J3.15 NMAP DEVELOPMENT STATUS AND PLANS

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1. Introduction

NMAP is the primary application used at the National Centers for Environmental Prediction (NCEP) service centers to display meteorological data and generate graphical forecast products. The service centers include the Climate Prediction Center (CPC), Marine Prediction Center (MPC), Hydrometeorological Prediction Center (HPC), Tropical Prediction Center (TPC), Aviation Weather Center (AWC), and the Storm Prediction Center (SPC). NMAP is also used operationally by the Pacific and Alaskan Regions to support their graphical product generation, and by the River Forecast Centers to support the Quantitative Precipitation Forecast Program. NMAP is one part N-AWIPS which is an integral component of the National Centers AWIPS. NMAP is being integrated into the AWIPS environment as a base-line AWIPS application planned for release in build 5.2.1. Unidata distributes and provides N-AWIPS support for the university community and also makes N-AWIPS available to private industry and the general meteorological community.

This paper presents a brief overview of NMAP functionality, a description of recent enhancements to the program, and future plans.

2. NMAP Functionality

NMAP has been developed to support the NCEP service center production of graphical products. The NCEP service centers produce a variety of graphical products varying significantly in content and geographic scale. Examples of these products are:

- Domestic and international aviation significant weather charts produced by the AWC;
- Surface analysis and forecast charts produced by the HPC, MPC, and TPC;
- Outlook and watch products produced by the SPC;
- High seas and off-shore marine charts produced by the MPC.

Most of the service center products and their descriptions are available at their respective Web sites.

The NCEP service centers have fundamental requirements that NMAP must address to support their product generation. These include:

- Global data set access and display on user-defined geographic scales and map projections;
- Meteorological object drawing and editing;
- The production of graphical products integrated with data display;
- Graphical product post-production into formats required by NCEP customers including GIF, TIFF, PostScript, AWIPS RedBook and Fax.

2.1 NMAP Display Capabilities

NMAP is a Graphical User Interface (GUI) program built on the General Meteorological PacKage (GEMPAK) libraries. Therefore, NMAP has access to GEMPAK's rich set of model diagnostics, parameter calculations, meteorological display tools and output device drivers.

NMAP analyzes and displays a wide variety of meteorological data including:

- Surface data such as METAR, SYNOP, marine, ship and Model Output Statistics (MOS);
- Upper-air data such as rawinsonde, aircraft, and model soundings;
- Gridded data generated from model output and GEMPAK objective analysis programs;
- Radar imagery from single radars and multi-radar mosaics;
- Satellite imagery in McIDAS and GINI formats;
- Lightning data;
- Forecast products such as watches, warnings, flash flood guidance and SIGMETS.

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These data sets can be combined together, displayed and animated in a loop. For example METAR and rawinsonde observations can be overlaid on satellite imagery. NMAP automatically time matches each data set to a user-designated data source so that data are properly time-synchronized for each frame in the loop.

Data can be displayed in a wide variety of ways. Station models for surface and upper-air station data can be pre-defined or edited using an NMAP GUI. Parameters, their station model position and their attributes such as color and size are user selectable. Station data parameters can also be color coded by their value. Gridded data sets can be contoured and/or color filled using pre-defined restore files that specify the desired grid diagnostic(s), and contour attributes including color and interval, and color fill thresholds. NMAP supports up to 32 different graphics colors and up to 128 image colors for display.

NMAP provides access to numerous map backgrounds and overlays. Geo-political maps, latitude/longitude lines, roads, rivers, etc. can be selected from a GUI. In addition, fixed location information such as aviation VOR points, city locations, etc. can be displayed as overlays. Map background and overlay attributes such as color, line type and thickness can be edited in the GUI. The map backgrounds and overlays presented in the GUI are table driven.

Several cursor functions are available in NMAP. The position of the cursor relative to any fixed station data set in the GEMPAK station file format can be displayed in the GUI as the cursor is moved. Fixed station data sets include city locations, VOR points, watch anchor points, etc. The program also lists the name of a bounded region such as a county as the cursor is moved. The distance and direction between two points can also be displayed in NMAP. In addition, a function exists to plot the projected track of a feature based on cursor selected positions and frame times. Cloud temperature and height derived from the cursor position and infrared imagery are also plotted in an NMAP GUI.

