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Biondi, Riccardo; Neubert, Torsten; Syndergaard, S.; Nielsen, J.

Publication date:
2010

Link back to DTU Orbit

Citation (APA):
Biondi, R., Neubert, T., Syndergaard, S., & Nielsen, J. (2010). Convective towers detection using GPS radio occultations. Abstract from 2010 AGU Fall Meeting, San Francisco, CA, United States.

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Convective towers detection using GPS radio occultations

R. Biondi[1], T. Neubert[1], S. Syndergaard[2], J. Nielsen[2]
[1]DTU Space, National Space Institute, København, Denmark
[2]DMI, Danish Meteorological Institute, København, Denmark

The tropical deep convection affects the radiation balance of the atmosphere changing the water vapour mixing ratio and the temperature of the upper troposphere and lower stratosphere. To gain a better understanding of deep convective processes, the study of tropical cyclones could play an important role since they lead to deep convective activity. With this work we want to investigate if severe storms leave a significant signature in radio occultation profiles in the tropical tropopause layer. The GPS radio occultation (RO) technique is useful for studying severe weather phenomena because the GPS signals penetrate through clouds and allow measurements of atmospheric profiles related to temperature, pressure, and water vapour with high vertical resolution. Using tropical cyclone best track database and data from different GPS RO missions (COSMIC, GRACE, CHAMP, SACC and GPSMET), we selected 1194 profiles in a time window of 3 hours and a space window of 300 km from the eye of the cyclone. We show that the bending angle anomaly of a GPS RO signal is typically larger than the climatology above the tropopause. Comparisons with co-located radiosondes, climatology of tropopause altitudes and GOES analyses will also be shown to support our hypothesis and to corroborate the idea that the bending angle anomaly can be used as an indicator of convective towers. The results are discussed in connection to the GPS radio occultation receiver which will be part of the Atomic Clock Ensemble in Space (ACES) payload on the International Space Station.