Meteorological Data Viewers at Japan Meteorological Agency

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1. Introduction

The Japanese Islands are sometimes suffered from natural disasters caused by severe meteorological phenomena such as heavy rain or snow fall, violent winds associated with typhoons, and so on. Forecasters in Japan have to seize an enormous body of observational data and numerical model results as quickly as possible. Because of a large quantity of data, high performance assistant tools, which are convenient to handle, should be developed in order to augment efficiency of the routine work. This paper outlines two important meteorological data viewers, developed at Japan Meteorological Agency (JMA) and currently employed in the JMA's forecasting routine.

2. Brief explanation of the communication network of JMA

The JMA's communication network is called "L-ADESS (Local Automated Data Editing and Switching System)" which links 180 observatories of JMA. Observed data and prevision documents are transferred via the L-ADESS, whose terminals usually consist of two UNIX workstations and three PCs. Both X-Window system and Motif are adopted in the workstations, and PCs are equipped with X-server emulator. The two tools for visualization are installed in the workstations.

3. Outline of the two visualization applications

Two viewers, referred to as the GMFV (GPV* Multi Frame Viewer) and the ODV(Observational Data Viewer) respectively, are X-based applications installed in the terminals of L-ADESS. The former is a software for visualization of data issued from Numerical Weather Prediction (NWP), and the latter for monitoring observational data. These programs running in the terminals of L-

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* GPV is short for the Grid Point Value, which represents NWP-product value arrayed in the grids.

ADESS serve as powerful tools for forecasters to seize meteorological conditions temporarily and spatially because plane view of horizontal and vertical cross-sections can be visualized at forecasters' will.

3.1 The GMFV

A viewer called GMFV was elaborated in order that forecasters can monitor and analyze data from NWP including guidance from every angle. It was developed in 1992 for the first time and has been improved continuously. It was then converted into Windows95/98 and Linux application software.

It provides plane view of "snap shots" of meteorological variables at a certain time or time sequences of these variables in several tile-like small areas in the window, called "frames". Superposition of several variables is also possible.

The GMFV operates basically in one of the following three modes, which determine a way for showing sets of selected meteorological variables in each frame, or "frame layout": "time-sequence", "snap-shot", and "time-data" modes. In the time-sequence mode, a single meteorological variable or superposed several ones are displayed in the each frame in order of time. The "snap-shot" mode figures simultaneously different types of variables at a certain time with any combination, in each frame. The "time-data" mode is a composite of the time-sequence and snap-shot modes. A set of superposed meteorological variables is shown in each horizontally aligned frames in order of time, and other sets of variables at the same time are exhibited in each vertically aligned frames (Fig. 1).

Change from one mode to another is simply made by selecting "Layout" menu in the menu bar then choosing one mode. Number of frames appeared at the same time is also changeable through the menu. Sets of superposed meteorological variables are chosen in the user-friendly dialog box.

In the three modes above, the GMFV is equipped with the following important functions. First, it permits to demonstrate data in vertical cross-section along an arbitrary line in the frames. Positions of cross-sections can be selected in one of the frames by designating two points (Fig. 2). Second, time-sequences of forecasted variables at all point can be shown (Fig. 3). Furthermore, in any mode, zooming, un-zooming, changing time, and animation can be freely made. Features of GMFV are listed in Table 1.

In order to meet special needs for visualization of data at the observatories of JMA, the graphic and data-handling libraries consisting of the basis of the GMFV are distributed to the terminals of L-ADESS so that development of another new browsing tools in these terminals is easily made by combining the prepared programs in the libraries.

3.2 The ODV

The ODV is a visualization software that can handle all kinds of observation data provided for the daily routines, and it has a flexibility in browsing data(Figs. 4 trough 6). This application was established by organizing several pre-existing viewing tools, aiming at the same GUI usage as the GMFV and availability of superposing different kinds of data.

Its functions are similar to those of the GMFV. As in the GMFV, the ODV has three modes for visualizing observed data ("time-sequence", "snap-shot", and "time-data" modes). Zooming, un-zooming and animation are also available. Change of modes and frame layouts is made in a similar manner as for the GMFV. In addition , the ODV can save preferred modes, combination of data, and the other settings as arbitrary named file. If a forecaster selects the setting file from the file menu simply, the corresponding image is emerged. For this function, forecasters can browse observation data easily and quickly. The features of the ODV are listed in Table 2.

4. Conclusions

Outline and performance of two important visualization tools are presented; one for displaying numerical model results and the other for showing observational data. Both of which were developed at JMA, and are currently used in the JMA's forecasting routine work, owing to their high presentation capability and common interface.

