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Introduction of MICAPS - A Chinese Forecaster's Interactive System

Bing Luo*   ,   Xiaoguang Tan**   ,   Yatian Guo***
*National Meteorological Center, CMA, Beijing, China
**Institute of Urban Meteorology , CMA, Beijing, China
***Chinese Academe of Meteorological Science, CMA, Beijing, China

1. INTRODUCTION

MICAPS is the abbreviation of Meteorological Information Comprehensive Analysis and Process System . It is now the standard graphics workbench of Chinese forecasters .

The main functions of MICAPS include : 1. Data access by 3 ways of opening a data file, selecting parameters such as element, time, etc., opening a compositive graphics file . 2. Displaying graphics of iso-line , element plotting, streamline, sounding maps, typhoon tracks, and so on. 3. Analysis function include: zoom in and zoom out, step forward and backward, step upward and downward, animation etc. 4. Providing tools of iso-line editing, gridded data editing and point forecast editing . 5. Providing some tools of data analysis, such as area statistics , real-time vorticity and divergence calculating , etc . 6. Printing and saving the meteorological graphics . The special features of MICAPS include : 1. It works in MS-Windows system , the system architecture is a kernel system which provides common functions and plus several Active X controls which provide the functions for special fields. 2. Compositive graphics can provide quick and flexible data access . 3. Personalization and flexible feature setting of graphics and data access. 4. Gridded data editor. 5. Strong functions for additional development . 6. Background implementation.
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2. OVERVIEWS

A high-speed technologically-advanced processing, display, and telecommunication network called the *Meteorological Information Comprehensive Analysis and Process System (MICAPS)* is the centerpiece of National-wide Weather Service operations in China.   MICAPS is an interactive computer system that integrates all meteorological, satellite, and radar data into one computer workstation.   MICAPS allows forecasters the interactive capability to view, analyze, combine, and manipulate   graphical and alphanumeric weather data. Thus, MICAPS provides a   effective means for forecasters to prepare and issue forecasts.
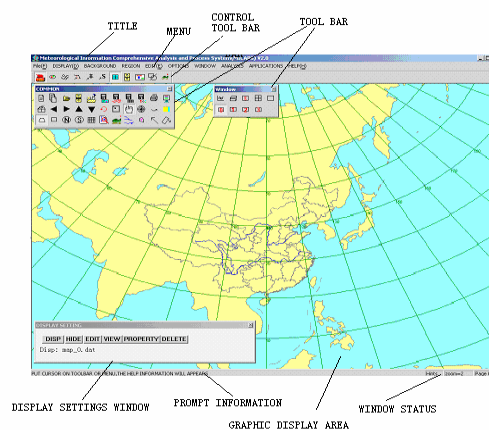

Figure 1 interface

2.1 Versions

we have micaps1.0s   on MS-windows and SGI workstations. micaps2.0 has one version for MS-windows and we have a Linux version .all the versions are being used in Chinese operational predition system   .

In the article , I just introduce the micaps2.0 for MS-windows .

2.2 Main functions

MICAPS2.0 ingests and processes the following primary data sets:

- Numerical model forecast data from the T213, GRAPES, ECMWF, and ensemble models
- Radar data(mosaic)
- satellite data (visible, infrared, and water vapor satellite imagery)
- Observed surface data
- Observed upper-air
- Other data and programs, such as river gauges, river levels, and forecasts
- Various forecast guidance products of NMC

2.2.1 Data search

In the Data Searching of MICAPS system the function of data acquisition is implemented by the Data Input Dynamic link library of each component. If you want the system to acquire the different type of data you must modify the dynamic link library.

MICAPS system has four data searching modes: filename searching, parameter searching, composite chart file searching and scrolling page searching.

2.2.2 Interactive tools

- graphic modification   tools
- grid data editor
- weather forecasting tools
- city forecastor tools
- data analysis tools
- other tools.

2.2.3 Architecture

The MICAPS system architectural design is driven by expandability, flexibility, availability, and portability. The system is easily expandable to allow for the introduction of new functionality and the augmentation of   ACTIVEX components. MICAPS is designed so that software and data can be used another where in China . In fact, MICAPS is a dynamic system that frequently is updated with new software and hardware capabilities to keep it   working for forecasters.

