NWP: coupled systems, weather phenomena forecast and researches

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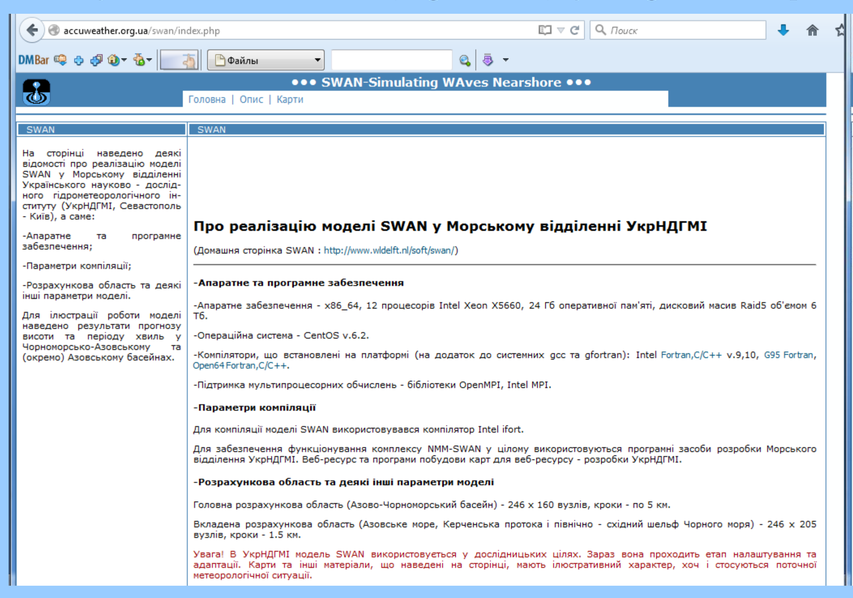
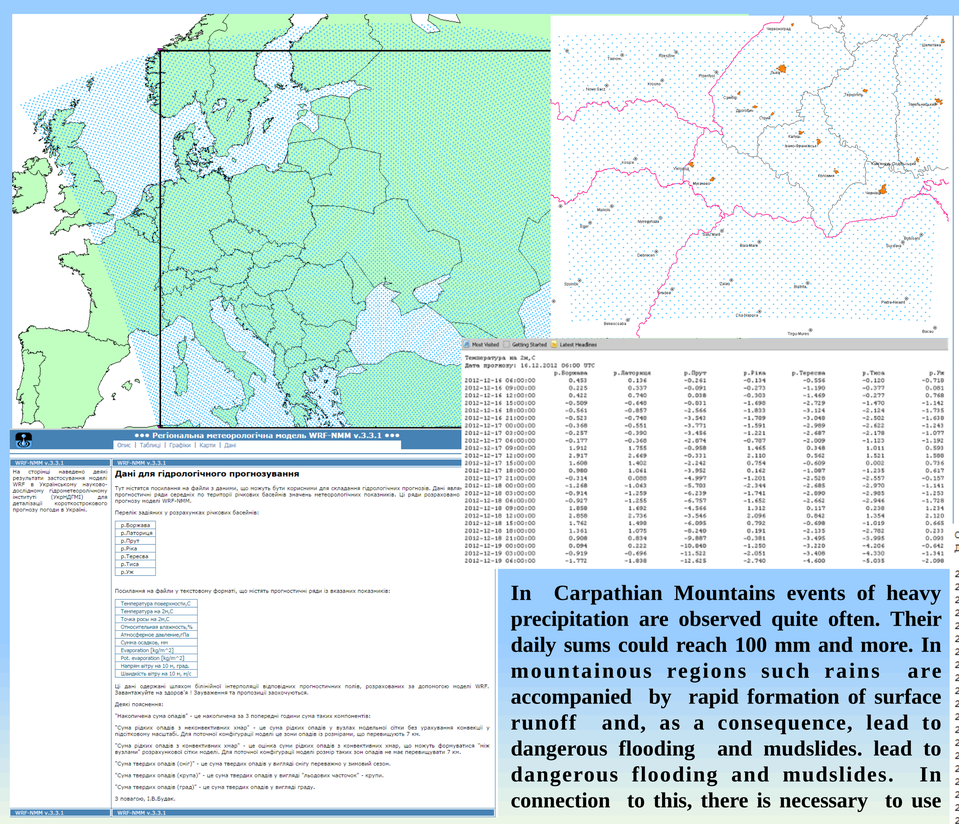
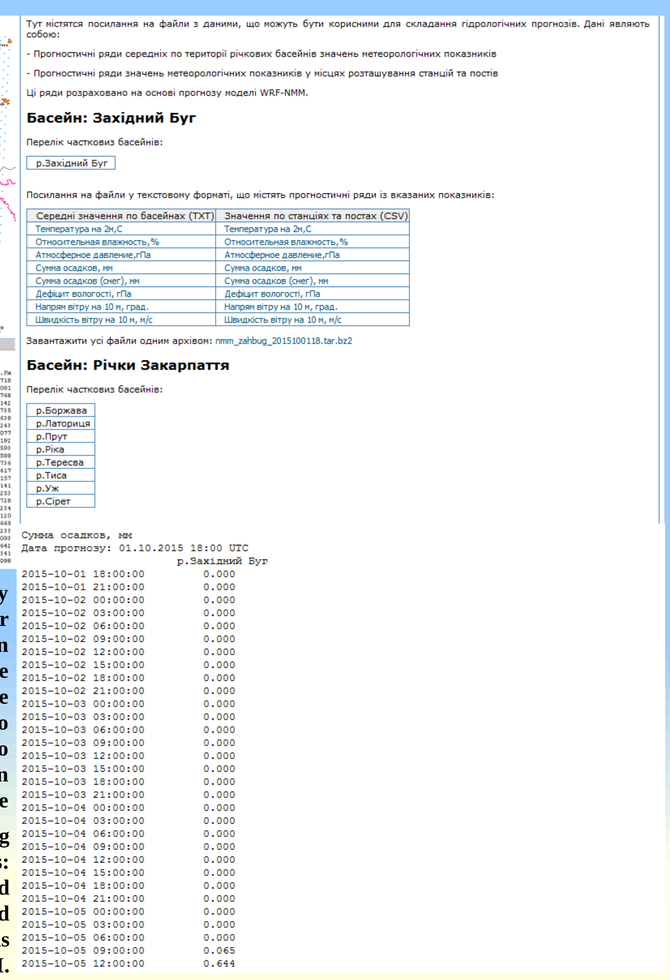
During recent years in UHMI in framework of the system of hydrometeorological service in Ukraine five coupled systems were developed. As a rule these systems consist two main blocks: atmospheric and subject models. These systems are related with sea, agricultural, hydrological and air pollution forecasts.

