



CGMS-35, CMA-WP-09
Prepared by CMA
Agenda Item: II/3
Discussed in WG2

Summary of the Working Paper.

CMA-WP-09 reports on CMA/NSMC activities concerning TOVS/ATOVS data receiving, processing and archiving. Up to now, NSMC has archived for 10 years the HRPT TOVS/ATOVS data and retrievals. The long time series data and archive from NSMC three ground stations covers China and surrounding area, provides potentiality of utilization for climate study in East Asia. Plan is proposed with this respect in the report including reprocessing the data to establish a climate data bank of TOVS/ATOVS derived products.

ATOVS Products and Plan for Climate Study at NSMC

The National Satellite Meteorological Centre (NSMC) began establishing the TOVS pre-processing / retrieving system from time of NOAA14 and started archive on an operational basis in 1998. With new launches of NOAA satellites, processing for new satellite data was added to the system accordingly. Since 1998, five satellites namely the NOAA 14, 15, 16, 17 and 18 have been received and processed by the system, and TOVS data have developed into current ATOVS data. NSMC has stored for ten years the TOVS/ATOVS retrievals, TOVS/ATOVS HRPT data received and pre-processed from three ground stations, created a long time series four-dimensional distribution of atmospheric parameters covering China and surrounding area. Figure 1 illustrates the geographic locations of three NSMC ground receiving stations and data coverage. As a result, a large amount of observational data is available for use to derive atmospheric parameter products from TOVS/ATOVS, and to make a preliminary study of climate change in East Asia and predict evolution in the future. Figure 2 is the satellite passes received the three ground receiving stations under NSMC.

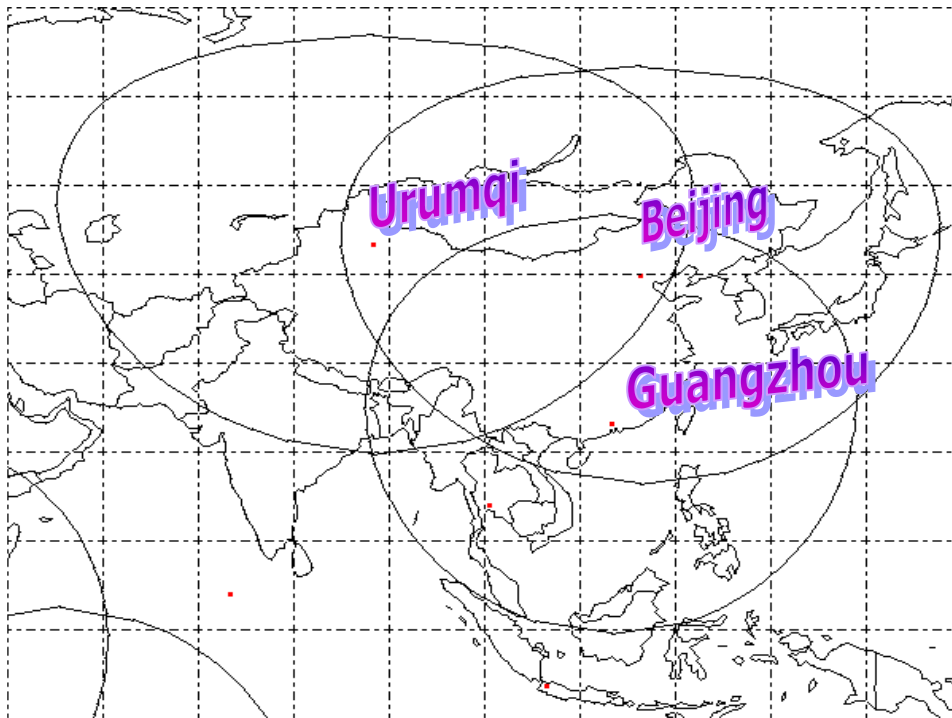


Figure 1: Geographic locations of three NSMC ground receiving stations and data coverage