The MICAPS system was developed on common structure , we use activeX to construct the whole system.
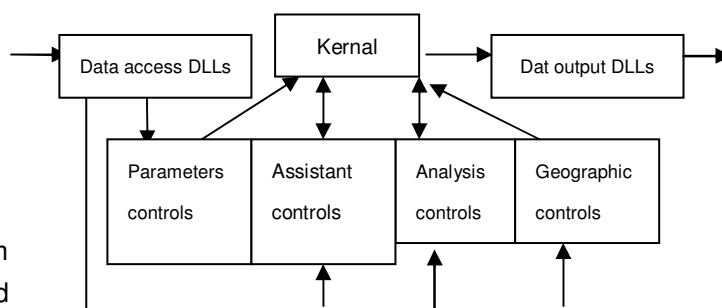

Figure 2 architecture

2.2.4 Display

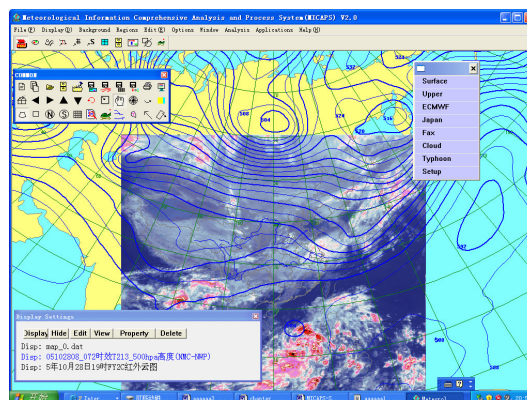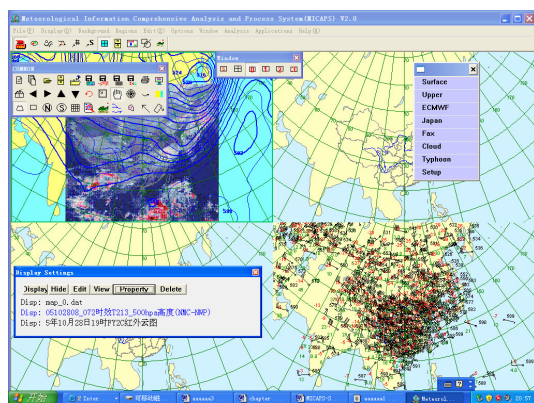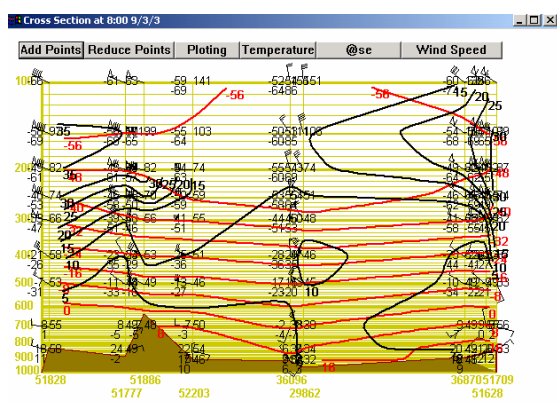Figure 3   display

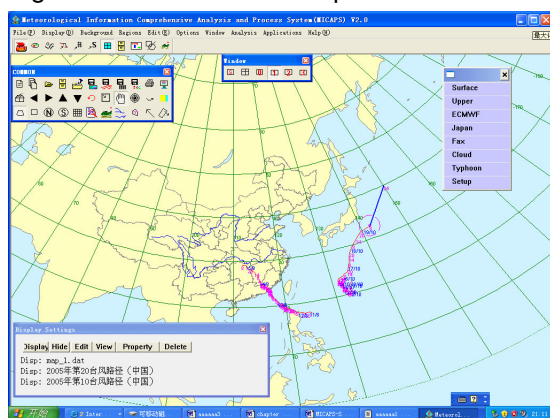Figure 4   windows and control

Figure 5   cross section map

Figure 6   typhoon

3. THE SPECIAL FEATURES OF MICAPS :

3.1 It works in MS-Windows system , the system architecture is a kernel system which provides common functions and plus several Active X controls which provide the functions for special fields.

