RUSSIAN FEDERATION

FEDERAL SERVICE FOR HYDROMETEOROLOGY

AND ENVIRONMENTAL MONITORING OF THE RUSSIAN FEDERATION

(ROSHYDROMET)

ANNUAL JOINT WMO TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA PROCESSING AND FORECASTING SYSTEM (GDPFS) AND RELATED NUMERICAL WEATHER PREDICTION RESEARCH ACTIVITIES FOR 2016

Country: Russian Federation **Centre: RSMC: Novosibirsk**

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1. Summary of main highlights

1.1 As a base NWP operational technology the version of mesoscale model for limited area COSMO-Ru-Sib13.2 (50º – 120º E and 45º – 75º N) and Global model of Hydrometcenter of Russia and Institute of Numeric mathematics of Russian Academy of Sciences SLAV 2008 are implemented.

1.2 Trial experiments with versions of COSMO-ART 13.2.

1.3 A technology of statistical interpretation of numerical forecasts on the basis of composition of the output of the global and regional numerical models products available in RSMC Novosibirsk is under development.

2. Equipment in Use

Computational cluster Altix 4700 with 104 processing cores. In the cluster are additionally added six servers and hard disc with total capacity of 11 TB.

Receiving and transfer of information is conducted via GTS Novosibirsk-Moscow, Novosibirsk-Khabarovsk, Novosibirsk-Ulan-Ude, and via national network Novosibirsk-Omsk, Novosibirsk-Irkutsk, Novosibirsk-Krasnoyarsk. All channels are based on VPLS services.

3. Used Data and Products Coming from GTS and Other Communication Syatems:

3.1 Via GTS network via the program-hardware complex UniMAS the following meteorological information is transferred:

a) synoptic data - 7467 stations

b) aerologic data - 631 stations

c) climatic gata - 727 stations (WMO-368, State MS-359)

d) data in GRIB code - 14663 messages a day

e) data in BUFR code - 40698 messages a day *

3.2 Productions, coming via GTS and other Centers.

ECMWF Reading (analysis and forecasts of the main meteorological fields: GRIB $2,5^0$x$2,5^0$, 0.5x0.5)

NMC Exeter (analysis and forecasts of the main meteorological fields: GRIB $2,5^0$x$2,5^0$),

WMC Moscow (analysis and forecasts of the main meteorological fields: GRIB $2,5^0$x$2,5^0$ over the territory of Siberia and Far East.

4. **Forecasting System**

4.1 **Time Schedule and Forecasting Period*:***

Main initial hours of the forecasting system operation are 00^h и 12^h UTC, additional starting hours are 00 and 18 UTC.

- Model for limited area - COSMO-Ru-Sib13.2 starting from 00 UTC and 12 UTC: lead time 78 hours, readiness time by 4:30 UTC and 16:30 UTC consequently. Integration is based on information on initial and boundary conditions provided by German Meteorological Service (Deutscher Wetterdienst (DWD) via ftp://nsk.meteorf.ru (data transmission time is 25 min, general integration time is 1 hour at 75 ncpus)

- Global model SLAV-2008: starting from 00 UTC and 12 UTC: lead time is up to 72 hours, readiness time by 3:40 and 15:40 UTC, for 06 and 18 UTC – lead time 24 hours, readiness time is 10.00 and 22.00 UTC.

- Application systems: MOS based on statistical complexation of output of different numerical models (UKMO, PLAV, COSMO-Ru13): additional calculations (fire hazard index) - lead time is up to 72 hours starting from 00 UTC during the period from May to October: readiness time is 1:10, 3:55 and 5:05 UTC, for start from 12 UTC - the year round by 17.05.

- Operational technology of thunderstorm prediction based on NCEP and COSMO-Ru-Sib with lead time up to 72 hours, start time 00 and 12 UTC for period from May to September.

- In trial mode – versions of the model COSMO-Ru-Sib 6.6 and COSMO-Ru-Sib 2.2.

- In research mode – Limited Area Model WRF-ARW with horizontal grid step 14 km. (trial regime, once a day, starting from 12 UTC, lead time up to 48 hours, data transfer – up to 25 minutes, calculation duration 5,5 hours at 60 ncpus, initial and boundary conditions are received from ftp://ftpprd.ncep.noaa.gov (USA).

- In research mode – model COSMO-ART 13.2

4.3 **Short-range forecasting (0-72 hours)**

4.3.1 Data assimilation, objective analysis and initialization

4.3.1.1 In operation:

System of operational data processing (sorting, control, disposal to data bases) and objective analysis (OA) on the basis of program complex developed in the WMC Moscow (Hydrometeorological Center of Russia) with data processing in code BUFR.