In the future, we have intention to combine these two viewers into a next generation viewer, which is profited by a flexibility and easy-handling GUI of the GMFV and the ODV. This viewer is expected to become a more effective tool for forecasters.

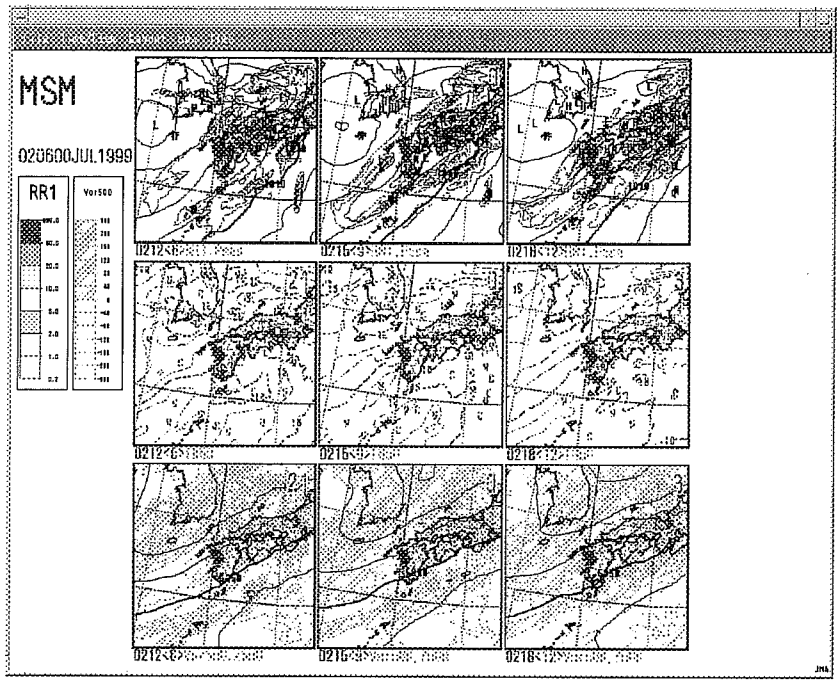

Figure 1: Example of the GMFV presentation in "time-data" mode. Each of 9 tile-like panels is a "frame". Upper three panels show rain rate(mm hr^{-1}) and sea level pressure in order of time from left to right, middle three panels exhibit a time-sequence of temperature at the level of 850 hPa, and lower three panels present vorticity and geometry height at the level of 500 hPa.

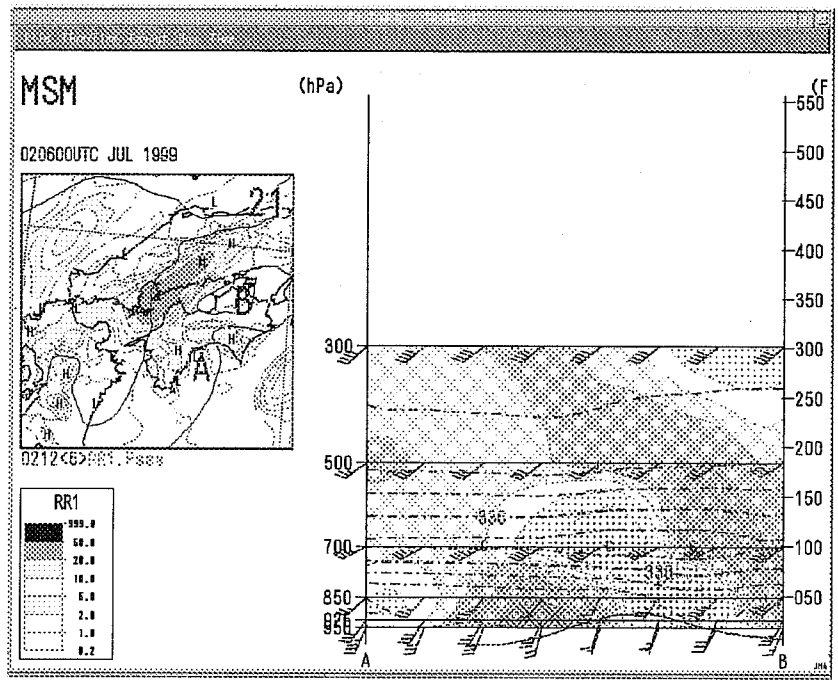

Figure 2: Example of vertical-section image visualized by the GMFV(right panel) along a line AB In the left panel.