3.2 Compositive graphics can provide quick and flexible data access .

Composite chart can be looked as a set of data which can be searched as whole. There is a set of information of the data saved in a composite chart file named by the users .When users are selecting this file, system will automatically superposed display the new current time level's graphics and images of the corresponding data in the displaying area based on the information of the file .

Defining the composite chart:

After input the name of composite chart in the pop upping window of defining composite chart, all graphics & images in current displaying window will be saved as a composite chart in this file.
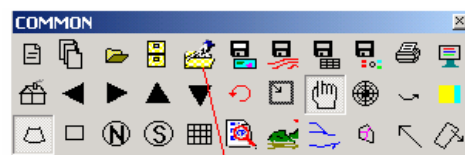
Defining composite chart icon

Figure 7 defining composite chart window

MICAPS can display universal image data: The data type corresponding to universal image data is 13th category of data of MICAPS.The projection type and standard longitude must be consistent with base map if overlapping between the image to be displayed and base map is wanted to be done correctly. MICAPS will remind user and not display this incorrect image.

3.3 Personalization and flexible feature

Figure 8 general Toolbar

Figure 9 Window Management Toolbar

Figure 10 color Palette Toolbar：

Figure 11 contour line Tollbar

Figure 12   line Editing Toolbar

We also have Weather Sign Editing Toolbar：
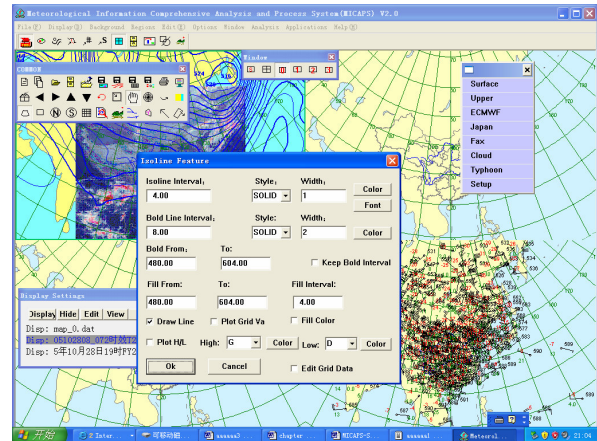

Figure 13 weather sign editor toolbar

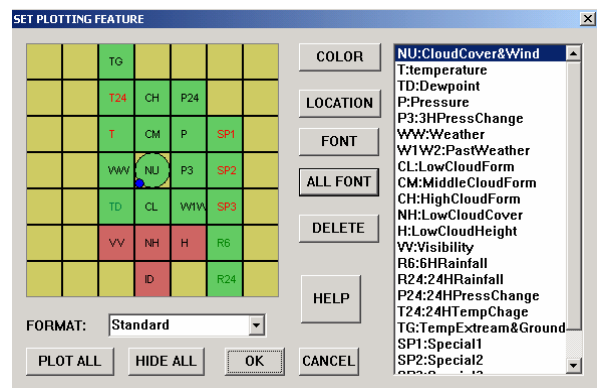Figure 14 contour line   attributes setting

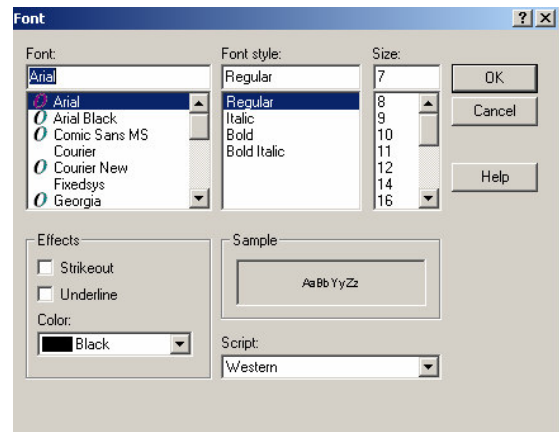Figure 15   plot feature setting

Figure   16 plotting font & format setting

3.4   Grid data editor

When contour line is being displayed its line can be edited and the grid data can be edited directly as well.

