Variational estimation of cloud parameters with a view towards cloudy radiance assimilation: Application to AIRS observations

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A variational estimation procedure for the retrieval of effective cloud top height and emissivity is proposed. The method is based on a cloud emissivity model which accounts for the frequency dependence of cloud absorption and scattering, and possible mixed phased situations. The method is applied to real AIRS observations, using 61 channels mostly sensitive to temperature. A 6-h forecast serves as background field, and remains fixed. The problem of infrared cloudy radiance assimilation is approached by assuming that the atmospheric and cloud contributions to observed radiances can be well modelled if the effective cloud parameters are known precisely. Under these conditions, the assimilation of cloudy radiances appears feasible over a broad range of situations defined by the cloud parameters. Examples of 1D-var assimilation are shown, using 100 AIRS channels, this time including humidity channels and allowing the atmospheric state to vary. A comparison of the resulting temperature and water vapor increments with spatially and temporally coincident radiosondes is performed.
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