Master 2: Research Training 2023-2024

Laboratory: Laboratoire d'Optique Atmopshérique - LOA (https://www.loa.univ-lille.fr/)

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Retrieval of water vapor content above clouds from remote sensing observations in the shortwave infrared

According to the latest IPCC report (2021), the role of clouds in the climate system remains a challenge for climate modeling. The formation and development of clouds in the atmosphere depend largely on the amount of water vapor available, which tends to increase in the context of climate change. Knowledge of the spatial and temporal variability of water vapor in a cloudy atmosphere is an essential information to improve our knowledge of the mechanisms linking water vapor and clouds and thus to constrain small-scale physical cloud models and numerical weather prediction models.

Water vapor amount and profiles are currently retrieved from microwave or infrared sounders at spatial resolutions of about ten kilometers. However, the study of the interactions between cloud and water vapor requires a higher spatial resolution that will be achieved by the mission C^3IEL (Cluster for Cloud evolution, ClImatE and Lightning), currently under study jointly by the CNES (Centre National d'Etudes Spatiales) and the ISA (Israeli Space Agency). The mission will be composed of 2 to 3 satellites carrying three water vapor imagers measuring in the shortwave infrared (SWIR). According to the imager wavelenlength, measured radiations are not, partially or highly absorbed by the water vapor. Exploiting this differential absorption between the channels, recent developments done during a PhD work show that, using an optimal estimation method, the water vapor content above clouds can be retrieved with uncertainties of few kg/m2 above ocean.

The objective of the internship would be to extend this algorithm to retrieve water vapor above land and to assess to uncertainties of the retrieved integrated water vapor content.

Key words: water vapor; cloud ; satellite remote sensing