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Studying uncertainty in LUT-based aerosol retrieval employing Bayesian statistical approach applied to TROPOMI/S5P measurements

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In this presentation we consider uncertainty in Look-up table (LUT) based technique for retrieving aerosol optical depth (AOD) and aerosol type using TROPOMI/S5P measurements.
The LUTs are multi-dimensional tables containing aerosol microphysical properties and they have been constructed using libRadtran simulations.
Especially we study difficulty in aerosol microphysical model selection that reflects the retrieval uncertainty. As a source of uncertainty we have also acknowledged so called model discrepancy originating from imperfect forward modeling.
The methodology considered is based on Bayesian inference where the retrieved AOD estimate is given as maximum a posterior (MAP) value and uncertainties are described as posterior density functions. We have also combined statistically the most appropriate aerosol microphysical models by Bayesian model averaging when the selection of single best-fitting model is not clear.
The motivation is to consider difficulty in aerosol model selection and obtain realistic uncertainty estimates.
We have applied this methodology to OMI/Aura measurements in our earlier studies. Here we present results when used higher resolution measurements from TROPOMI/S5P and studied the methodology covering various aerosol conditions including wild fire and dust events.