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Exploring Total Column Water Vapor retrievals from Satellite-Based Near-Infrared Measurements in Pre-Convective Environments

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Satellite-based near-infrared (NIR) measurements within the water vapor absorption band at around 0.9 microns and adjacent window bands are used to retrieve total column water vapor (TCWV) in clear-sky, daytime conditions. The sensitivity of the ratio of these measurements increases towards the surface, allowing detailed observation of atmospheric moisture variability down to the boundary layer. Low-level moisture plays a crucial role in the formation of deep convection and accompanying severe weather like heavy precipitation. Monitoring local to regional changes in (boundary layer) moisture, e.g. increase of moisture in convergence zones, can serve as an early indicator of convective development before the onset of clouds and precipitation. The predictive potential of these TCWV fields has been demonstrated for a set of cases using spatially high-resolution TCWV retrievals obtained from morning-time measurements from the Ocean and Land Colour Instrument (OLCI) aboard the polar-orbiting Sentinel-3 satellites. OLCI's TCWV fields at 300m resolution capture small-scale convective features within the boundary layer.

The OLCI TCWV retrieval retrieval framework is being adapted for the Flexible Combined Imager (FCI) on the new Meteosat Third Generation (MTG) satellite. FCI is the first geostationary instrument to include this NIR water vapor absorption band, offering an unprecedented opportunity to generate high temporal and spatial resolution TCWV datasets with large spatial coverage, enabling a more comprehensive monitoring and characterization of local to regional TCWV spatial variabilities and temporal changes, particularly in preconvective environments. Through the assessment of these TCWV fields, their evolution and how they relate to convective development later on, we hope to offer valuable information for nowcasting methods.

VAT

Session

From Classical to Integrated Remote Sensing: New retrieval and estimation techniques (e.g. fusion, Bayesian)

Preferred Contribution Type

Oral Presentation

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