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Guidance in Coastal Regions

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This bulletin, prepared by Lawrence D. Burroughs and Jordan C. Alpert of the National Meteorological Center, describes the automated regional fog and visibility guidance for coastal regions of the United States. These forecasts are made with model output from a regional fog model developed by David Feit and Jordan Alpert. The fog model was implemented first for the Northeast Coast, effective with the 1200 UTC cycle on March 2, 1993. Eventually, regions along the Gulf of Mexico Coast and the West Coast (including the Gulf of Alaska) will be added. Other regions will be considered later.

Each implementation of a new region will be announced by a National Technical Information Message (NTIM), which is available under AFOS product identifier WSHPNMNC (World Meteorological Organization [WMO] header NOFS41 KWBC), and amendments to this TPB.



Mary M. Glackin
Chief, Services Development Branch



NUMERICAL FOG AND VISIBILITY GUIDANCE IN COASTAL REGIONS

by Lawrence D. Burroughs and Jordan C. Alpert,
Development Division, National Meteorological Center¹

1. INTRODUCTION

A major concern to National Weather Service (NWS) marine forecasters is the problem of forecasting advection fog at sea. Previously, fog forecasts based on statistical methods were issued over the open ocean only (Burroughs, 1989; National Weather Service [NWS], 1989); until now, no system existed to provide similar guidance in coastal and offshore areas.

The Ocean Products Center (OPC) of the National Meteorological Center (NMC) has developed a partially diagnostic and statistical model designed to provide fog and visibility guidance in coastal and offshore regions. The first region for which forecasts are produced is along the Northeast Coast of the United States. It was implemented with the 1200 UTC cycle on March 2, 1993. The Regional Fog Model is transportable from region to region, (i.e. only the size of the region and its location varies, but not the model itself). The fog model will provide guidance for the West Coast (including the Gulf of Alaska) and the Gulf of Mexico Coast. The guidance is available on AFOS as four graphical products, and will also be available in the future in GRidded Binary, or GRIB, files.

2. MODEL DESCRIPTION

To simulate the formation of fog and stratus, time dependent changes of temperature, water vapor, and liquid water content are predicted by the fog model. It consists of a variable horizontal region size and seven vertical layers between the earth's surface and 2 kilometers (km). Computations are based on standard finite difference techniques. Horizontal velocity fields in

space and time for the forecast period are obtained from the Aviation (AVN) version of NMC's Global Model (Kanamitsu et al., 1991) for both the 0000 and 1200 UTC cycles. The AVN velocities are used to advect heat, moisture and liquid water in the Regional Fog Model. For the East Coast region, a 20 by 20 subset of the Regional Analysis and Forecast System (RAFS) C grid (NWS, 1985) is used. There are seven vertical layers between the lowest, at 25 m above the sea surface, and the top of the model, which is close to 2 km. The five highest vertical levels are designed to approximately coincide with the first five sigma levels of the AVN model, starting with fog model level 3. The fog model level 2, at 25 m, is the level used to determine visual ranges and fog conditions (see Fig. 1).

The initial conditions for the fog model are obtained from the Spectral Statistical Interpolation (SSI) analysis (Derber et al., 1991). The boundary conditions for potential temperature, specific humidity, u- and v-wind components, and surface pressure are obtained from the AVN model. A buffer zone is used on lateral boundaries to facilitate a smooth transition between the AVN and the Regional Fog Model. At the boundary grid points, only values from the AVN are used. At the first gridpoint in from the boundary, a mix of two-thirds of the AVN boundary value and one-third of the fog model value is used. At the second gridpoint in, a mix of one-third AVN and two-thirds fog model is used. At all other interior points, only fog model values are used. Boundary values are updated by the fog model advective scheme only if there is advection from the fog model interior domain to the boundaries. Otherwise, the lateral boundaries are interpolated linearly in time from the

1 Ocean Products Center Contribution No. 56