

ANNUAL JOINT WMO TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA PROCESSING AND FORECASTING SYSTEM (GDPFS) AND NUMERICAL WEATHER PREDICTION (NWP) RESEARCH ACTIVITIES FOR 2015

Country: Kazakhstan/Centre: Kazhydromet

1. Summary of highlights

The new forecasting computation technology using the non-hydrostatic hydrodynamic model WRF is developed. Currently the runs of model are conducted daily.

2. Equipment in use

The new computer equipment is installed. It includes 1 computational serve: eight clusters XEON-5500 eight-core processor (64 processors, 2.83 GHz each) and three servers on two AMD Athlon 64x2 Core Processor 4200+. These clusters are installed for the quasi-operative integration of mesoscale WRF model and regional climate models.

UniMAS - Pentium IV, 2 000 MHz.

AWS-weather - Pentium III, 800 MHz.

GIS Meteo - Pent dual, 2 000 MHz.

E-mail server - VectraVL-800 1 800 MHz.

Satellites - Pentium III, 1 100 MHz.

E-mail - Pentium IV, 3 000 MHz.

Switch 2512, SAS 2224, DSR 2216,
Cisco2500,2811

Server - Pentium IV, 3 000 MHz.

Modems - TAINET, Zyxel, ASM-31, DSL-25400, FG-PAM-SAN-Eth.

The soft- and hardware for weather maps preparation – Pentium IV, 3 000 MHz, DesignJet – 450C.

3. Data and Products from GTS in use

- SYNOP
- TEMP
- ECMWF Reading
- WMC Washington

4. Forecasting system

4.1 System run schedule and forecast ranges

Conventional methods of weather forecasting are applied in Kazhydromet based on analysis of actual information using baric fields forecast, which is being received from the World Meteorological Centre (Washington), European Centre for Medium Range Weather Forecasts (Reading), and Moscow Centre.

Every day meteorological, sea, hydrological and agrometeorological forecasts are made up. Regularly the week, decade weather forecasts are issued for all the regions of Kazakhstan. One of the main tasks of Kazhydromet is to make forecasts of the dangerous and natural phenomena, reports of the weather changes and distribute to customs and user.

Kazhydromet's activities in medium range forecasting are based on ECMWF operational model. This means twice a day with 00 and 12 GMT starting time are available to Kazhydromet. Short range NWP modeling is based on mesoscale WRF model.

4.2 Medium range forecasting system (4-10 days)

Products from ECMWF are used for medium range forecasting. Operations concentrate mainly on deterministic products.

4.2.1 Data assimilation, objective analysis and initialization

4.2.1.1 In operation

4.2.1.2 Research performed in this field

4.2.2 Model

4.2.2.1 In operation

4.2.2.2 Research performed in this field

4.2.3 Operationally available Numerical Weather Prediction Products

10-day deterministic forecasts are available at Kazhydromet. Charts from the World Metrological Centre (Washington), European Centre for Medium Range Weather Forecasts (Reading), and Moscow Centre are used for making up forecasts. Some of the products are downloaded as images and displayed on internal website.

- mean sea level pressure analysis and forecast
- 2 m temperature analysis and forecast
- 10 m wind analysis and forecast
- temperature analysis and forecast on 100/925/850/700/500/400/300/250/200/150mb pressure levels
- geopotential height analysis and forecast on 100/925/850/700/500/400/300/250/200/150mb pressure levels
- specific humidity analysis and forecast on 100/925/850/700/500/400/300/250/200/150mb pressure levels
- wind components analysis and forecast on 100/925/850/700/500/400/300/250/200/150mb pressure levels
- sea surface temperature
- sea ice cover

4.2.4 Operational techniques for application of NWP products (*MOS, PPM, KF, Expert Systems, etc.*)

4.2.4.1 In operation

NWP products are used to pre-fill site forecast information in selected points. The information is later over-viewed by duty forecaster.

4.2.4.2 Research performed in this field

4.2.5 Ensemble Prediction System (EPS)

4.2.5.1 In operation

EPS products from ECMWF are available and used at Kazhydromet.

4.2.5.2 Research performed in this field

4.2.5.3 Operationally available EPS Products

EPS products from ECMWF are available at Kazhydromet. Following products are prepared at ECMWF as images and downloaded and displayed on internal website for one week period ahead.

- probability that cloud cover
- probability that precipitation exceeds 1/5/10/20 mm per 12h
- probability that wind gusts exceeds 15/20/25 m/s
- probability that temperature °C.

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

Charts from the World Meteorological Centre (Washington), European Centre for Medium Range Weather Forecasts (Reading), and Moscow Centre are used for making up forecasts. For drawing of atmospheric fronts are analyzed initial GRID data base, SYNOP, TEMP and results of SYNOP and TEMP objective analyses, and satellite information.

The new forecasting computation technology using the non-hydrostatic hydrodynamic model WRF is developed. Currently the runs of the model are conducted daily.

4.3.1 Data assimilation, objective analysis and initialization

4.3.1.1 In operation

Boundary conditions for the new forecasting computation technology using the non-hydrostatic hydrodynamic model WRF are provided by GFS.

4.3.1.2 Research performed in this field

In process

4.3.2 Model

4.3.2.1 In operation

The regular two times in a day automated calculation from 36 to 168-hour forecasts using the WRF mesoscale model is realized at the computational complex XEON-5500 with resolution 13 and 18 km and for Center Asia with resolution 4 km. Also forecasting meteorology: air temperature, precipitation, wind, mountain and foothill areas of the Almaty region, with a resolution of 2 km.

The system skims GFS data in GRIB2 format from NCEP server (forecasts starting at 00 and 12 UTC), starting pre-processing programs WPS (geogrid, ungrib, metgrid) with these data, starting WRF ARW model (using 48 processors). Forecasting results are presented in NetCDF format with meteorological fields visualization and development of meteograms is performed in NCL system. Starting time is 00 and 12 UTC.

4.3.2.2 Research performed in this field

4.3.3 Operationally available NWP products

In addition to the weather maps, meteograms and upper atmosphere diagrams of selected locations are provided:

- mean sea level pressure forecast
- 3h precipitation forecast
- 2 m temperature forecast
- from 10 to 550 m temperature forecast
- from 10 to 550 m wind forecast

5. Verification of prognostic products

5.1 The verification of short- and middle-range weather forecasts of general purpose is made according to manual on a weather service accepted in Kazhydromet centre and added in 1993. This is not a computing method and calculations are manually made up. The average verification of our forecast is around 80-90%. As of WRF products verification we just making compare simulated meteorological fields with actual charts.

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

6.1 Development of the GDPFS

6.2 Planned research Activities in NWP, Nowcasting, Long-range Forecasting and Specialized Numerical Predictions

Further development of NWP in Kazakhstan using different models. Improving of technical resources, creating of new forecasting system using NWP operationally. Applying of 3 and 4D-Var assimilation and system of verification output product. Development of climate problem researching.

7. References

<http://kazhydromet.kz>