



## **Retrieval of minor constituents in a cloudy atmosphere with remote sensing millimeter wave measurements**

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We know very little about the atmospheric chemistry in presence of clouds, because optical path through the cloud itself prevents remote sensing observations. The cloud effects on the radiative transfer are to increase the atmospheric optical depth and to introduce the scattering source function contributes. In the millimeter and sub-millimeter wave region the absorption effect is reduced for ice particle clouds and the scattering effect becomes important only for the larger particles composing the cloud. The millimeter and sub-millimeter wave region can be used to study the atmospheric chemistry in the presence of clouds. The effect of the clouds depends on particle phase, on radius and on numerical density of the particles composing the cloud. A theoretical retrieval analysis is made to assess conditions in which retrieval is possible. We find that in most cases an atmospheric continuum model is sufficient to describe the radiative transfer in cloud, however, in a few cases, that will be specified, a model that takes into account the scattering contribution is needed.