

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

Ukraine

1. Summary of highlights

- Developing forecast of transport of atmosphere pollution, which is presented by three independent coupled systems:
 - on the base of WRF ARW and CALMET/CALPUFF;
 - on the base of WRF-Chem;
 - UHMI (Ukrainian Hydrometeorological Institute) model of scattering for a point source emissions with initial data from GFS.
- Developing coupled system WRF/CGMS (weather/crop yield) for short-term correction of forecast of total dry biomass.
- Developing weather phenomena forecast system (first stage is thunderstorm forecast, scheduled to be completed in 2016).
- Upgrade coupled system WRF NMM/SWAN model (shift to SWAN version 41.01) for forecasts of wave's direction, their heights and period for the basins of Black and Azov Seas. Forecast products are published free of charge (<http://accuweather.org.ua/swan/index.php>).

2. Equipment in use

- The UHMI computing backbone is provided by
- Intel Xeon E5 2660 Unix server having 16 cores, operated by CentOS operating system (for operational NWP).
- Intel Xeon X5660 Unix server having 12 cores, operated by CentOS operating system (for operational NWP).
- Intel Xeon E3 1220 Unix server having 4 cores, operated by CentOS operating system (for operational NWP).
- SGI Altix 4700, IA64, 48 cpus Intel Itanium, operated by Novell SUSE Linux Enterprise Server 10 SP 2 (for external users and research activities).
- A Raid5 storage array provides disc storage of 28 TB.

3. Data and Products from GTS in use

- SYNOP, AMDAR, TEMP, SHIP, PILOT, SATEM, METAR, SPECI, TAF.
- Gridded products in GRIB/GRIB2.
- DWD global model (ICON).
- NCEP global models.

4. Forecasting system

4.1 Forecast schedule and ranges

<u>Time (UTC)</u>	<u>System running</u>
04:50	00 UTC main analysis GFS/ICON
05:10	00 UTC WRF NMM v.3.3.1 forecast (00h-78h) for Carpathian Mountains Region

<u>Time (UTC)</u>	<u>System running</u>
06:30	00 UTC WRF ARW v.2.2.1 forecast (00h-120h)
07:55	00 UTC WRF ARW v.3.3.1 forecast (00h-120h)
08:20	00 UTC WRF NMM v.3.3.1 forecast (00h-120h)
09:25	COSMO (currently not in operational mode) forecast (00h-78h)
10:50	06 UTC main analysis GFS
11:20	06 UTC WRF NMM v.3.3.1 forecast (00h-78h) for Carpathian Mountains Region
12:30	06 UTC WRF NMM v.3.3.1 forecast (00h-120h)
14:15	06 UTC WRF ARW v.3.3.1 forecast (00h-120h)
15:15	06 UTC SWAN forecast (00h-96h)
15:40	12 UTC main analysis ICON
16:50	12 UTC main analysis GFS
17:25	12 UTC WRF NMM v.3.3.1 forecast (00h-78h) for Carpathian Mountains Region
18:40	12 UTC WRF NMM v.3.3.1 forecast (00h-120h)
20:35	12 UTC WRF ARW v.3.3.1 forecast (00h-120h)
22:50	18 UTC main analysis GFS
23:20	18 UTC WRF NMM v.3.3.1 forecast (00h-78h) for Carpathian Mountains Region
00:30	18 UTC WRF NMM v.3.3.1 forecast (00h-120h)
02:10	18 UTC WRF ARW v.3.3.1 forecast (00h-120h)
03:15	18 UTC SWAN forecast (00h-96h)

4.2 Medium range forecasting system (4-10 days)

4.2.1 Data assimilation, objective analysis and initialization

4.2.1.1 In operation

None

4.2.1.2 Research performed in this field

None

4.2.2 Model

4.2.2.1 In operation

WRF ARW/NMM v.3.3.1: <http://accuweather.org.ua/>

4.2.2.2 Research performed in this field

None

4.2.3 Operationally available Numerical Weather Prediction Products

18 meteorological parameters near surface: T2m, RH2m, MSLP, Wind speed / direction and etc.

5 meteorological parameters on the standard geopotential levels: geopotential height, mixing ratio, wind speed and wind direction.

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

4.2.4.1 In operation

Coupled NWP and Hydrological model for the 7 rivers of Pripyat river basin.

4.2.4.2 Research performed in this field

Developing expert systems.