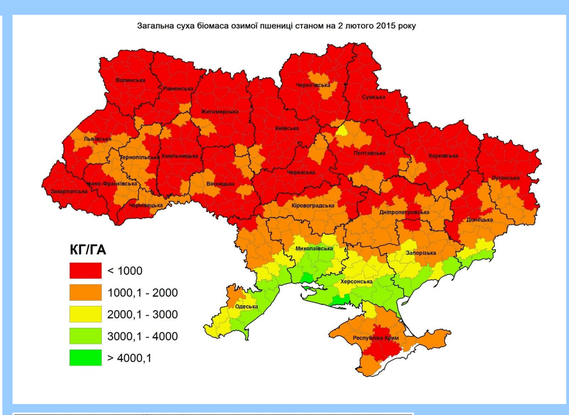


WRF NMM/SWAN model (shift to SWAN version 41.01A in progress)
Example of forecasts of waves direction, their heights and period for the basins of Black and Azov Seas

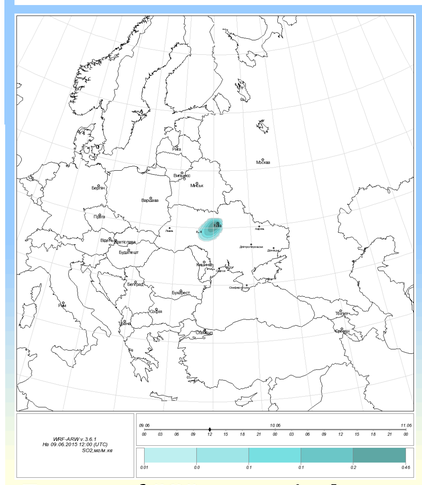


In Carpathian Mountains events of heavy precipitation are observed quite often. Their daily sums could reach 100 mm and more. In mountainous regions such rains are accompanied by rapid formation of surface runoff and, as a consequence, lead to dangerous flooding and mudslides. lead to dangerous flooding and mudslides. In connection to this, there is necessary to use modern weather forecast models with a detailed spatial and temporal discretization for solving problems in applied hydrology. As of the 2014 , forecast for the basin was realized for 7 rivers: Borzava, Latorica, Prut, Rika, Teresva, Tisza, Uzh. WRF NMM v.3.3.1 weather forecast and technique for further basins selection for hydrological forecasts with the help MIKE model and rainfall-runoff model of UHMI. At the end of 2014 the same system for the West Bug river was developed, which based on WRF NMM weather forecasts and hydrological model of UHMI.





WRF/CGMS Example of forecast total dry biomass of winter wheat on 02 February 2015 [kg/ha] (Kryvobok O.A. and Kryvoshein O.O., 2015)

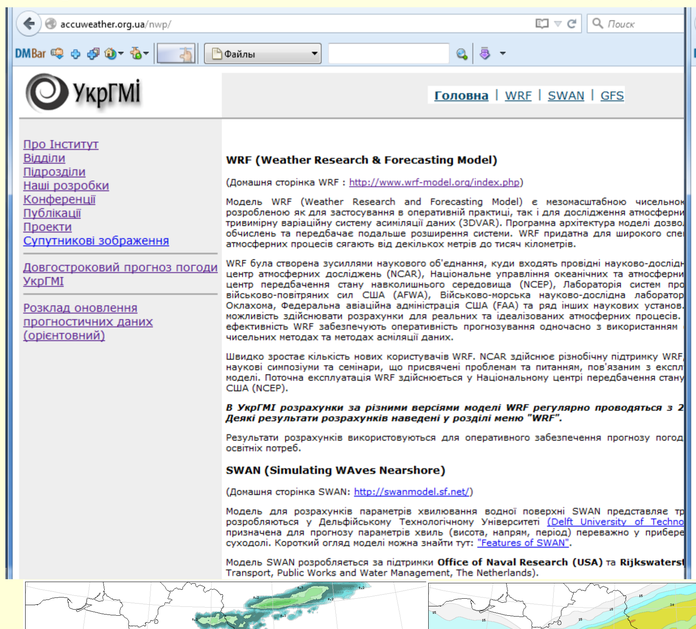


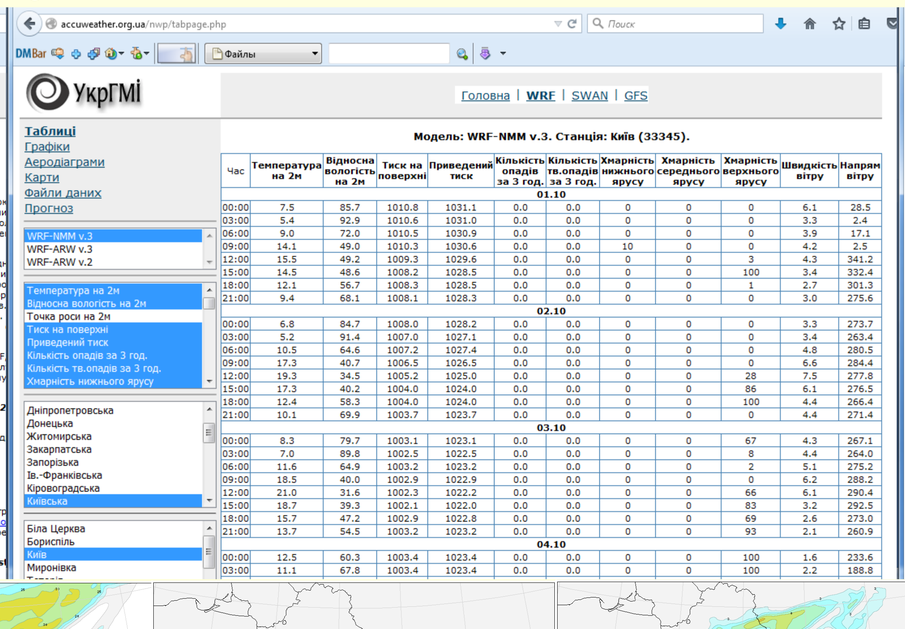
Forecast of SO2 content in the troposphere column. Fire near Vasylkiv town in June 2015

