

Technical Procedures Bulletin

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**Subject: GFS Global
Visibility
Guidance
Product**

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This bulletin, prepared by L. D. Burroughs of the Marine Modeling and Analysis Branch (MMAB), Environmental Modeling Center (EMC), National Centers for Environmental Prediction (NCEP), describes automated global visibility guidance provided in graphic and GRIB formats.

The GFS Global Visibility Guidance will be implemented in early 2004. It is an improvement and extension of the current fog and visibility guidance which covers the northern hemisphere and uses a statistically based system. The guidance runs twice per day at 00 and 12 UTC, provides forecasts out to 3 days at 12-h intervals with outputs in GRIB and image graphics, and is run seasonally from April through September.

The differences between the current system and the new system include:

- (1) The model has been extended to a global 1.0 x 1.0 degree longitude/latitude grid.
- (2) Uses a version of the Stoelinga and Warner visibility algorithm which has been modified for use with the GFS.
- (3) Has been extended to 7 days at 3-h intervals and is run 4 times a day at 00, 06, 12, and 18 UTC the year around.
- (4) Regional animated and still graphics are available at

<http://polar.ncep.noaa.gov/fog/experimental>. These files are available by anonymous ftp in gif formats at

<ftp://polar.ncep.noaa.gov/pub/fog/experimental> and in GRIB formats at

<ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/omb/prod/fog.yyyymmdd>, where yyyy - year; mm - month; dd - day. There are two types of GRIB files: global 1x1 deg files - fog.thhz.gvisg; northern hemisphere 1x1 deg files - fog.thhz.fvnhg; where hh - cycle time (00, 06, 12, 18 UTC).

- (5) GRIB bulletins will be available in AWIPS Build OB5 which is due to be distributed in the Spring of 2005. Graphics are available on NAWIPS, and the web.

Technical Procedures Bulletin No. 380 is now operationally obsolete.



GFS Global Visibility Guidance¹

by L. D. Burroughs

1. INTRODUCTION

According to Trémant (1987), 80 percent of all accidents at sea occur in fog. Fog is also a hazard to aviation interests, and has been the cause of many serious multiple car accidents. Although this guidance is specifically designed for ships at sea; it can be used to help with terminal aviation forecasts for surface conditions, and public weather forecasts for fog events.

The open ocean fog and visibility guidance was first implemented in 1989. Forecast equations were developed from 10 years of predictand and predictor data by using discriminant analysis techniques for 3 Atlantic and 4 Pacific regions. Guidance was available from April through September for the northern hemispheric oceans only and consisted of a nowcast and forecasts out to 3 days at 12-h intervals. The guidance was run twice a day at 00 and 12 UTC. In 2002, the OPC requested that the forecast interval be reduced from 12-h to 3-h and the forecasts be extended to 5 days. At the same time, the Office of Climate, Weather, and Water Services (OCWWS) increased the outlook requirement from 5 to 7 days, and the GFS cycle times also increased from 2 to 4 cycles per day. The open ocean fog and visibility guidance was obsolescent and inflexible, *i.e.*, used older technology with less than stellar results and was unable to add forecast times or cycle times, so a replacement technology was used to develop a new visibility system.

The global system incorporates the following changes to the guidance:

- Expanded to a global 1.0 x 1.0 degree longitude/latitude grid with a domain of 0° - 360°E and 90°N - 90°S.
- Uses moisture and precipitation variables from the GFS (Caplan *et al.* 1997) and sea surface temperatures from the RTG_SST (Thiébaux *et al.* 2001).
- Outputs
 - ▶ Global and regional animated and still graphics available on web at <http://polar.ncep.noaa.gov/fog/experimental>
 - ▶ Global and regional gif images available by anonymous ftp from <ftp://polar.ncep.noaa.gov/pub/fog/experimental>
 - ▶ Global and regional GRIB files are available by anonymous ftp from <ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/omb/prod/fog.yyyyymmmyy>, where yyyy - year; mm - month; dd - day. There are two types of GRIB files: global 1x1 deg files - fog.thhz.gvisg; northern hemisphere 1x1 deg files - fog.thhz.fvnhg; where hh - cycle time

¹ MMAB Technical Note No. 237

(00, 06, 12, 18 UTC).

- ▶ Northern hemisphere GRIB for AWIPS to be available with AWIPS Operational Build (OB 5) which is due to be distributed in the Spring of 2005. Graphics are available on NAWIPS, and the web.

The GFS Global Visibility Guidance System is to be implemented early in 2004. Technical Procedures Bulletin No. 380 (NWS, is, hereby, superceded).

2. GFS GLOBAL Visibility GUIDANCE

Global visibility guidance is computed by using an algorithm developed by Stoelinga and Warner which is based on the extinction coefficients of various hydrometeors. The algorithm has been used for several years in the Eta model with great success. The algorithm has been modified to use the parameters available in the GFS for the new global visibility guidance system.

