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Cloud Detection from Radio Occultation Measurements in Tropical Cyclones

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In mature tropical cyclone (TC), the eye of the storm is dominated by outward sloped dense low-level clouds such as stratus or convective stratocumulus clouds, with large water and ice content. Remote sensing observations of cloud-top height, cloud-top temperature and cloud profiling information are an important input to the TC strength prediction. Due to its all-weather, all-day capabilities, the RO technique could be useful in TC cloud detection. Although the RO technique is considered insensitive to clouds, recent studies show a refractivity positive bias in cloudy conditions. Thus, the aim of this work was to examine how sensitive RO observations are to the presence of clouds in TCs during 2007–2010. Thermodynamic parameters were obtained from the ERA-Interim reanalysis, whereas the water and ice cloud contents were retrieved from the CloudSat profiles. Our results reveal that the influence of clouds is significant and can exceed the RO bending angle standard deviation for 21 out of 50 (42%) investigated profiles. Mean clouds' impact is detectable between 9.0 and 10.5 km, while, in the case of single events, clouds in most of the observations are significant between 8 and 14 km. Almost 15% of the detectable clouds reach 16 km height, while the influence of the clouds below 5 km is insignificant.