Geophysical Research Abstracts
Vol. 16, EGU2014-8705, 2014
EGU General Assembly 2014
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# Exploring the sources of gravity waves with COSMIC GPS, radiosondes and lidar

Sergey Khaykin (1), Alain Hauchecorne (1), Philippe Keckhut (1), Nahoudha Mze (1), and Chantal Claud (2)
(1) LATMOS/IPSL, UVSQ, CNRS-INSU, Guyancourt, France, (2) LMD/IPSL, Ecole Polytechnique, Palaiseau, France

GPS radio occultation temperature profiling technique, featuring high vertical resolution, global coverage and diurnal sampling, represents a powerful mean for studying the sources and climatologies of gravity waves (GW). Operational since April 2006 until present COSMIC GPS satellite system provides 1500-2000 occultations per day.
We use 8-year series of temperature profiles provided by COSMIC to derive global spatiotemporal distribution of GW potential energy in the altitude range between 10 and 35 km. At high latitudes we show evidence of gravity waves associated with sudden stratospheric warming events and intense mesoscale storms called polar lows. At mid-latitudes the gravity waves are shown generated by geostrophic wind adjustment and jets. Additionally, we use routine twice daily radiosoundings at selected locations to study GW generation by mid-latitude thunderstorms and polar lows. In the tropical region we observe convectively generated GW propagating into the stratosphere and interacting with the background quasi-biennial oscillation (QBO) wind. Enhancements in GW potential energy around the descending 0 m/s QBO eastward shear phase line are reported.
Further, we combine radiosondes, COSMIC and Rayleigh lidar temperature observations in an attempt to reconstruct GW energy distribution from the lower troposphere up to the mesosphere. The results are compared with ECMWF analysis.