Visibility is computed on a global 1.0 by 1.0 degree longitude/latitude grid which extends from 90° N to 90° S and from 0° through 360° E. Forecasts out to 7 days are produced at intervals of 3-h. The guidance is produced 4 times a day from the 0000, 0600, 1200, and 1800 UTC cycles.

3. AVAILABLE PRODUCTS AND DISSEMINATION

The visibility products are disseminated on the web as graphical stills and animations, on NAWIIPS in graphical formats, and on AWIPS as GRIB bulletins.

a. Dissemination on the web

The visibility guidance is available for ftp from the NCEP operational web site

<ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/omb/prod>.

Three days of data are provided. Each day has a separate directory name with the form

fog.yyyymmdd, where yyyy is the year, mm is the month, and dd is the day; the files are

fog.thhz.gvisg - global 1 x 1 deg lon/lat GRIB file with forecasts out to 7 days at 3-h intervals;

fog.thhz.fvnhg - northern hemispheric 1 x 1 deg lon/lat GRIB file with forecasts out to 7 days at 3-h intervals;

where hh is the cycle time (00, 06, 12, 18 UTC).

Regional and global gif images and animations as well as a description of the system is available at the MMAB non-operational web site located at

<http://polar.ncep.noaa.gov/global.fog>;

These images and animations may also be ftp'd from

<ftp://polar.ncep.noaa.gov/pub/global.fog>.

b. GRIB Bulletins for AWIPS

GRIB bulletins for the northern hemisphere will be available for use in AWIPS when software build OB5 is distributed in the Spring of 2005. Table 1 gives the bulletin headers and their meaning. Bulletins are available at 3-h intervals from 03- through 24-h, at 6-h intervals from 30- through 72-h and at 12-h intervals from 84- through 168-h. Visibility is given in m. A 1.0° x 1.0° lon./lat. grid is used with a domain from 0° - 360°E and 0° to 90°N.

4. Forecaster Considerations

This system is designed to give visibilities that may occur under any meteorological condition; it is global in nature and is run year round. The old system was seasonal, covered only the northern hemisphere, and was statistically derived rather than using physically observed extinction coefficients for the various types of moisture related obstructions to visibility that occur. This system does not account for non-moisture related obstructions, such as smoke, volcanic induced obstructions, smog, blowing dust or sand, *etc.*

The system is designed to show more realistic depictions of lowered visibilities near the surface, but it doesn't show developing advection or arctic sea smoke fog situations very well because of the coarse resolution of the products. Under extreme conditions these situations may be depicted, but under nominal conditions synoptic conditions, lowered visibilities due to fog and haze may not show up. The system gives a good sense of motion to systems with lowered visibilities, but is only as good as the GFS model output data being used. There is room for a lot of improvement in the product and for value adding the product.

Evaluation is an ongoing process, and we are very interested in getting feedback from users, so we can improve the guidance. Please send comments or questions to

ncep.emc.marine.meteorology@noaa.gov.

5. REFERENCES

Caplan, P., J. Derber, W. Gemmill, S.-Y. Hong, H.-L. Pan and D. Parish, 1997: Changes to the NCEP operational medium-range forecast model analysis/forecast system. *Wea. Forecasting*, **12**, 581-594.

National Weather Service, 1989: Open Ocean Fog and Visibility Forecast Guidance System. *NWS Technical Procedures Bulletin No. 380*, NOAA, U.S. Department of Commerce, 10 pp. [OBSOLETE]

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Thiébaux, H. J., B. Katz, W. Wang, and L. D. Burroughs, 2001: Realtime global sea surface

temperature analysis RTG_SST. *NWS Technical Procedures Bulletin No. 477*, NOAA, U.S. Department of Commerce. [Available at http://polar.ncep.noaa.gov/mmab/tpbs/rtg_sst_tpb]

Table 1. WMO GRIB bulletin header descriptors.

| T ₁ | T ₂ ¹ | A ₁ ² | A ₂ | dd | Station id |
|----------------|-----------------------------|-----------------------------|---|----|------------|
| O | V | I | B C D E F G H I J K L M X N Y O P Q Z R S T U | 88 | KWBJ |

Where:

T₁ is the bulletin type descriptor: O - oceanographic.

T₂ is the parameter descriptor, V - visibility.

A₁ is the grid and domain descriptor: I - 1.0° x 1.0° lon/lat grid over domain from 0 - 360E and 0 - 90N.

A₂ is the forecast hour descriptor, see notes below.

dd is the surface descriptor: 88 - ocean surface.

Notes:

1. Forecast hour descriptors at 3-h intervals from 3- to 24-h, at 6-h intervals from 30- to 72-h, and at 12-h intervals from 84- to 168-h.