Retrieval of frontal cloudiness microstructure characteristics from satellite radimeteric data

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This paper presents results of consecutive numerical simulation of the NOAA satellite signal (reflectance of frontal mixed stratiform clouds) for channels of AVHRR. in

visible and near infrared regions of spectrum.

The simulation is based on the next models:

a) The time-dependent numerical microphysical model of stratiform frontal clouds with 3 forms of ice crystals(needles, plates, columnes).

b) Models of computations of scattering characteristics of drop and crystal systems. Simulations of scattering characteristics of liquid drops are based on the Mie theory. Simulations of scattering properties of randomly oriented ice crystals are based on the geometric optics and far-field diffraction approximation. Computations were realized in visible and near-infrared part of spectrum (λ_1= 0.55 μm, λ_2= 1.6 μm,

$\lambda_3 = 3.6$ μm).

c) The Discrete Ordinate Method (DOM) for simulation of solar radiation transfer in not uniform clouds.

Simulations of CR (cloud reflrctance) show that $CR_{\lambda 1}$ and $CR_{\lambda 2}$ change synchronously with the cloud intrgral optical thickness (IOT) which is detrmined basically with liquid water content (LWC). The channel λ_3 = 3.6 μm is less sensible to the optical thickness. $CR_{\lambda 2}$and $CR_{\lambda 3}$ are very different in a great LWC region but become close in a region of significant crystallization and precipitation.

The comparison $CR_{\lambda 1}$, $CR_{\lambda 2}$, $CR_{\lambda 3}$ gives the new possibility to distinguish regions with thick layers (with great LWC) and regions of highly crystallization and precipitation.

Modeling results were used for the development of retrieval procedure of IOT and ř – effective radius if cloud particles as well as for procedure of above –mehtioned distinguishing. It has been shown (from NOAA AVHRR data) in concrete cases that regions of considerable precipitation are concerned with either near crystallic clouds (IOT< 15-20, ř >100-200 mkm) or thick mixed clouds with the great LWC (IOT> 25-30, ř > 15 mkm).