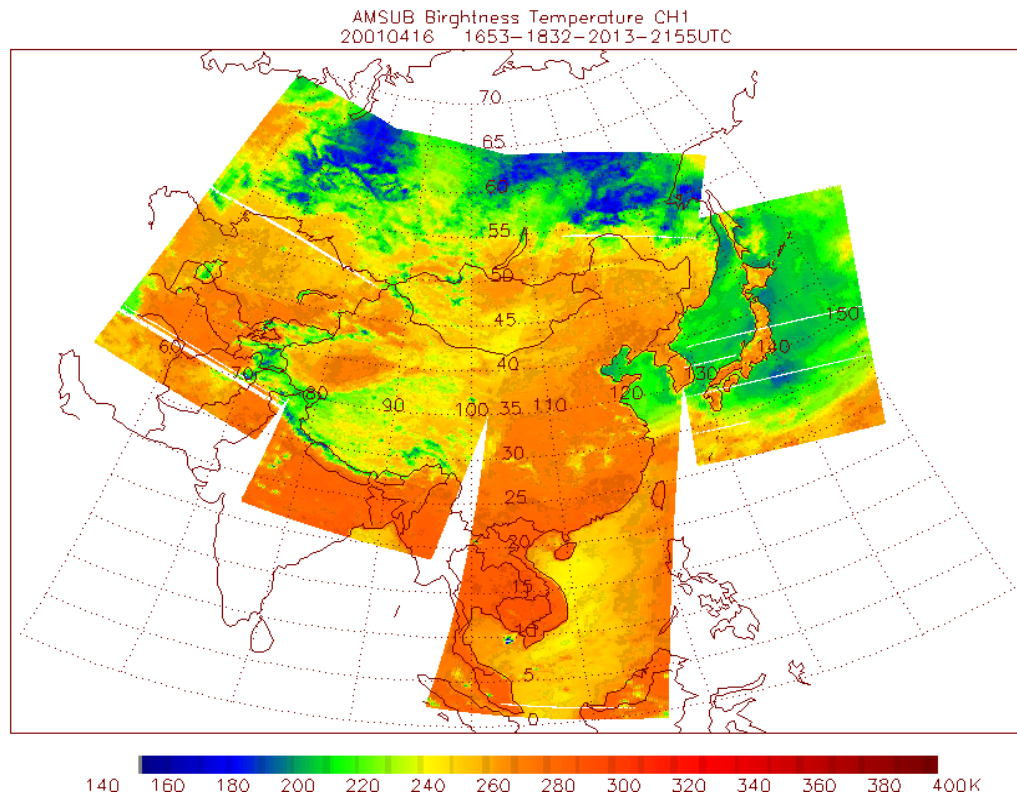


Figure 2: Satellite data passes received by three NSMC ground receiving stations

An Introduction of NSMC's derived products of TOVS/ATOVS

The NSMC receives the advanced atmospheric vertical sounders (TOVS/ATOVS) of NOAA-14/15/16/17/18 meteorological satellite series. The radiation value, for 3D and 4D variation assimilation to the NWP model, is generated after processing at different levels. Atmospheric temperature and humidity profiles as well as other relevant parameters are generated as end products.

Currently, the three ground receiving stations in Beijing, Guangzhou and Urumqi are able to receive HRPT/ATOVS data from 6 - 8 orbits (3-4 orbits respectively during daytime and night) every day, data covering 0 -- 65 N, 50 - 140 E. At present, the operational ATOVS data processing system processes ATOVS data twice a day (morning and afternoon orbits), generates temperature, humidity, potential height and geostrophic wind and distributes in real-time through 9210 communication lines. ATOVS data processing system adopts physical retrieving method to deduce various quantitative products, and uses global numerical weather prediction field as first-guess for the retrieval model, the space horizontal resolution is 50-75 km. The following retrieving products are generated by the ATOVS data processing system:

- 1) 1000 – 10hPa 15-layer atmospheric temperature;
- 2) 1000 – 300hPa 6-layer due point temperature;
- 3) 1000 – 10hPa 15-layer geopotential height;
- 4) 850 – 100hPa 9-layer geostrophic wind;
- 5) Total amount of precipitable water in atmosphere;
- 6) Index of stability of the whole atmosphere;
- 7) Total ozone content in atmosphere;
- 8) Total amount of emitted long wave;

- 9) Lifted index at 500hPa;
- 10) Cloud top temperature;
- 11) Cloud top air pressure.