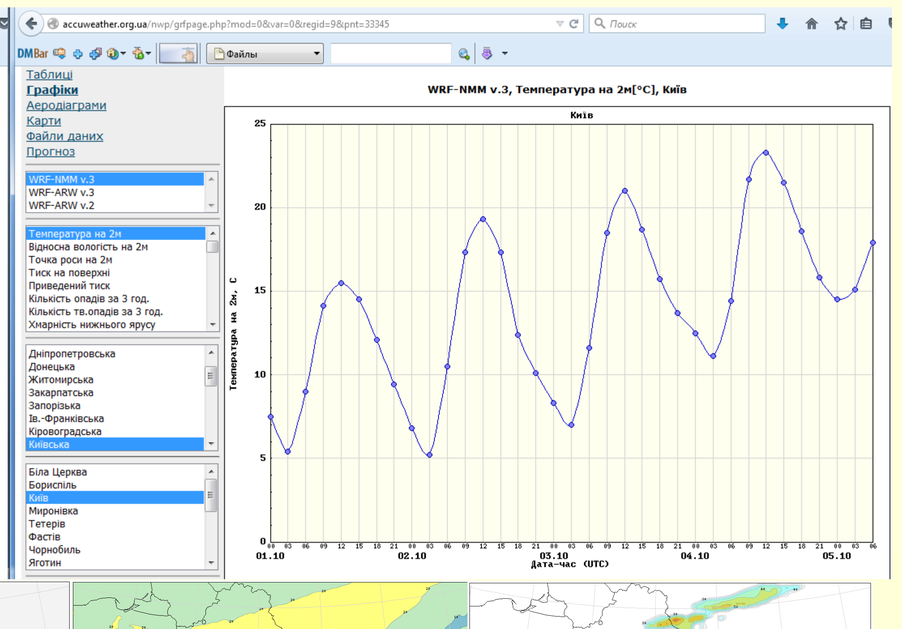
The forecast of transport of atmosphere pollution is presented by three systems:

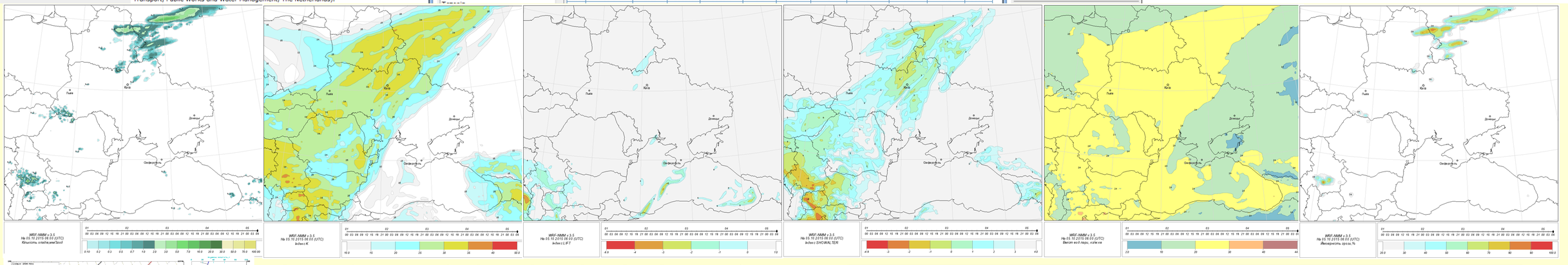
- **on the base of WRF ARW and CALMET/CALPUFF**
- **on the base of WRF-Chem (see Fig. left side)**
- **UHMI model of scattering for a point source emissions with initial data from GFS**

