CURRENT STATUS FOR OPERATIONAL PROCESSING OF TOVS DATA AT THE HUNGARIAN METEOROLOGICAL SERVICE

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1. INTRODUCTION

As it was reported at the ITSC-IX, the operational use of TOVS data is an integral part of the data processing system of the Hungarian Meteorological Service (HMS). Data from NOAA 14 satellite overpasses are processed in real-time at the Satellite Research Laboratory's HRPT satellite receiving station using the ITPP5 software. Since mid 1998 data are also being processed with the test version of the ATOVS and AVHRR Processing Package (AAPP) software (development coordinated by EUMETSAT) in conjunction with an inversion model called Inversion Coupled with Imager (ICI) developed at the Centre de Météorologie Spatiale (CMS) of Météo France. Under a cooperation agreement and collaboration with CMS we were able to participate in the testing phase relevant to the installation and operational runs of the AAPP and ICI software on our local HP workstation. This paper presents, firstly, the results of those tests, and secondly a comparison of retrieved profiles using ICI in Lannion (CMS) and Budapest (HMS).

One of the principal aims of these efforts is to provide the Hungarian Advanced Weather worKstation (HAWK) with real time TOVS/ATOVS-derived meteorological fields for nowcasting over the acquisition zone of Budapest. We use PCs for receiving the data from all orbits of the NOAA14 and NOAA15 satellites, while the HRPT data file processing takes place on a J210 HP UNIX workstation.

4. MAIN STEPS OF THE OPERATIONAL WORK

4.1 AAPP

The first step was to adapt the AAPP software for preprocessing the HRPT raw data including both TOVS/ATOVS and AVHRR parts. The only problems we encountered were only due to the different versions of UNIX OS and FORTRAN compiler used. The AAPP version 0.89 was running operationally from December 1997 till November 1998 for NOAA14 and now the AAPP v. 1.0 is running operationally from November 1998 for NOAA14 and NOAA15.

4.2. MAIA

"Masque AVHRR pour Inversion" ATOVS (MAIA) performs mapping and cloud mask for HIRS data with AVHRR images (*Le Gléu et al.* 1989), which are necessary for the retrieval parts. The MAIA software was

developed by CMS of Météo France. The required input data are the level1d HRPT file and NWP model forecasts for surface air temperature and surface pressure. We use ECMWF 24h forecasts.

The MAIA software is running as the last part of AAPP. Its outputs are archived on DAT cartridges since December 1997.

4.3 ICI

For the retrieval part of the TOVS/ATOVS data processing we installed the Inversion Coupled with Imager (ICI) software (*Lavanant et al.* 1995, 1997) which operationally processes TOVS/ATOVS measurements together with surface and cloud information from AVHRR images (by MAIA) to produce sounding retrievals. It requests NWP analyses 4 times per day (00, 06, 12, 18 UTC) up to as high level as possible (at least 50 hPa) and radiosonde data for the first-guess library. At HMS we use the ECMWF analyses at 00 and 12 UTC at a 1°*1° resolution up to 100 hPa. For each profile clear brightness temperatures are computed with the RTTOV forward model interpolated and extrapolated on the 40 working levels.

The ICI software is running operationally from 1 December 1998 for NOAA14 and from 23 December 1998 also for NOAA15.

4.3.1 Inversion

The ICI resolution is a function of an input parameter (M). It can be changed at each run. The best resolution is to consider each HIRS pixel (M=1). We run ICI operationally for 3x3 HIRS pixel boxes (M=3). The retrievals are separated due to cloud condition and surface types (sea, land or cost line). The cloud clearing is based on AVHRR cloud detection. There are three cloud classes: clear (< 10%), partially cloudy (between 10% and 70%) and cloudy (> 70%).

5. VALIDATION

For monitoring and comparing the results of AAPP or MAIA software in Budapest and in Lannion we used the PvWave software at CMS. Fig. 1 shows an example for brightness temperature from AMSU-B channel 1, NOAA15 and surface temperature (made by MAIA software) for NOAA14 at 7 December 1998. The figure indicates that our results in Budapest are similar to the CMS's ones.