Among others, through contractive analysis between Retrieved ATOVS products and conventional upper-air observations (RAOB), it is possible to calculate the deviation, root-mean-square error. The error range of derived products is as follows:

- Atmospheric temperature: 40 layers(1000-0.1hPa), the accuracy being 2K;
- Atmospheric humidity: 15 layers (1000-300hPa, the accuracy being 20%.

Appendix 1 and 2 indicate the file archiving format of atmospheric parameters derived from ATOVS of NOAA14 and NOAA15/16/17/18 respectively.

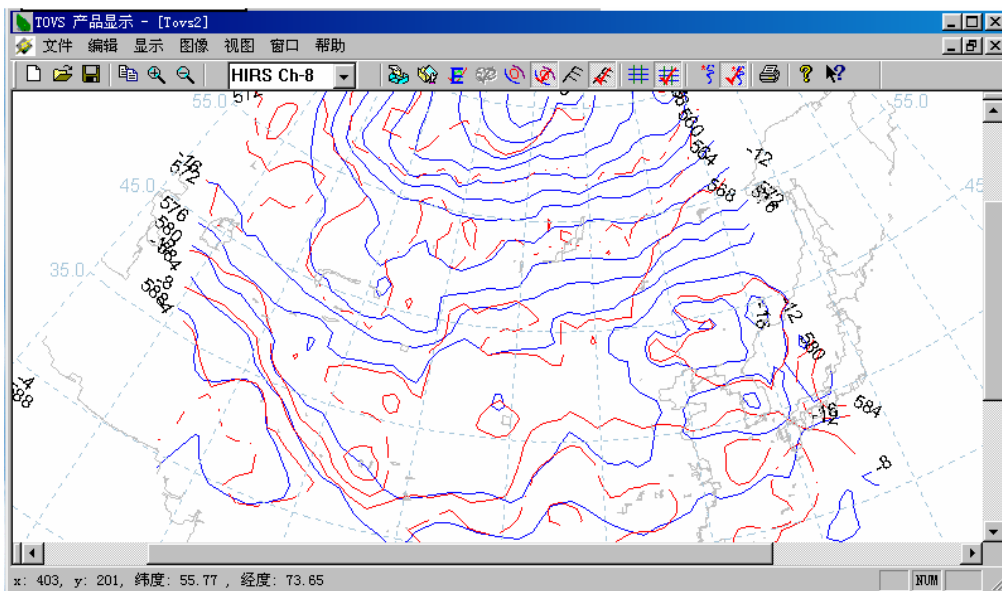


Figure 3: Overlapping of geopotential height filed on temperature field derived from ATOVS at 500 hp.

