy in the atmosphere, exerting a profound influence on the global circulation, particularly in the stratosphere and above. Accurately measuring and simulating GWs is thus vital both for understanding the dynamics of the atmosphere and for developing the next generation of weather forecasting and climate prediction models. Recent advances in measurement techniques allow us to study GWs in the real atmosphere in 3D, letting us characterise key properties such as their phase speeds, group velocities and the directional momentum fluxes they transport. Here, we present an annual climatology of these properties at the global scale derived from NASA/AIRS 3D observations, and compare our results to equivalent grid-resolved GW climatologies in four leading reanalyses: CFSR, ERA-5, JRA-55, and MERRA-2. Our results cross-validate the reanalyses and the 3D observations used, and have broader implications for the accurate modelling of the atmosphere.

Key words: gravity waves, reanalyses, satellite data, 3D observation