For studying the quality of the retrievals, ICI produces statistical files. The retrievals are compared to meteorological database (NWP analyses and radiosonde profiles). Ten day statistics are made for the 3 cloud classes separately over land and sea on 7 layers and on 40 RTTOV levels. Statistics made in Budapest and Lannion for period between 1 and 10 January 1999 are shown on Fig. 2. (*Randriamampianina et al.* (1999)

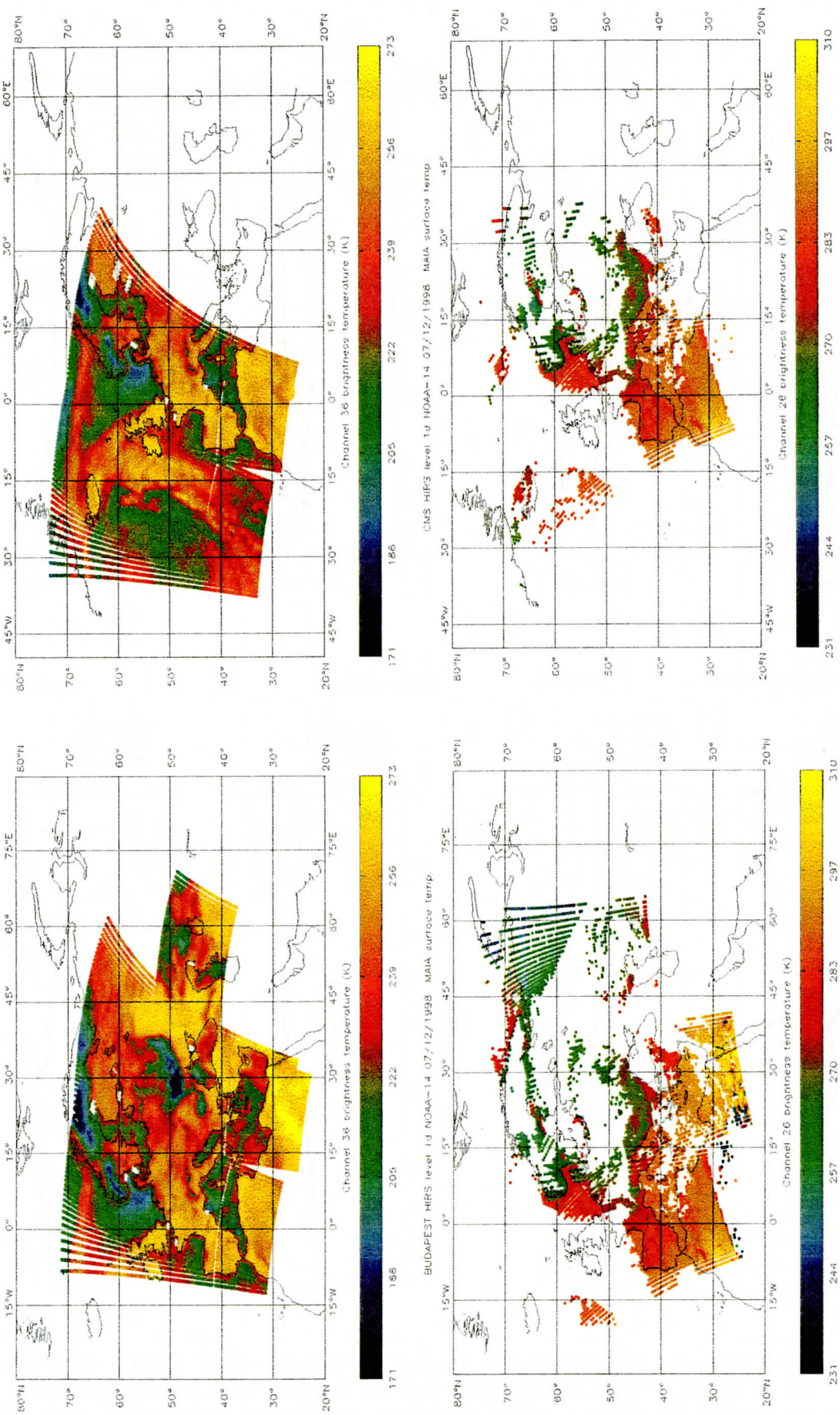

Fig. 1 Brightness temperature computed by AAPP from AMSU-B channel 1, NOAA15 at 7 December 1998 received and processed at the HRPT station Budapest (top left) and Lannion (top right). Surface temperature computed by AAPP and MAIA software for NOAA14 at 7 December 1998 in Budapest (bottom left) and in Lannion (bottom right)