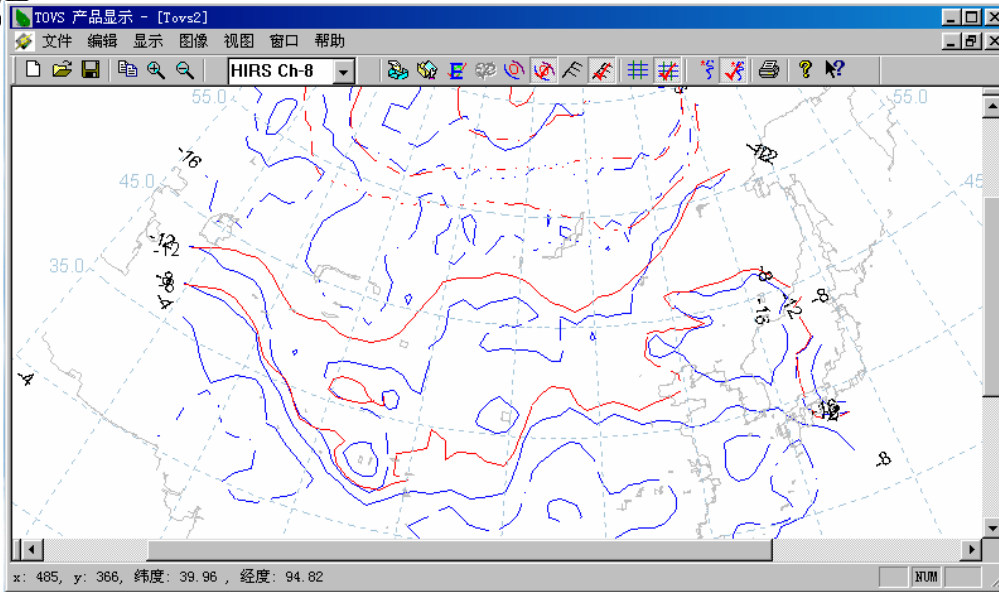


Figure 4: Comparison between temperature field (blue line) derived from ATOVS and NWP temperature field (red line) at 500 hp

