The contribution for 2006 on the Global data processing and Forecasting system (GDPFS) and numerical weather prediction research activities of NIMH Bulgaria.

3. The data received via GTS contains SYNOP and TEMP messages both from surface and from ship reports, SATEM. Reports from climatological and rain gauge stations in Bulgaria.

GRIB, GRID and digital facsimile are used to obtain NWP products.

4.3.2 Model

The model used as operational and research tool in BULGARIA is ALADIN. This is limited area spectral model for regional weather forecasting. As it is well known we will skip the detailed description and will give the link to documentation www.cnrm.meteo.fr/aladin/gmapdoc .

4.3.2.1 The parameters for the operational application in Bulgaria at the beginning of the 2006 were like follows:

Base for the operational suite is cy29t2op2

Horizontal resolution – 12 km

Number of grid points - 108x80

Number of vertical levels- 41

Advection scheme: two times semi – Lagrangian

Time step – 514.28571 s

Coupling frequency – 6 h

Forecast range – 48 h

Run frequency – twice daily 00 and 12 UTC

LBC-s – produced by ARPEGE

During the 2006 some of these parameters were changed like follows

Horizontal resolution was changed to 9 km

Number of grid points – 144x108

Number of vertical levels was increased to 46

Coupling frequency was changed to 3 h

Time step now is 400 s

The forecasting range was extended to 72 h

Run frequency was not changed but initial time now is 06 and 18 UTC

During the last year were done the porting for cy31t1op1 and preparation of parallel suite for it.

4.3.2.3 The model variables output is available on model grid or on LALON grid with step 0.1x0.1 degrees. On a vertical they might be on the model levels, on the pressure levels and on any height above the orography desired by end-users.

The default visualization is done for the surface fields (2m temperature, 2m relative humidity, 2m extreme temperature, mean sea level pressure, 10 m wind, total cloudiness, precipitation totals for 3,6 and 12 hours, separately for rain and snow), and for the temperature, humidity, geopotential and wind on the standard pressure levels.

4.5 Numerical sea wave model

4.5.2 .1 The numerical wave model VAGBUL is in operational use by the Weather Forecasting Department of the NIMH-BAS. This is a discrete spectral wave model that considers the processes of generation, dissipation and nonlinear interaction of the wave energy through parameterization. The model is a version of the wave model VAG, used by the French Meteorological Office - Meteo France, and adapted to the Black Sea conditionsThe numerical wave model VAGBUL is in operational use by the Weather Forecasting Department of the NIMH-BAS. This is a discrete spectral wave model that considers the processes of generation, dissipation and nonlinear interaction of the wave energy through parameterization. The model is a version of the wave model

VAG, used by the French Meteorological Office - Meteo France, and adapted to the Black Sea conditions

Numerical aspects of the wave models, implemented for the Black Sea

1. Initialization
   The initial state is the 24 hours forecast of the wave spectrum from the previous day.

2. Horizontal resolution
   The numerical models VAGBUL, WAM and WW3 were implemented on a spherical grid cover the area of the Black Sea from 40°N to 47°N and from 27°E to 42°E on a regular latitude-longitude grid. The grid resolution is 0.25°x0.25° latitude-longitude grid.
The NIMH-BAS is testing an improved wave forecast with 0.833° x 0.833° ° latitude-longitude grid.

3. Spectral discretization
   For VAGBUL, 22 frequencies logarithmically spaced from 0.040 Hz to 0.296 Hz, at the intervals of $Df / f = 0.1$, and 18 directions (constant increments).

4. Input data
   The numerical wave model is forced with 10 m wind fields provided by the ALADIN NWP model. The wind fields are available every 6 hours on a regular latitude-longitude grid with a 0.25°x0.25° mesh size. A bilinear interpolation scheme is used to collocated the 10m winds with the fine mesh grid of the wave model.

5. Output data
   Wave model output products are available every 6 hours up to 48 hours from 00.00 and 12.00 UTC. Wave energy two-dimensional spectra are post-processed to provide output fields of the following variables:
Significant wave height
Wave direction
10m Wind speed
10m Wind direction
Mean period
Peak period
Swell wave height
Wind wave height
Mean Swell direction
Mean Swell period
   In addition, directional wave spectrum output charts for selected locations in the western part of the Black Sea are available. (WW3 wave model) The wave spectra are displayed in polar diagrams.

The model results are available for NIMH-Varna via Internet and used for the issue of storm warnings in case of strong winds over the Black Sea area

4.5.2.2 A new physics was implemented last year in the operational version VAGBUL model, in order to improve the forecast quality, looking for a better balance of the source terms in the energy budget computation. That new physics package has been proposed by *Fradon (1997) and Fradon et al. (1999)* and implemented in the last version of the French VAG model by *Stefanescu and Lefevre (2001)*. The new physical parameterization is obtained by combining the VAG source terms with the source terms used in the third generation wave model WAM (*WAMDI Group, 1988*), which is in operational use at European Centrum for Medium Range Weather Forecast (ECMWF).

In addition to the VAGBUL wave model, since 2002 NIMH-BAS has also operated the third generation wave models WAVEWWATCH III (version 2,22) and WAM (cycle 4). All wave models include some shallow-water physics, namely bottom friction, refraction and shoaling.