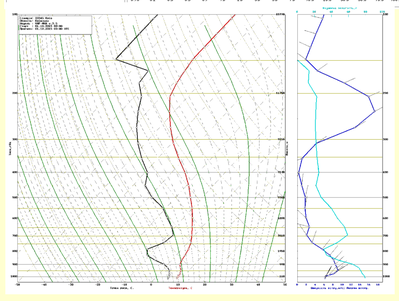
The conceptual idea of Operational emergency response system for accident atmospheric emissions in Ukraine is shown in (V.I. Osadchy, V.M. Voloshchuk, V.A. Prusov, I.V. Budak, V.M. Shpyg, O.A. Kryvobok, O.Y. Skrynyk, 2015)



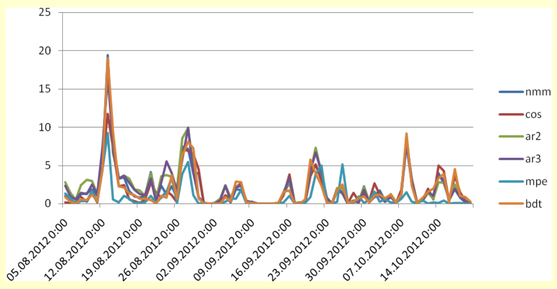








Web-pages of new system for the weather and weather phenomena forecasts (upper row). Examples of forecasts charts for 3h precipitation sums, K index, Lifted index, Showalter index, precipitable water and thunderstorm possibility (second row). Skew t chart example (situated left side) WRF NMM v.3.5: time of initialization is 00 UTC; forecast: 102 h)

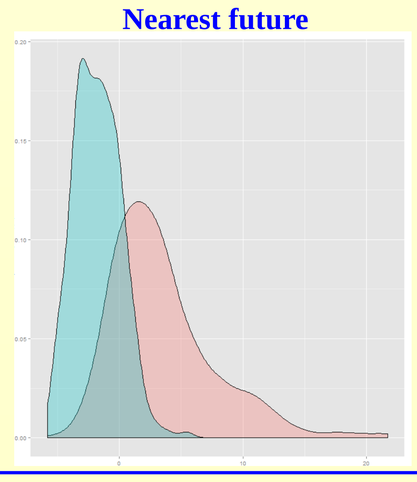


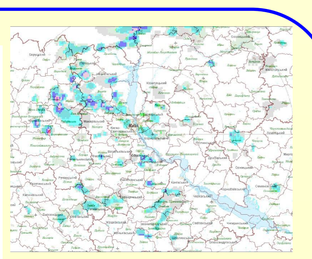
Averaged precipitation sums for the territory of Ukraine on second day of forecast obtained by WRF NMM v.3.3.1, WRF ARW v.3.3.1, WRF ARW v.2.2.1 and COSMO model in comparison of EUMETSAT satellite products MPE and surface measurements network.

Period covers 05 August - 20 November 2012.

Analysis of L-index, K-index and other instability indexes based on NWP and observed data in Europe is proposed for improving of thunderstorm activity forecasts for urban and rural areas. More accurate definition of instability indexes characteristics and limits of their usefulness in predicting thunderstorms and developing of new criteria for thunderstorm forecast that will be based on output data of NWP models are expected to be developed.

Nearest future





Radar image (July 2013)

Density distribution of LI-Index
Reference designation: "blue" – thunderstorm "yes"; "pink" – thunderstorm "no"