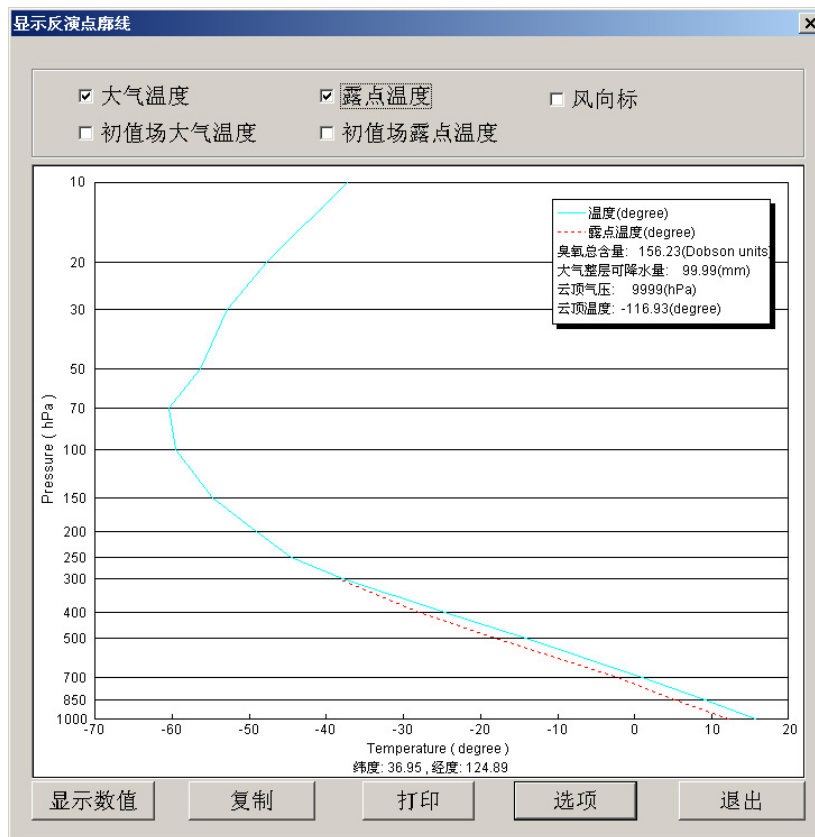


Figure 5: Vertical distribution of derived products at deriving point

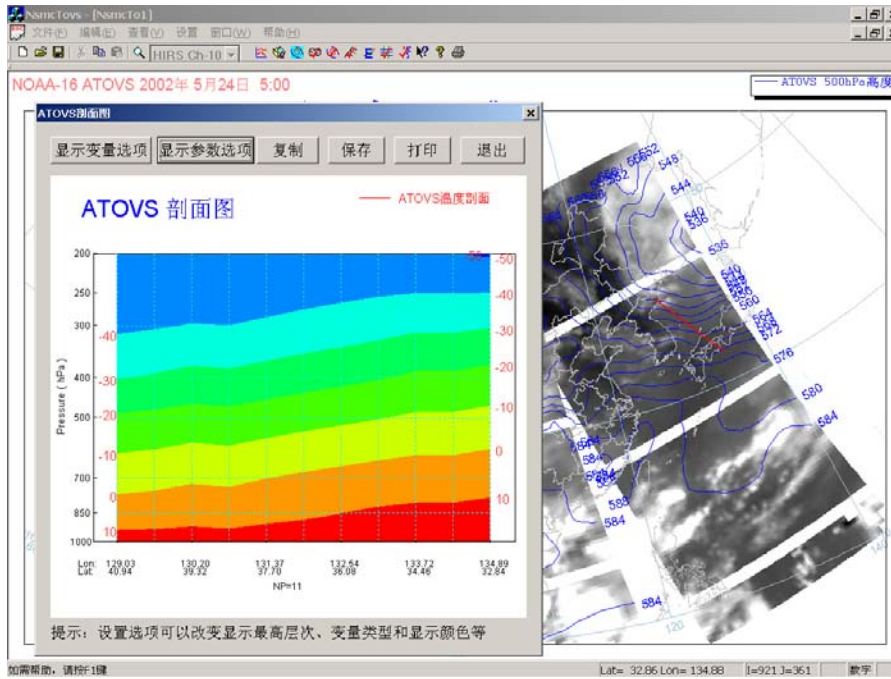


Figure 6: Temperature profiles (colourful zebra) are as follows, as indicated by red markers:

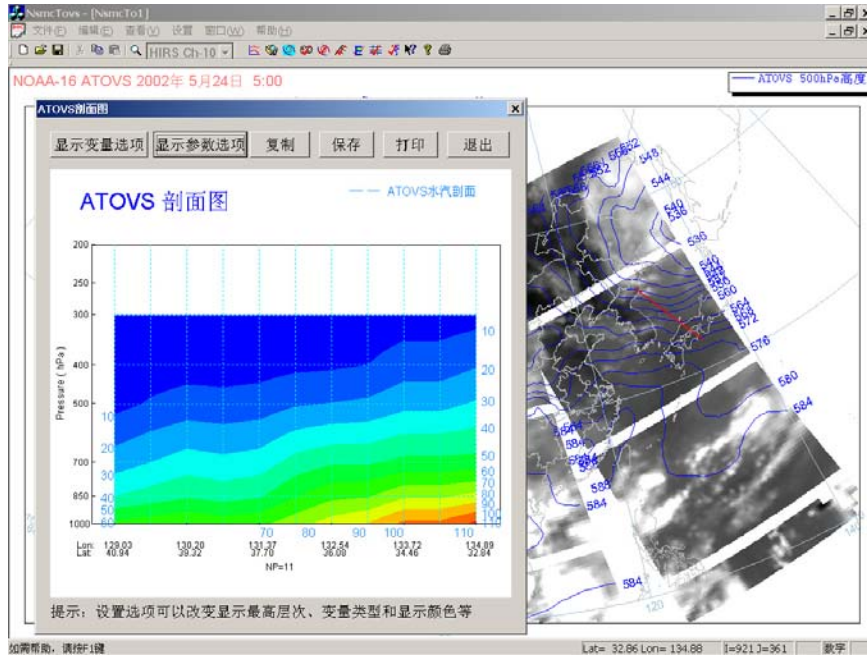


Figure 7: Water vapour profiles (colourful zebra) are as follows, as indicated by red markers:

