JOINT WMO TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA PROCESSING AND FORECASTING SYSTEM AND NUMERICAL WEATHER PREDICTION RESEARCH ACTIVITIES FOR 2006

The Republic of Uzbekistan
The Center of Hyrometeorological Service
(UZHYDROMET)

1. Summary of highlights

Numerical Weather Prediction research activities are carried out in Uzbekistan at Hydrometeorological Research Institute (NIGMI) of Uzhydromet in the Weather Forecast Department.

By 2006 the research variant of the automatic system of short-range forecasting of meteo-parameters in free atmosphere, wide-spread precipitation and atmospheric fronts on the base of regional hydrodynamic model of atmosphere has been developed. It is planned to introduce the system operationally in the future.

2. Equipment in use

"[information on the major data processing units]"

Work Stations HP9000, disk storage - 9.3x2GB
Operational System HP-UX 10.0
Personal Computers – PENTIUM
Operational Systems WINDOWS
SCO Unix 5.04
Linux RedHat 5.1

3. Data and Products from GTS in use

SYNOP, GRIB, TEMP, GRID, PILOT, RADOP

4. Forecasting system

4.3 Short-range forecasting system (0-72 hrs)

4.3.1 Data assimilation, objective analysis and initialization

4.3.1.2 Research performed in this field

"[Summary of research and development efforts in the area]"

In 2006 at Hydrometeorological Research Institute of Uzhydromet activities on improving of software support for the complex of automatic control and objective analysis of initial meteorological information were conducted taking into account probable data unavailability and time lag. GRIB, SYNOP and TEMP data are decoded and recoded into special double-level information database, which is a structurally organized union of informational objects.

At the first level an initial database is formed. In case of lack of GRIB data its retrieval is carried out using barometric formulas of geopotential, spline and linear interpolation. SYNOP data are checked and objective analysis is performed using the weight anisotropic interpolation method, TEMP data - using optimal interpolation (for geopotential - taking into account wind using geostrophic approximation). Secondary database consists of information

elements after control, retrieval and objective analysis steps. It serves for providing of the hydrodynamic model with diagnostic and forecast information.
For atmospheric fronts calculation special database are developing based on initial GRIB data base, SYNOP, TEMP and results of SYNOP and TEMP objective analysis, and satellite information.

4.3.2 Model

4.3.2.2 Research performed in this field
"[Summary of research and development efforts in the area]"
In 2003-2006 at Hydrometeorological Research Institute of Uzhydromet the research variant of the automatic system of short-range forecasting of meteo-parameters in free atmosphere, wide-spread precipitation and atmospheric fronts on the base of Regional Hydrodynamic Model of Atmosphere were developed. The score of the system is the Regional Hydrodynamic Model of short-range forecast of meteo-elements for 48 hrs which was obtained from Roshydromet (Russia) /1/. The model was improved by means of horizontal and vertical resolution rise, development of blocks for wide-spread precipitation calculation on the base of synoptic information, atmospheric fronts and surface wind. For the first time in world practice an algorithm of taking into account complementary force in the model ensuing from causal mechanics statements /2,3/ has been proposed and analyzed. The model has been adapted to Center Asian Region and tested on the base of 2003 data set.

The finite-difference model has been fulfilled on classification of Arakawa C-grid in horizontal (61x76 points) inclusive the territory of Central Asian with the step of 100 km. 21 levels in vertical have been used in Sigma-coordinate system. Central difference method has been utilized for integration by time. Time step is 60 s.
Forecast outputs of the Regional Hydrodynamic Model as follows:

- pressure at sea level;
- geopotential fields on the standard isobaric surfaces from 1000 to 100 hPa;
- temperature fields on the standard isobaric surfaces from 925 to 100 hPa;
- humidity fields (temperature of dew point) on the standard isobaric surfaces from 925 to 400 hPa;
- wind components fields on the standard isobaric surfaces from 1000 to 100 hPa;
- surface wind values at the sites of Uzbekistan;
- wide spread precipitation values at the sites of Uzbekistan;
- atmospheric front parameters.