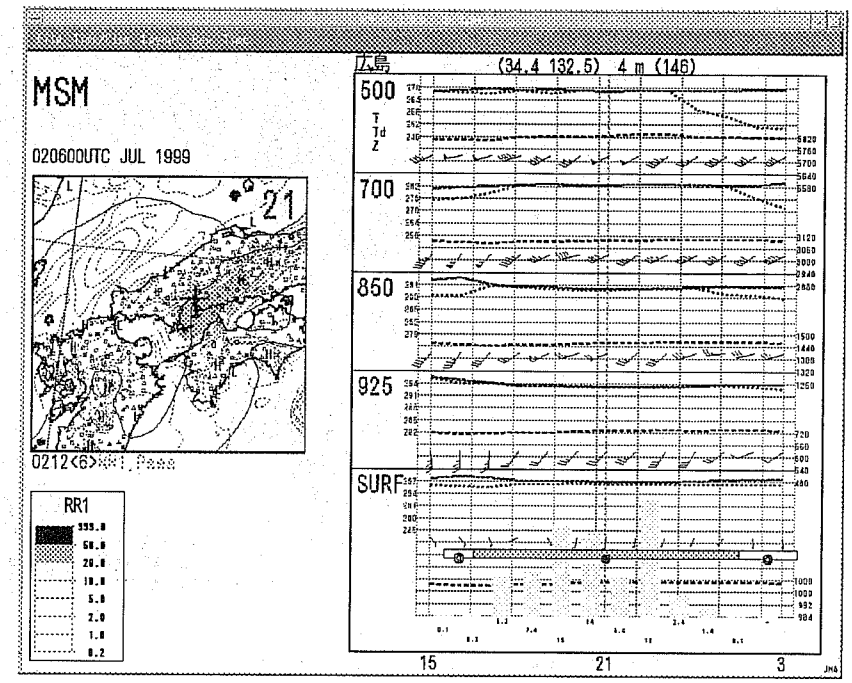

Figure 3: Visualization of time-sequence of forecasted variables as a function of height by the GMFV(right) . Winds and geometrical heights at the five levels of 500, 700, 850, 925 hPa and surface are plotted. The selected point is Indicated by a mark "+" In the left panel.

Table 1: Features of GMFV

Functions	Visualized Products
Display in short time	Regional Spectrum Model(RSM)
Intuitive user interface	RSM for aviation
Single frame layout	Global Spectrum Model(GSM)
multi frame layout	Forecast based on neural network (point)
Cross section	Kalman-filtered forecast (point)
Point time sequence	MOS(point)
Overlapping	
Zooming and un-zooming	Data format
Animation	JMA original for forecast
Hardcopy and Image dump	