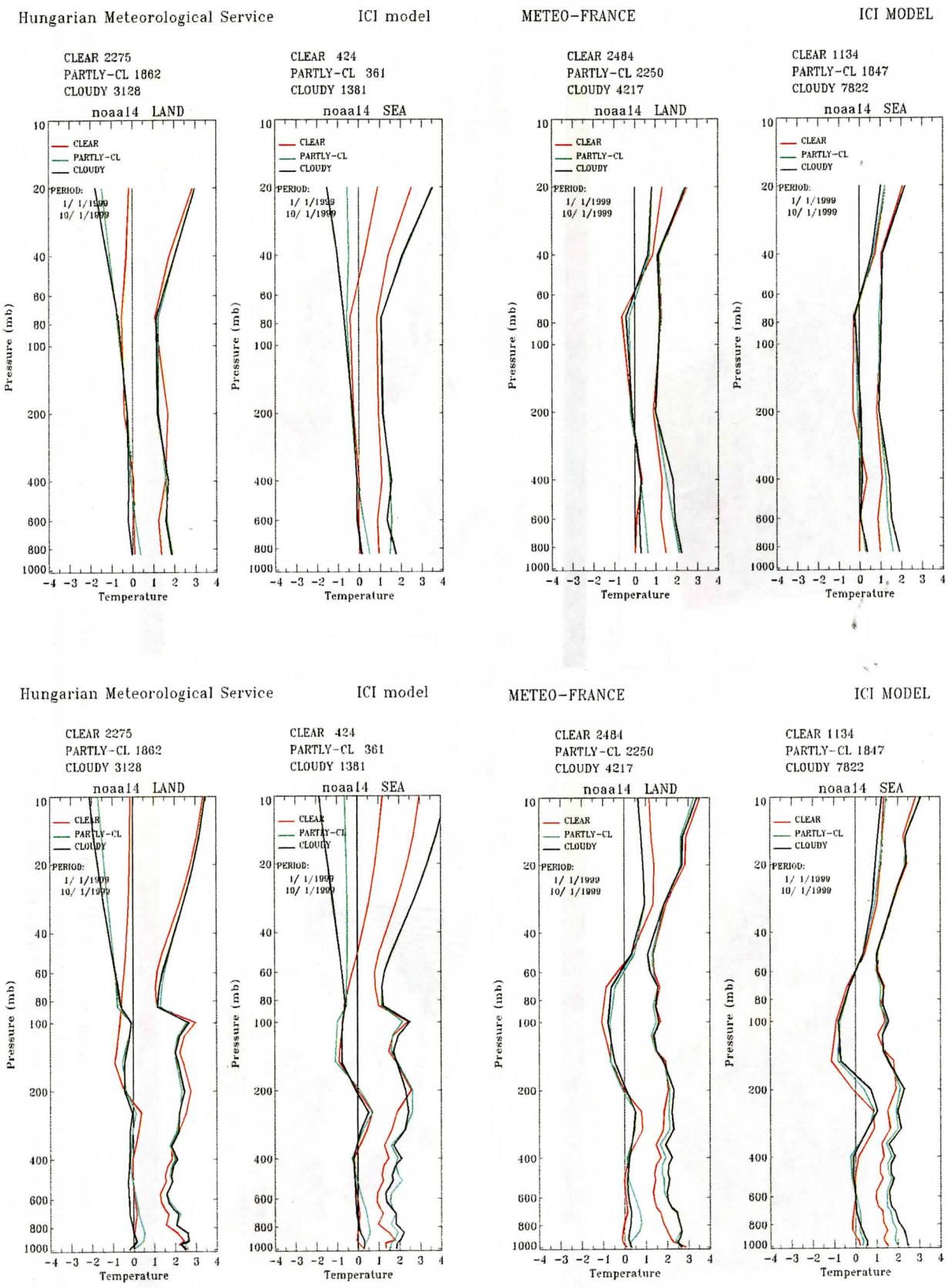

Fig. 2 Accuracy of ICI retrievals in Budapest (left figures) and Lannon (right figures) for NOAA14 between 1 and 10 January 1999, separately over land and see. Bias and standard deviation of the inversions compared to the analyses and radio sounding are given on layers (top figures) and on levels (bottom figures) for three cloud classes with the number of co-localisations.

also investigated the quality of the ICI products.) It can be seen that we have problems with the extrapolation on upper levels since the ECMWF files, which are available for us, contain only 11 levels up to 100 hPa. Unfortunately we can not illustrate any statistics for NOAA15 because of the very few number of co-localisations. The problem is that the 06 and 18 UTC analyses are not available at the HMS at the moment and also a bigger ECMWF model area would be necessary (the area from -45W to 45E does not cover our whole acquisition zone).

6. CONCLUSION AND FUTURE WORK

The operational processing of the HPRT data from NOAA14 and NOAA15 were presented in this paper. As a result of the collaboration between France and Hungary, since December 1998 the Hungarian Meteorological Service produces operationally retrievals using the AAPP, MAIA and ICI softwares. We still have some problems concerning to the ECMWF database available at HMS, which can be solved in the near future with increasing the area and time frequency of this database. It will also help to solve the profile extrapolation problem (because of the only 11 levels of ECMWF profiles). For monitoring the results and its quality, visualization tool for forecasters and validation using an exportable free ware graphical software package are already under development.

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