NMAP supports up to eight display loops. In this way different combinations of data sets can be rapidly accessed and animated. Independent geographic areas, zoom areas, roam factors, map backgrounds, map overlays, and image enhancements can be applied to each loop. A maximum of 80 data frames is currently supported.

2.2 Product Generation Capabilities

NMAP provides an extensive set of meteorological objects and drawing tools that are needed to produce graphical products. These tools are accessed using the NMAP product generation palette. The NMAP product generation drawing tools are integrated with its data display so that meteorological products can be drawn and edited on top of any selected NMAP data display loop.

Meteorological objects are grouped into several classes including fronts, lines, weather symbols, wind vectors and text. Fronts, for example, include all of the necessary front types, such as cold, warm, etc., required for NCEP products. A graphical product such a surface analysis is drawn by selecting objects from several classes, e.g., fronts, symbols, and text. In addition to the standard meteorological objects, there are product specific objects such as watches and SIGMETs that provide specific drawing tools that are needed for those products. For example, the watch object draws a watch based on shaping a parallelogram. The object uses specialized algorithms to define the watch location and geometry and counties touched by the watch. NMAP then generates the watch text products based on the drawn watch object and information entered by the forecaster in an NMAP GUI.

Numerous operations or object actions are available on the product generation palette to aid the forecaster. These include move, line modify, line add point, object delete, object copy, object group/ungroup, undo/redo, line point edit, etc. Any drawn object can be selected and its attributes such as color, size, line and width can be edited. Default object attributes are table driven.

NMAP product generation objects are saved into a Vector Graphics File (VGF). The VGF stores information including the object type, attributes, and geographic location (latitude and longitude) for all objects in a product. This allows NMAP generated products to be properly navigated for subsequent display and editing. It also allows for a VGF to be post-processed into product formats such as GIF, TIFF, etc.

3. Recent Enhancements

Numerous enhancements have been made in recent months. NMAP follows a highly evolutionary development paradigm with new versions released every two to three months. Generally enhancements are made so that the service centers can meet new product obligations or improve forecaster efficiency. This section will highlight a few of the significant recent enhancements.

Procedures have been added to NMAP to allow forecasters to save and restore data settings for each loop. In this way, NMAP can be rapidly configured to load the latest times from the desired data sets into selected loops. Loop information

that can be stored in a procedure file includes data set name(s), frame skip factor, number of frames, roam factor, geographic area, map projection, map overlay(s) and auto-update on/off.

The capability to specify a single valid time for each loop has been added. This feature allows the forecaster to load various data sets, valid at the same fixed time, into a loop for comparison.

QuikScat wind barb displays have been added to NMAP. The wind barbs are color-coded based on the wind speed.

New products recently added to NMAP include probablistic outlooks for the SPC, the Winter Weather Guidance and the Flood Coordination products for the HPC, and capabilities to generate seamless surface analyses for the HPC, MPC and TPC.

4. Future Plans

Several improvements are planned for NMAP data display and product generation functions.

NMAP and the underlying GEMPAK grid diagnostic software will be enhanced to handle higher resolution gridded data sets such as the newly operational 12km eta model. Horizontal interpolation of grids with different navigation will also be added to facilitate model comparisons.

The capability to apply a loop's zoom area, roam factor and map overlays to other loops will be added. This feature will facilitate data comparison between loops.

The ability to load multiple products into NMAP product generation will be added. Each product will be able to be toggled on and off for editing. This feature will allow forecasters to generate and edit more than one product at a time.

NMAP will be enhanced to generate BUFR messages for the AWC significant weather charts. This capability is necessary for the AWC to fulfill its International Civil Aviation Organization (ICAO) agreements. The ability to decode and display significant weather charts in the BUFR format will also be added.

Several enhancements will be added to support new products scheduled for the NCEP service centers and other NMAP users. These products include:

- Watch-By-County products for the SPC;
- Additional HPC medium range products such as the Heat Index;
- The Pacific Region Marine Graphics product;
- Volcanic Ash Advisory product for NESDIS.