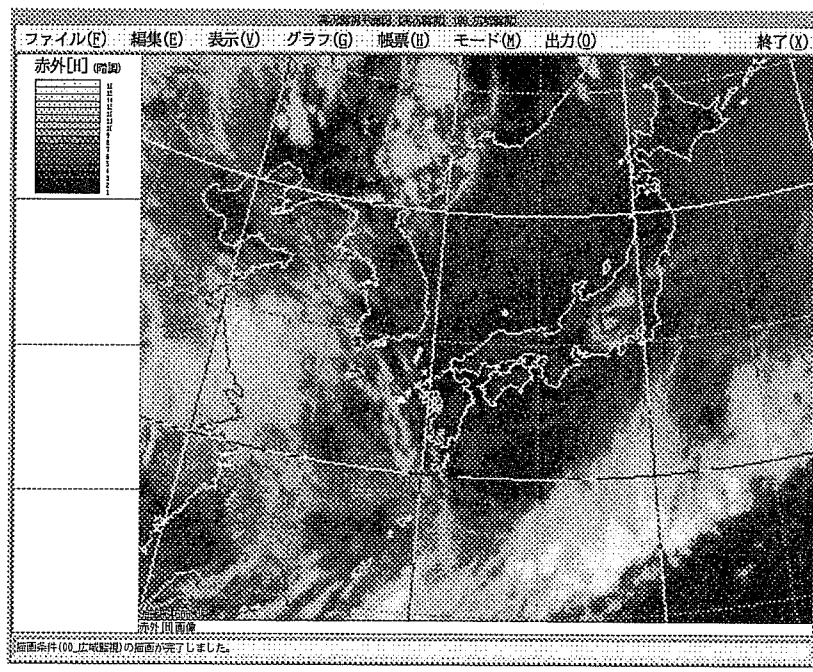

Figure 4: Satellite Image visualized by the ODV

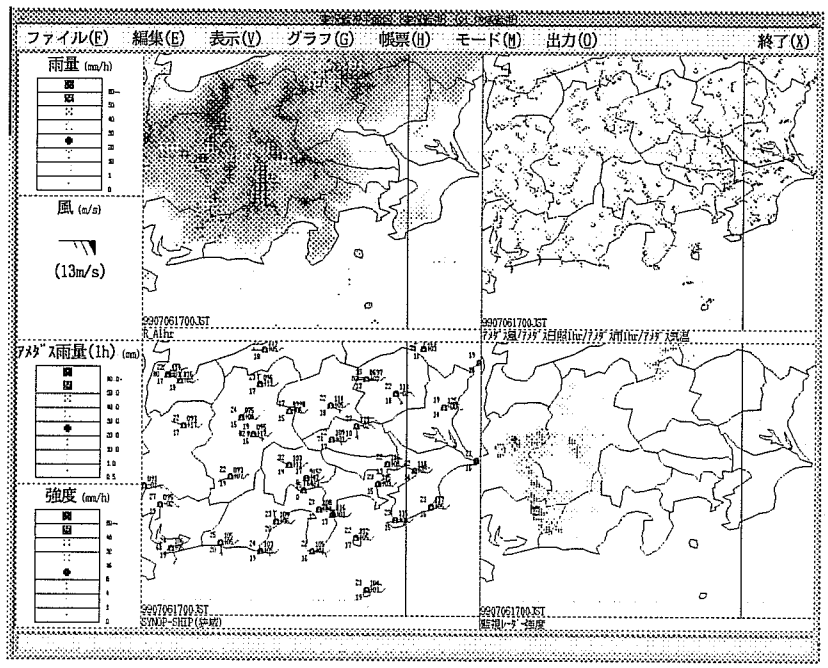

Figure 5: Example of the ODV visualization of four element in "snap-shot" mode; RADAR-AMeDAS precipitation and topography (left upper), AMeDAS(right upper), SYNOP (left lower), and RADAR echoes(right lower).

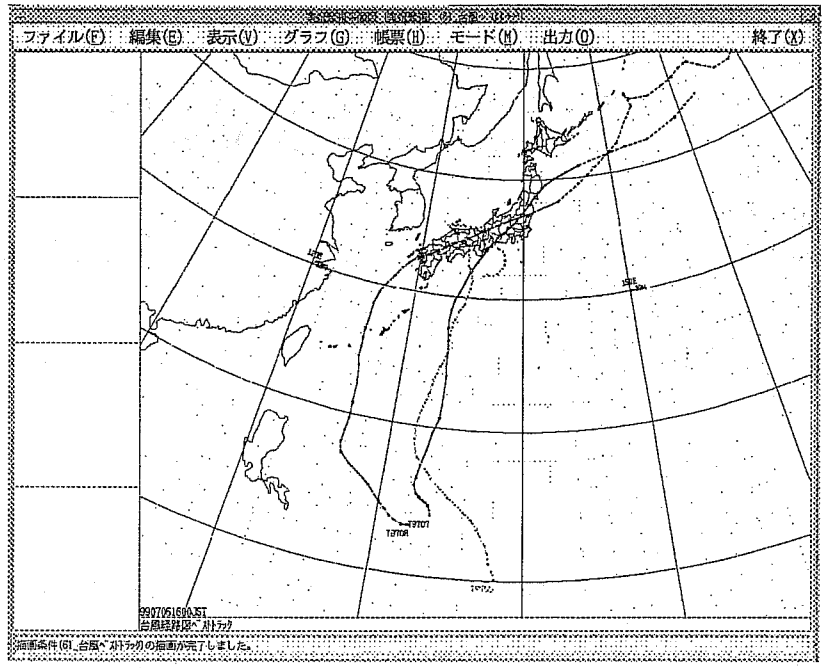

Figure 6: Typhoon tracks visualized by the ODV.

Table 2: Features of ODV

Functions	Visualized data
Display all observation data.	Satellite image
Change draw-setting	RADAR image
Save draw-setting file	AMeDAS*
Multi frame view	RADAR-AMeDAS precipitation
Time sequence	SYNOP data
Data overlapping	METAR data
Zooming and un-zooming	Aerological observation data
Animation	Track of typhoon
Hardcopy	
	Data format
	JMA original

* AMeDAS is short for the Automated Meteorological Data Acquisition System, which means a surface meso-network of JMA.