4.3.2 Short-range numerical forecasting models

4.3.2.1. In operation:

- Limited area model COSMO-Ru-Sib13 –(grid 13,2x13,2 km). Renewal of the model versions is conducted under the supervision of the WMC Moscow accordingly the COSMO consortium activities (cosmo-model.org). Calculation area: 50º – 120ºE. and 45º – 75ºN. Integration is based on information on initial and boundary conditions provided by German Meteorological Service (Deutscher Wetterdienst (DWD) and additionally is controlled by WMC Moscow.

- Global model SLAV-2008 (0.5625°x0.28°, 28 vertical levels). Realization is controlled by the WMC Moscow and the Institute of Numerical Mathematics of the Russian Academy of Sciences.

4.3.2.2. Research in this area

- Adaptation of the global model SLAV-2008" to geographic specifics of the Western Siberia, inclusion of the block of temperature and soil moisture data assimilation [3].

- Research based on the Limited area model WRF-ARV (grid step 14 km).

4.3.3. Operatively available products:

- Limited area model COSMO-Ru-Sib13.2:

Prognostic values of meteorological parameters (extended range) in the grid points of calculation area 13.2 km in GRIB code - surface temperature, wind, precipitation are places in text format at the internal data bases of the RSMC Novosibirsk, meteograms of the complex of the basic meteorological parameters with one-hour discreteness for 122 settlements of the Ural-Siberian region in text and graphical formats. Graphical files: maps of precipitation, pressure, temperature, surface wind, and wind gusts, Po, H500, T850 with three-hour discreteness (797 maps for each period). Graphical products are distributed at the server ftp://nsk.meteorf.ru and at the site http//sibnigmi.ru..

- Global model SLAV-2008:

Values of predicted basic meteorological parameters at 2.5x2.5º grid at the standard isobaric surfaces, SLP, precipitation, and surface temperature are distributed in the internal data bases. Key information in graphical form – 84 maps for each integration period is presented at ftp-server ftp://nsk.meteorf.ru and at the site sibnigmi.ru.

4.2.4. Operative applied techniques (MOS, KF, expert systems, etc.)

4.3.4.1 In operation:

- MOS - on the basis of complex consideration of available output products of the NWP models (UKMO, PLAV, COSMO-Ru13) the additional calculations (fire hazard indexes) with 72-hour lead time starting from 00 UTC are conducted during May-October period – readiness time 1:10, 3:55 and 5:05 UTC, starting from 12 UTC - the year round, readiness time is 17.05 UTC. Information in table format is placed at ftp-server ftp://nsk.meteorf.ru for regional users.

- Forecast for the Ural-Siberian region for 3 days. Results for 00 and 12h are presented in table form at ftp-server ftp://nsk.meteorf.ru for regional users.

- The system also includes:

- Preparation of composed tables of precipitation and air temperature forecasts at stations' levels within the zone of responsibility of the RSMC Novosibirsk (West Siberian Federal Meteorological Center - WSFMC) using the available NWP technologies (system of automated preparation of forecasting maps for 00h and 12h UTC) using the COSMO-RU-Sib13.2 (lead time 72h), SLAV (lead time 72h), RGNS (lead time 48h), EGRR (lead time 120h), WRF for 12 UTC (lead time 48 h)).
- forecast verification (daily and pentad) precipitation (quantity) and air temperature at the stations and averaged over the certain territories of the zone of responsibility of the RSMC Novosibirsk with 48-hour lead time.

4.3.4.2 Research in this area

The "CMOS" approach (input: t2m forecasts from UKMO, SLAV, COSMO-Ru) is introduced in as a basic for T2m forecasting

4.5. Specialized numerical forecasts

4.5.3. Available products:

Fire hazard indexes forecasts - at warm period – daily with lead time 72 hours are delivered according to agreed list of users and to forecasting centers of the Region.

6. Plans for future two years (2018-2019)

- Prepare for operational use versions of the COSMO-Ru-Sib model - COSMO-Ru-Sib 6.6 and COSMO-Ru-Sib 2.2;

- Implement into operation the technology of using variational analysis developed in the WMC Moscow for upgraded SLAV 2008 model;

- Continue testing of the global data ass 3D-Var (WMC Moscow – Tsirulnikov et.al. – *references are presented in WMC Moscow*). Implement the technology into operation.

- Continue testing and implement into operation the global model SLAV 2008 adjusted to the territory of responsibility of RSMC Novosibirsk with block of temperature and soil moisture data assimilation;

- Continue experiments with WRF-POLAR model;

- Install the model of climatic system developed in the Institute of Numarical Mathematics of the Russian Academy of Sciences CM5.0 for analysis of Siberian climate variability;

- Introduce the version of COSMO-Ru technology with Nudjing data assimilation system and included parameterization of temperature evolution in the internal water bodies.

7. Consortium *(if appropriate)*

Cooperation with the WMC Moscow within the framework of RosHydromet in COSMO Consortium (more details in the report of WMC Moscow).

A license for using the complex chemical-transport model COSMO-ART is obtained by RSMC Novosibirsk.

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