



Cloud identification and classification applied to satellite Far InfraRed Observations (FORUM mission)

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The FORUM, Far-infrared-Outgoing-Radiation Understanding and Monitoring, mission has recently been selected by ESA as one of the two candidates for the Earth Explorer 9 mission. Its main goal is the study of water vapor and clouds by filling the long-standing gap in Far InfraRed (FIR) spectral observations from space. The present work illustrates two cloud classification and identification methodologies capable to exploit spectral radiance data in the FIR:

1) ICICLE is a classification algorithm based on Support Vector Machine – SVM. Its main advantages are the well-developed theoretical background, the high flexibility, a measure of classification probability, the possibility of providing classification with non-linearly separable training sets. Disadvantages include the dependence of classification scores on free parameters (whose number increases if a nonlinear kernel is chosen) and the large computational time to perform the grid search process.

2) IPCA is a new methodology based on the Principal Components Analysis – PCA. It can perform multi-class classifications, it is very fast and it is independent on free parameters. The main disadvantage is the intrinsic linearity of PCA.

The ICICLE and IPCA are applied to a synthetic dataset set-up to reproduce observation of the future FORUM mission. Extensive simulations are performed, by using accurate line-by-line multiple scattering radiative models, in order to represent radiance spectra in clear and cloudy conditions from 100 to 1600 cm^{-1} with the FORUM spectral resolution and viewing geometry. Tropical, Mid Latitudes and Antarctic conditions are accounted for and derived from ECMWF re-analysis ERA-Interim.

Results highlight the importance of FIR part of the spectrum in cloud identification and classification. The FIR information content is also evaluated and discussed.