

## **5.METEOROLOGY.**

The most of the activities were performed in the Slovak Hydrometeorological Institute (SHMI), Bratislava. SHMI exploits data from geostationary meteorological satellites mainly in operational practice. Images from the satellites Meteosat 6, 7 (interval of 30 minutes) are regularly received and processed. Images from other geostationary satellites (Goes 8, 9, GMS and Meteosat 5) are received and processed occasionally. Imagery that shows cloud fields over Europe and adjacent Atlantic in three spectral bands is used for weather analyses and forecasting in a form of animation sequences or in a form of individual images. Individual images are often combined with other meteorological information like the fields of temperature, humidity, pressure and precipitation and they can be used also as an input to numerical weather prediction models. Expert activities are included into studies of cloudiness' time evolution, mainly cumuliform cloudiness connected with showers and thunderstorms in the Central Europe region. The effort is oriented to distinguish between developing and dissipating phase of clouds. Mean time-trajectories in dual channel diagrams are obtained as the base to study cloudiness' life cycle and to estimate phase of cloud development. In the following three paragraphs, the Technology, the Processing and Data and Products, Users and Distribution, as well as Studies of SHMI are listed.

### **a. Technology.**

October 1998 was a breakpoint in satellite technology used at SHMI. The originally PDUS system WIRPS (Weather Imaging Receiving and Processing System, Dornier) was upgraded by components from VCS Nachrichtentechnik, GmbH. The main changes include new Meteosat High Resolution - Decryption Unit (MHR-DU), new workstation DEC Alpha with OpenVMS operation system and AXP-SAT Receiving and Processing software. MHR-DU performs the encryption/decryption algorithm based on the Data Encryption Standard. This algorithm is using the Meteosat Key Unit (MKU), which contains a secret station key and messages keys distributed by EUMETSAT via Meteosat satellite. MHR-DU processes receiving data by antenna and receiver (UKW technik Electronic GmbH) according to a schedule specified by the host computer connected to MHR-DU. This processing is definable by the user. User specified decoded data are forwarded to the computer after extraction from Meteosat data stream.

Computer DEC Alpha workstation insures powerful processing of received data in real time. It means extraction of data according to spectral bands, appropriate geometrical correction

and cartographic map projection, calibration and production of image files. Image files can be directly displayed on the monitor, coloured, zoomed and animated by visualisation software.

#### b. Processing.

Processing before system upgrade has been performed by one of the Unix computers with self-made software utilities that included all necessary operations with data after their acquisition by receiver (decoding and keys acquisition, data extraction, geometrical transformation, calibration, products' generation and dissemination to users). Almost all these operations could be replaced by new workstation and AXP-SAT software besides some special routines developed at SHMI for production of 3D-IR image, multichannel composite and special compressed IR image intended for the low-cost processing workstation at Regional offices and Meteorological stations (IMS product). Navigation facility of AXP-SAT contains a set of projections, which can be selected by user. The most used projections are Lambert conformal projection and Geostationary (Geosat) projection.

#### c. Data and Products.

The following formats are received regularly:

Meteosat A-format - Earth disc from Meteosat 7, channels IR, WV, VIS

Meteosat B-format - Europe and adjacent Atlantic, channels IR, WV, VIS

Meteosat 5 - India and Indian Ocean, channels IR, VIS

Goes E - North and South America channels IR, VIS

Goes W - Pacific Ocean, channels IR, VIS

GMS - Japan, Australia, channels IR, VIS;

#### d. Users and Distribution

The distribution is performed by Ftp-program to all computers where there is the necessity to use satellite imagery. Main users are general weather forecast offices and offices for aviation. The set of products listed above is transmitted to these users and used for weather analyses and forecasting in a form of animation sequences to observe time development of the clouds or as a single image combined with other meteorological data like fields of temperature, humidity, pressure, etc.

e. Studies.

Expert study is oriented to cloudiness' time evolution, mainly cumuliform cloudiness connected with the showers and thunderstorms in the Central Europe region. Mean time-trajectories in dual channel diagrams are obtained as the base to study cloudiness' life cycle and to estimate phase of cloud development. Two years of summer season data have been processed and there have been obtained mean time-trajectories for cloud midpoints' multi-channel values; trajectories are thought in diagrams IR-WV, IR-VIS and WV-VIS, respectively. Database from which the trajectories have been derived has been created manually. Every single cloud has been evaluated subjectively and inserted consequently into database. The results of the study give some possibility to distinguish in some cases between developing and dissipating phase of clouds. The results can be considered as a part of input to conceptual models, as descriptors of appearance, time duration, size and intensity of meteorological phenomena from the satellite point of view.