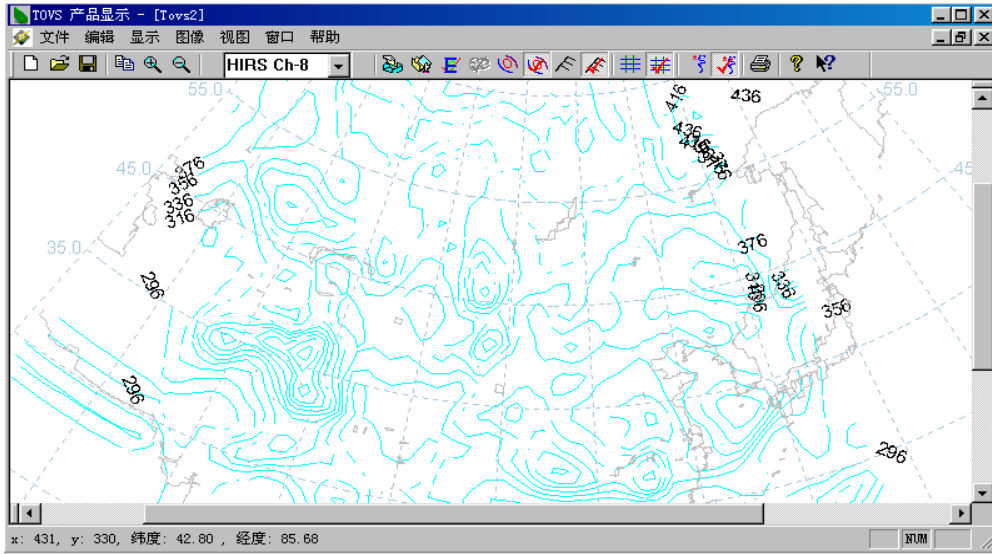


Figure 8: Distribution of total atmospheric ozone

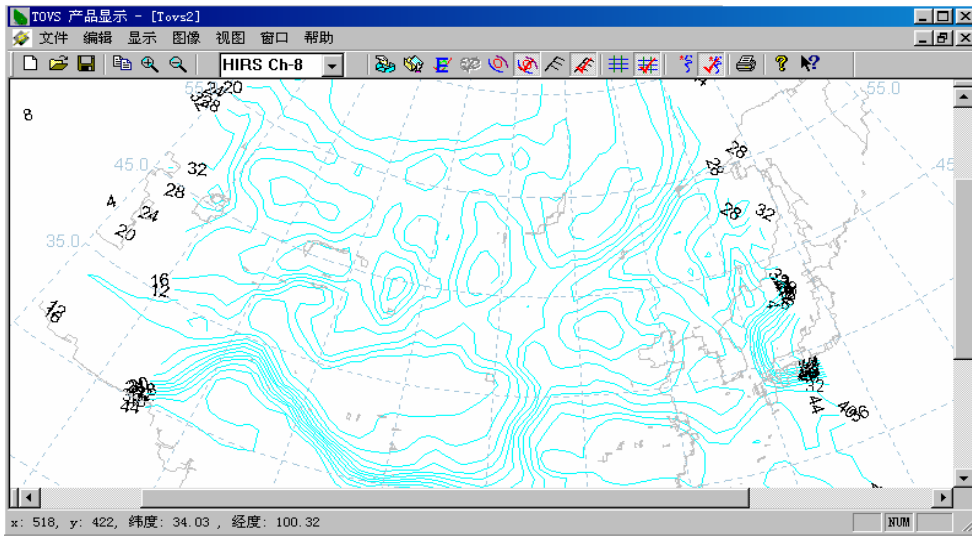


Figure 9: Distribution of precipitable water in the whole atmosphere

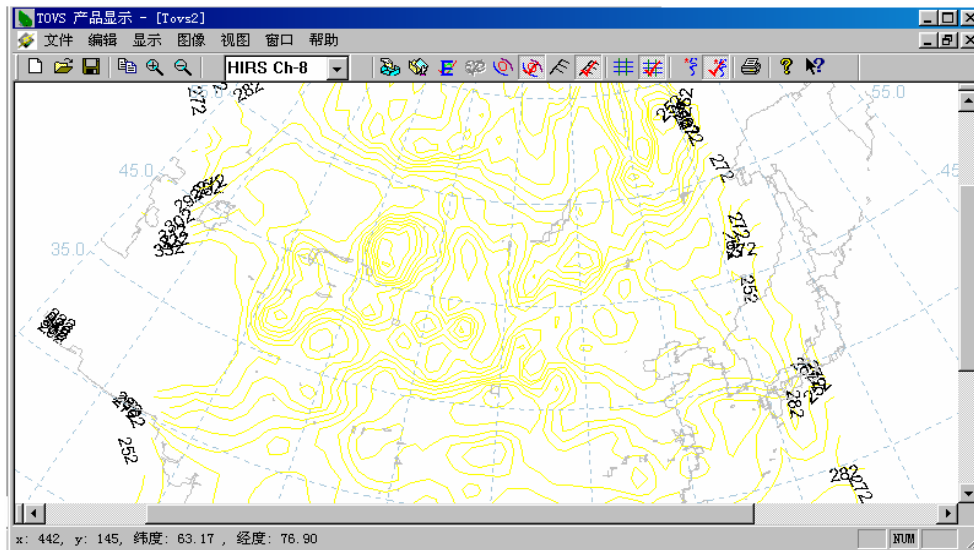


Figure 10: Distribution of emitted long wave radiation

Implementation plan for using TOVS/ATOVS derived products for regional climate monitoring/prediction in East Asia

1. Compilation of 10-year TOVS/ATOVS data

1.1 Compilation of *.f22 and *.f24 files, NOAA14 TOVS data received by NSMC from 1998 to 2000;

1.2 Compilation of NOAA15/16/17/18 ATOVS L1c and derived data of atmospheric parameters received by NSMC since 1999;

1.3 Compilation of NOAA TOVS/ATOVS data (including L1b and derived atmospheric data) received by NSMC since 1986. The global data of NESDIS in the same period will be used to supplement those lost data in consultation with NESDIS;

1.4 Collection and compilation of conventional upper-air observations in East Asia since 1986.

2. Reprocessing and analysis of 10-year derived atmospheric parameters of TOVS/ATOVS:

2.1 Analysis of the software package used by NSMC to retrieve ITPP, ICI and IAPP atmospheric parameters in dealing with NOAA14/15/16/17/18 TOVS/ATOVS HRPT data, so as to identify the errors of retrieving system of various software packages;

