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Validation and use of mesoscale GPS water vapour tomography during an IHOP_2002 severe convection case

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The IHOP_2002 field experiment took place in May - June 2002 in the Southern Great Plains of the United-States. The main objective of the IHOP_2002 campaign was to improve our knowledge of the small-scale water vapour variability and the skill of quantitative precipitation forecast models.

The paper presents first the theoretical framework of mesoscale (50 km x 50 km grid mesh) GPS water vapour tomography. Additional data from radiosoundings are combined in the tomography to improve the vertical resolution. The mesoscale GPS tomography is successfully validated with LIDAR and radiosonde measurements as the major water vapour variations are well retrieved. The statistical comparison between GPS tomography with radiosoundings assimilated and the LIDAR shows a small bias (1 g/m3) and a dispersion of 1.5 g/m3. The origin of this discrepancy might be due to uncertainties in GPS retrievals at low elevations.

Next the relation between the water vapour variability, atmospheric local circulation and convection initiation is studied during the 12 June severe convection case. The three-dimensional water vapour field retrieved with GPS tomography allowed us to document the evolution of humidity in the lower troposphere throughout the life cycle of a convective event. The GPS tomography is shown to usefully complement traditional techniques like radiosoundings and overcome operational limitations in LIDAR and microwave radiometry techniques.