4.2.5 Ensemble Prediction System (EPS)

4.2.5.1 In operation

None

4.2.5.2 Research performed in this field

None

4.2.5.3 Operationally available EPS Products

None

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

4.3.1 Data assimilation, objective analysis and initialization

4.3.1.1 In operation

None

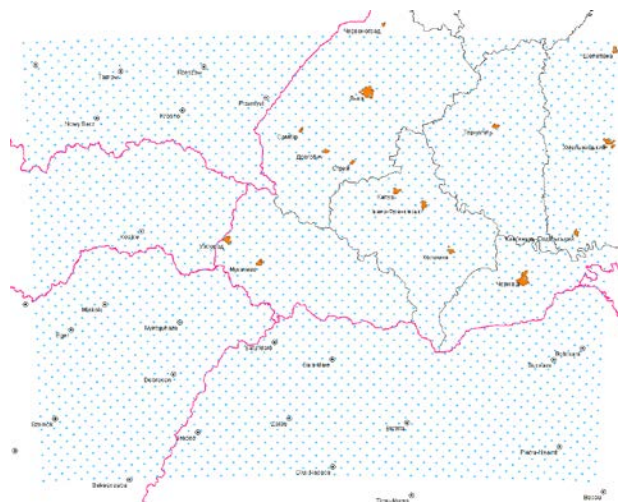
4.3.1.2 Research performed in this field

None

4.3.2 Model

4.3.2.1 In operation

WRF NMM v.3.3.1 produces forecast for Carpathian Mountains Region. It's part of the coupled system for the hydrological forecasting for the 8 river basins situated in Transcarpathian Ukraine Region.



4.3.2.2 Research performed in this field

None

4.3.3 Operationally available NWP products

13 meteorological parameters are shown as maps, charts, tables and output files in special format for other organizations of the Ukrainian Hydrometeorological Service System.

4.3.4 Operational techniques for application of NWP products

4.3.4.1 In operation

None

4.3.4.2 Research performed in this field

Research of possibility to use the Kriging for post-processing for non-hydrostatic COSMO with 14 km domains.

4.3.5 Ensemble Prediction System

4.3.5.1 In operation

None

4.3.5.2 Research performed in this field

None

4.3.5.3 Operationally available EPS Products

None

4.4 Nowcasting and Very Short-range Forecasting Systems (0-6 hrs)

4.4.1 Nowcasting system

4.4.1.1 In operation

None

4.4.1.2 Research performed in this field

None

4.4.2 Models for Very Short-range Forecasting Systems

4.4.2.1 In operation

None

4.4.2.2 Research performed in this field

None

4.5 Specialized numerical predictions

None

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

4.5.1.1 In operation

None

4.5.1.2 Research performed in this field

None

4.5.2 Specific Models (as appropriate related to 4.5)

4.5.2.1 In operation

The coupled system WRF NMM/SWAN model for forecasts of wave's direction, their heights and period for the basins of Black and Azov Seas: <http://accuweather.org.ua/swan/index.php>

The coupled system of forecast of transport of atmosphere pollution WRF ARW/CALMET/CALPUFF

The coupled system WRF/CGMS (weather/crop yield) for short-term correction of forecast of total dry biomass.

4.5.2.2 Research performed in this field

Research diurnally variations of pollutants in the atmosphere with the help of CALPUFF

4.5.3 Specific products operationally available

None

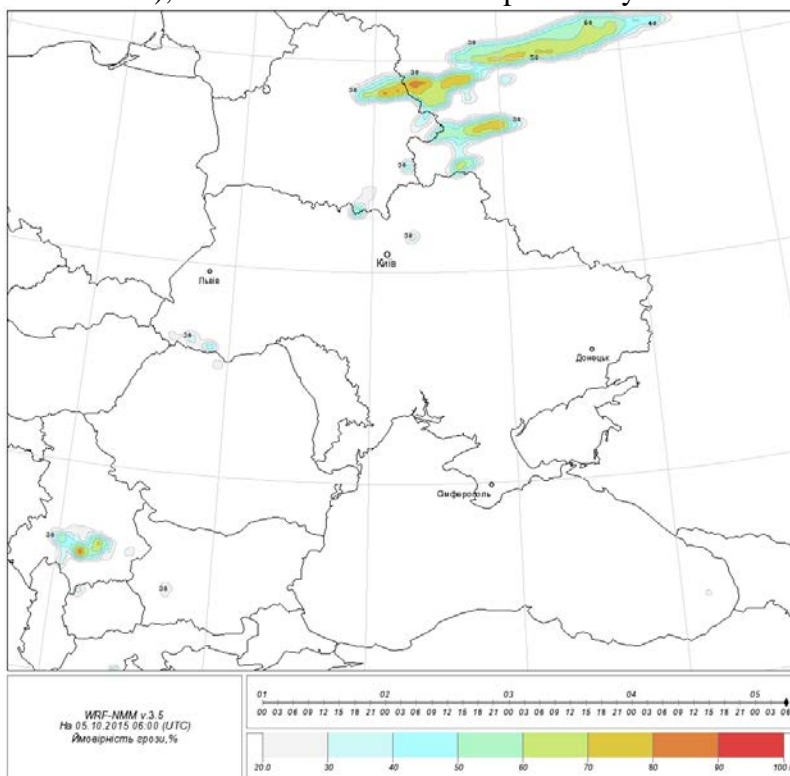
4.5.4 Operational techniques for application of specialized numerical prediction products (MOS, PPM, KF, Expert Systems, etc..) (as appropriate related to 4.5)