2.2 O₃, OLR and precipitable water in ITPP are used to deal with ATOVS HRPT data of NOAA15/16/17/18, so as to obtain O₃, OLR and precipitable water products of the whole atmosphere which are derived from satellites observations;

2.3 Accuracy analysis of comparisons between the derived data and observations from NOAA14/15/16/17/18 TOVS/ATOVS atmospheric parameters received by NSMC;

2.4 Mutual calibration, analysis and long time series calibration of NOAA14/15/16/17/18 TOVS/ATOVS L1c and derived data accuracy of atmospheric parameters received by NSMC;

2.5 Since 1986, reprocessing and re-retrieving atmospheric parameters of those lost NOAA TOVS/ATOVS data which are received by NSMC and supplemented by NESDIS global data in the same period;

3. Establishment of climatic data bank for TOVS/ATOVS derived products of atmospheric parameters in East Asia:

3.1 Establishment of long time series data bank of atmospheric temperature and humidity profiles in East Asia with a resolution of 50 km of TOVS/ATOVS;

3.2 Establishment of long time series data bank of total content of O3 atmospheric column in East Asia with a resolution of 50km of TOVS/ATOVS;

3.3 Establishment of long time series data bank of OLR from top of the atmosphere in East Asia with a resolution of 50km of TOVS/ATOVS;

3.4 Establishment of long time series data bank of precipitable water in clear sky in East Asia with a resolution of 50km of TOVS/ATOVS.