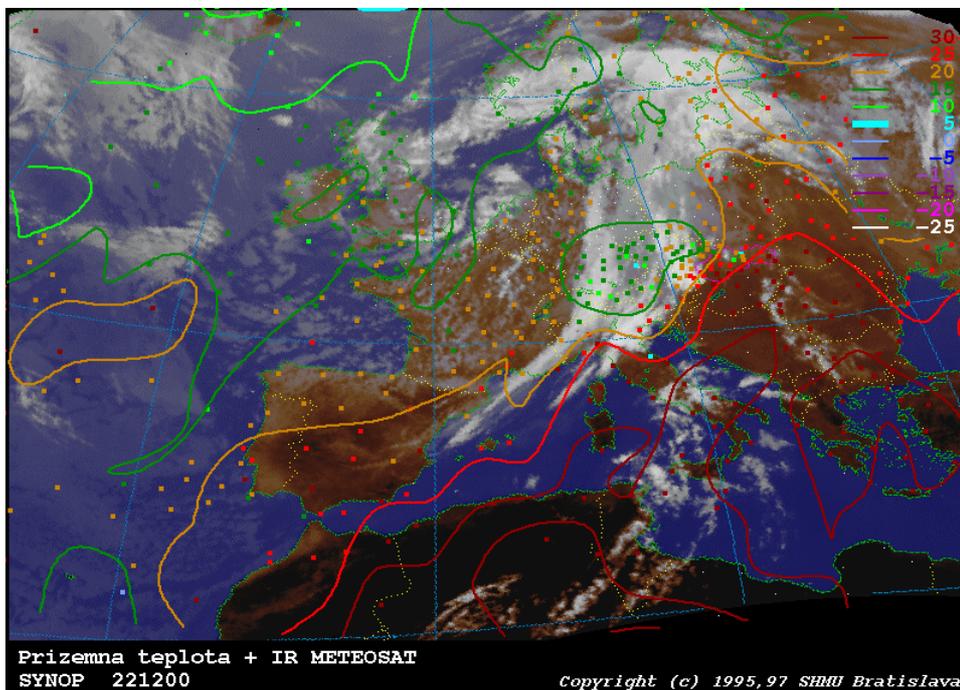


Fig.13. The Integration of METEOSAT Data with SYNOP Data: Infrared channel + surface temperature 22/6/1997 12,00UTC displayed on B-format picture of METEOSAT satellite.

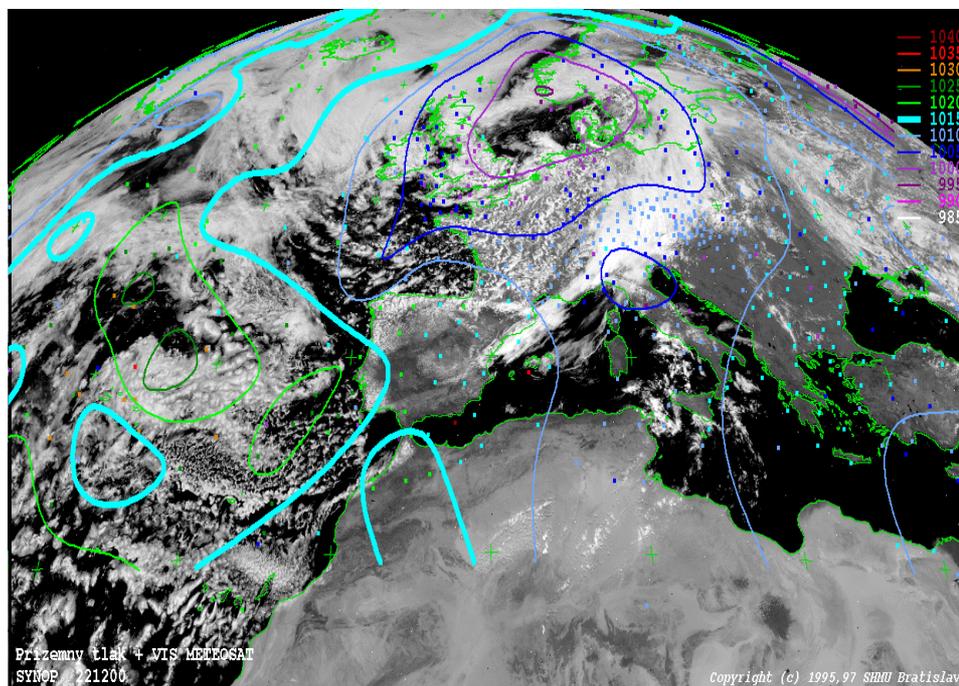


Fig.14. The Integration of METEOSAT Data with SYNOP Data: Visible channel + earth surface air pressure 22/6/1997 12,00 UTC displayed on B-format picture of METEOSAT satellite

#### References.

1. Káčer, M., J. Kaňák, R. Zehnal: Integration of the METEOSAT data with the SYNOP data. The 1997 Meteorological Satellite Data Users' Conference. Brussels, Belgium, 29th September - 3rd October 1997.
2. Kaňák, J.: Investigation of Cloudiness' Time-Evolution Based on Multi-Channel Satellite Imagery. The 1999 EUMETSAT Meteorological Satellite Data Users' Conference. Copenhagen, Denmark, 6 - 10 September 1999.

