ALLOCATION OF FRONTAL MIXED CLOUDS OF HIGHLY DEVELOPED CRYSTALLIZATION AND HEAVY PRECIPITATION FROM MULTISPECTRAL SATELLITE DATA

V. Bakhanov, O. Kryvobok, B. Dorman

Ukrainian Hydrometeorological Research Institute, 03028 Kyiv, Ukraine,
Avenue of Science 37, v_bakhanov@rambler.ru

I. NUMERICAL SIMULATION OF EVOLUTION OF MIXED FRONTAL CLOUDINESS, ITS MICROPHYSICAL AND OPTICAL CHARACTERISTICS AND SATELLITE SIGNAL

At first we have realized the consecutive numerical simulation of a satellite signal (cloud reflectance in visible and near-infrared channels of the NOAA AVHHR-radiometr). The numerical simulation is based on the next models:

1. Our realistic microphysical model (Bakhanov, Dorman, 1996) of a mixed stratiform cloud with 3 forms of ice crystals (needles, plates, columns).
2. Algorithms of calculations of scattering characteristics for drops (based on the Mie theory) and crystals (based on the geometric optics approximation).
3. The Discrete Ordinate Method (DOM, Liou, 1973) for simulation of solar radiative transfer in a not uniform cloud and calculation of a satellite signal.

The aim of numerical simulation of cloudiness consisted in proposing preliminary parameters and criteria for the separations of cloudiness regions with the great liquid water content (LWC) and regions of highly developed crystallization and precipitation.

II. RETRIEVAL OF CLOUD MICROPHYSICAL AND OPTICAL CHARACTERISTICS FROM MULTISPECTRAL RADIOMETRIC SATELLITE DATA

Then we have used some results of numerical simulation for improvement of the retrieval of the cloud optical thickness (COT) $\boldsymbol{\tau}$ and $\mathbf{r_{eff}}$ – effective radius of cloud particles.

We have also developed the procedure of distinguishing of regions with great LWC and regions of highly crystallization and precipitation (Bakhanov, Kryvobok, Dorman, 2004, 2006).

The last algorithm is based on criteria for **Tct** –cloud top temperature, $\mathbf{r_{eff}}$ and $(\boldsymbol{\tau_{1.6}/\tau_{0.6}})$ – the ratio of the COT for the wave length λ = 1.6 μm to the COT for λ = 0.6 μm. Some examples show that our distinguishing procedure gives results corresponding with ground-based precipitation data.

III. REFERENCES

Bakhanov V.P., Dorman B.A., 1996. Precipitation formation in winter frontal stratiform clouds with several crystal forms. *Proceedings of the 12-th Intern. Conf. on Clouds and Precipitation (Zurich), 846-849.*

Bakhanov V.P., Kryvobok O.A., Dorman B.A., 2004. Retrieval of microphysical and optical characteristics of mixed frontal clouds from multispectral satellite data. *Proceedings of the 2004 EUMETSAT Meteorological Satellite Conference (Prague), 301 -306.*

Bakhanov V.P., Dorman B.A., Kryvobok O.A., 2006. Frontal cloud microstructure effect on satellite signal (cloud albedo). *Presentations at the 2006 EUMETSAT Meteorological Satellite Conference (Helsinki).*

Liou K.-N., 1973. A numerical experiment using Chandrasecar's discrete-ordinate method for radiative transfer. *J. Atm. Sci., 30, 1303 -1326.*