4.5 Specialized numerical predictions

[Specialized NP on sea waves, sea ice, tropical cyclones, pollution transport and dispersion, solar ultraviolet (UV) radiation and air quality forecasting etc.]

4.5.1 Assimilation of specific data, analysis and initialization (where applicable)

4.5.1.1 In operation
"[information on the major data processing steps, where applicable]"
The system for numerical weather prediction on air-routs of the Republic of Uzbekistan operates on the base of source information in GRID code transmitted from Washington at 00 and 12 UTC with lead-time from 12 to 48 hrs. The information enters via “Synoptic” Work Station. .

4.5.2 Specific Models

4.5.2.1 In operation

"[information on models in operational use, as appropriate related to 4.5]"

The scheme of interpretation of numerical weather forecast on air-routes of the Republic of Uzbekistan functions in the operational regime. Two times a day four portions of forecasts (two for each starting term) are calculating for ensuring six hours time overlapping of forecast. By communication channels telegrams with forecast data of meteorological parameters on a single aircraft-rout leg along internal and external air-routes comes in from Tashkent Regional Specialized Meteorological Center to Tashkent Aviation-meteorological Station and basic airports of Uzbekistan (Samarqand, Bukhara, Urgench, Namangan, Termaz, Nukus). Wind, temperature per high from 1000 to 100 hPa and parameters of tropopause and maximal wind are predicted. Coverage area embraces diverse geographical directions. In all 169 aircraft-rout legs are involved. Estimation

Estimations of the forecast quality provide 90% reliability of meteorological parameters by ICAO criteria along the flight-levels.

6. Plans for the future *(next 4 years)*

6.2.1 Planned Research Activities in NWP

In the area of development of statistical forecasts it is planned to conduct the monitoring of mesoclimatic characteristics of daily sums of precipitation and extreme surface temperatures for 1997-2006 and develop of methodology of their forecast on second-fifth day at basic meteorological sites of the Republic of Uzbekistan.

The proposed methodology is based on the dynamic-stochastic approach. The substance of the approach is formation of an extended correlation matrix including a line of correlation coefficients between predictor and predictant. Regression equations are made using characteristic roots of the matrix. Under the special-organized construction of the source matrix of predictors and predictants the approach ensures, as distinct from classic ones, to take into account the dynamic of predicted meteo-elements described by the extended correlation matrix and to do most informational predictors, omitting screening procedure, automatically. The methodology allows to study temporal-spatial features of the indicated characteristics and construct quite new forecast methodology on the base of the dynamic-stochastic approach.

Development of operational computer based technology of automatic system for short-range hydrodynamic forecasting will imply the following stages :

- develop and improve software for objective analysis and automatic control of initial meteorological information taking into account probable data unavailability and time lag;
- use satellite pictures of cloudiness for determination of atmospheric front zones in addition to meteorological information.
- verify the forecast methods on independent data in quasi-operational regime to reveal probable errors of the method and determine their adaptability boundaries (season, geographical area, initial conditions of thermobaric field and synoptic situation);
- develop and improve software for forecast representation in the well-behaved form for synoptic analysis and forecast.

7. References

"[information on where more detailed descriptions of different components of the DPFS can be found]"
(Indicate related Internet Web sites also)

1. Losev V.M. Hydrodynamic finite difference model of regional forecast at CRAY computer // Proceedings. Hydrometcenter of Russia. -2000. – Iss. 334. - P. 69-90.
2. Arushanov M. L., Korotaev S. M. Geophysical effects of causal mechanics //On the way to under-standing the time phenomenon. The construction of time in natural scince. Part 2. The "Active" Properties of time according to N. A. Kozyrev̆. Singa-pore, New Jersey, London, Hong Kong:World Scientific,1995̆.PP. 101-108.
3. Arushanov M.L., Goryachev A.M. New approach to investigation of geo-physical fields on the example of the Earth's atmosphere. World Climate Change Conference. Abstracts. Moscow, 2003.