The edit function is mainly used to modify NWP result. NWP and its interpretation products is

often the foundation to prepare forecast in advanced prediction system. Forecasters modify NWP results by grid data edit function , add their experience into forecast result and the final forecast result will be formed. Therefore the function mentioned in this paragraph will meet this kind of requirements.
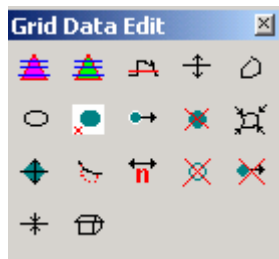

Figure　17　grid data editor toolbar

The tool icons from left to right and from top to bottom are: all field discretions, rainfall discretions, all field truncating, modifying all field values, fixed area selecting, contour line area selecting, 0 beyond the area, moving area, deleting area, no entrance to the area, modifying area values, displaying primary field, hide/show plotting, canceling area selecting, canceling area moving, restore all field values, canceling all of edit operations.

3.5 Background generation of image file

Sometimes users need not to pop up the MICAPS window. They can generate the image files in the background directly via setting MICAPS operation parameters.

MICAPS will generate the appointed image files directly without pop upping the window.

For graphics in the image files, the base map will display according contents of initial files. Data graphics displayed in image files determined by composite chart which assigned on the command lines.

Image file format is decided by the graphic format index code in the command lines. The relationship between the code and the format is: 1-BMP, 2-JPEG, 3-GIF　and 4-Windows Meta-File,　5-MICAPS Meta-file.（not image files

but the 14ᵗʰ category data.）

3.6 Controls for data analysis tool

When some graphics have been displayed in the MICAPS window, users can do further analysis with these graphics. This controls includes the routine tools used in medium-term and short-term forecast, like the difference between two points, high pass filter, area statistics, Laplace, gradient field, vorticity field, field of divergence. These diagrams closely related to concrete requirements of each profession, so the analysis tool controls is set to display the specific analysis diagram for each profession.
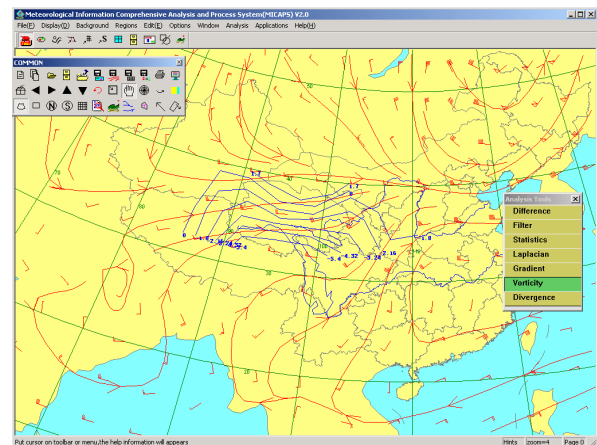

Figure 18　　example of computing the Vorticity Field (blue lines) of the surface wind field (red lines) .

3.7 Strong functions for additional development –ActiveX

The MICAPS V2.0 (MS-Windows Version)is running on PC and WINDOWS Operating System with structure of core software plus components. Once the core software started, the system will automatically connect to Dynamic Link Library uniquely in WINDOWS OS and to the components that composed by ACTIVE X Controls. All functions of system are implemented by core software and components.The system could have different functions if the components options have choose

by users to meet different requirements of professions.

There are one Dynamic Link Library and four ACTIVE X Controls in components at present stage. The Dynamic Link Library is used for accessing of data and the four Controls are: Parameter Retrieval Controls, Auxiliary Graphic Controls, Data Analysis Controls and Geographic Information Controls. Each Controls has own window on which user can operate according to the descriptions of each Controls to fulfill related functions. The maximum numbers of components are 3 as MICAPS system could accommodated at present stage.

The advantage of ACTIVE X controls is enable to modify window interface of controls and modify internal programs as DLL does. But all the messages of controls and external programs can not be modified.

The core program of MICAPS 2.0 is designed to support three components simultaneously, therefore, the following described each component has the three versions at same time. The core program will list windows for three versions while the control window popped up. The three versions use three different filename and every file should stored under directory which was registered at installation of MICAPS.

4. FUTRUE

We will develop more powerful system in the future including   Mult-Data sources like   HDF and GIS data interface   accessing ,   warning system , Production generation, and will transplant whole system to   cross platform application .