4.5.4.1 In operation

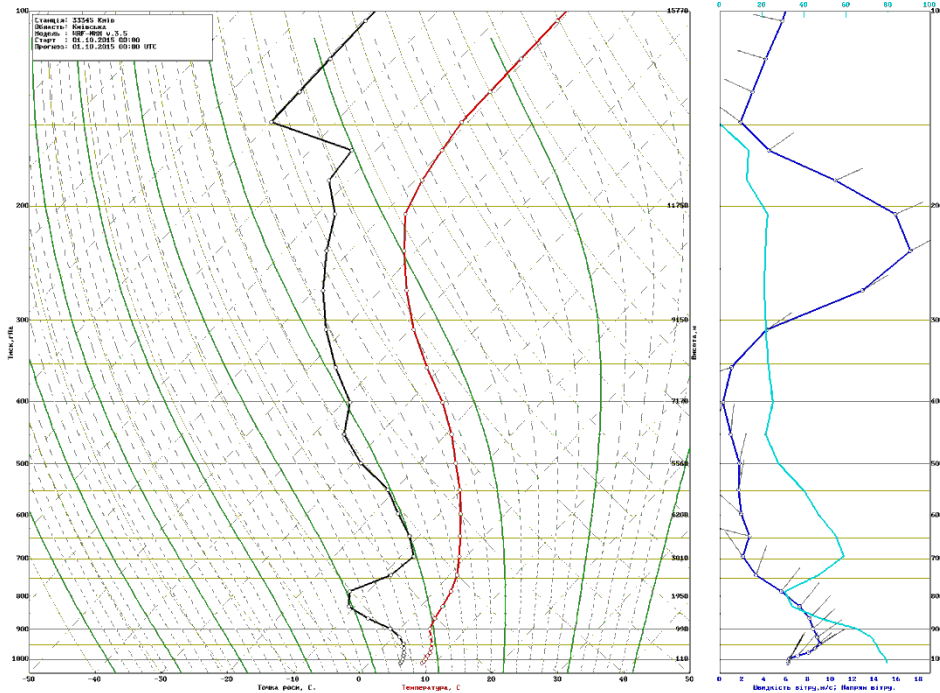
None

4.5.4.2 Research performed in this field

In 2015 the developing weather phenomena forecast system was started. First stage is thunderstorm forecast, which are scheduled to be completed in 2016. System produces forecast (00h-102h) information for main meteorological parameters, 5 instability indices (LI, KI, TT, SWEAT, Showalter Index), CAPE and thunderstorm possibility



aerological diagrams.



4.5.5 Probabilistic predictions (where applicable)

4.5.5.1 In operation

thunderstorm possibility

4.5.5.2 Research performed in this field

None

4.5.5.3 Operationally available probabilistic prediction products

None

4.6 Extended range forecasts (ERF) (10 days to 30 days)

4.6.1 Models

4.6.1.1 In operation

None

4.6.1.2 Research performed in this field

None

4.6.2 Operationally available NWP model and EPS ERF products

None

4.7 Long range forecasts (LRF) (30 days up to two years)

4.7.1 In operation

The Expert Methods of Ukrainian Hydrometeorological Center (UHMC) of long range forecasting (30 days)

Monthly and seasonal forecast provided for UHMC by NCEP (USA)

4.7.2 Research performed in this field

None

4.7.2 Operationally available EPS LRF products

None

5. Verification of prognostic products

Verification carried out for all mesoscale models for meteorological stations by T2m, MSLP, daily precipitation sum and wind speed.

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

6.1 Development of the GDPFS

None

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

6.2.1 Planned Research Activities in NWP

Further improvement of the regional model in collaboration with the COSMO consortium

6.2.2 Planned Research Activities in Nowcasting

None

6.2.3 Planned Research Activities in Long-range Forecasting

Continue collaboration in this area with National Weather Service of the USA

6.2.4 Planned Research Activities in Specialized Numerical Predictions

Further developing the weather phenomena forecast system and the forecast of transport of atmosphere pollution

7. References

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