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The impact of thin water vapor layers on radio occultation data

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Radio occultation observations enable to derive temperature and water vapor profile information by use of GPS satellite signals. The observed GPS satellite signal is affected by the changing refractivity field along the observation path. Very strong changes in refractivity can lead to a significant reduction of the observed signal strength. Such strong changes are generally a result of an increase of the water vapor concentration, as for example found on top of the Planetary Boundary Layer.

Within this talk we look at the amplitude strength of CHAMP radio occultation observations to determine the altitude and location of sudden changes in refractivity. Strong amplitude reductions were mostly found at higher altitudes, e.g. around 7km in the tropics, below the data starts to be very noisy. Wave optics simulations show that these reductions can be generated by vertical refractivity gradients around -100 1/km, thus requiring a layer of increased water vapor.

Application of these results are twofold; on the one hand it allows to study the distribution of water vapor layers and shows the achievable vertical resolution of radio occultation data. On the other hand it also allows to study the instruments tracking error requirements, since these layers can result in signal loss. Both aspects will be covered in this talk.