Explosive Storm Development in the Kerch Strait:

Simulation by the COSMO-ru-model and Synoptical Analysis

G.Rivin, I.Rozinkina, A.Bundel, B.Peskov, T.Dmitrieva,
Hydrometeocenter of Russia
OUTLINE

• 1. State of COSMO-RU operational running
• 2. The storm of November 11, 2007 – what has happened?
• 3. Features of the phenomenon
• 4. Simulation of these features by COSMO-RU
COSMO-ru-operational model

Russia joins Cosmo officially
- July 2007

Beginning of the data transfer from the DWD:
- July 2007

Operational technology development:
- July – September 2007

Operational technology functioning:
- September - October 2007

Research version functioning:
- September - present
COSMO-ru:

168 x 300 x 40 grid points

*Resolution*: 14x14 km
(0.125 ° x 0.125°),

*Time step* 80 s.
Detailed forecast over a large area

**Advantages:**

Convenient for testing processes of different genesis. A wide range of events, good conditions for classification of events into types

Development of big part of live cycle of cyclones into domain of mezoscale modeling

**Problems:**

Coarse resolution and inaccuracies in specifying the underlying surface properties (lakes etc)
Differences of the computer platform configurations between the DWD and the Hydrometeocenter of Russia
Solution of Problems:

- **Planned**
  - Increasing the resolution in regions with a high probability of severe events and high population density
  - Checking and Improving datasets containing land-surface information for the high resolution COSMO-ru version
  - Modification of post-proceeding in order to accommodate it to operational technologies of Hydrometeocenter of Russia
Acknowledgements:

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State on February 2008:

- We succeeded in modeling some test situations in the real-time mode;
- obtained the information about the forecast skill of some atmospheric variables (t2m, pressure, precipitation, and cloudiness);
- analyzed the simulations of a number of processes and mechanisms of spatial-temporal distribution of these variables.

One of the most important cases considered below is the storm over the Kerch Strait (between Black Sea and the Sea of Azov).
Study of the storm in the Kerch Strait on November 11, 2007
The disaster of November 11, 2007 is one of the biggest in the Kerch Strait between the Black Sea and the Sea of Azov

Three ships with a load of sulfur sank completely, two ships sank partially.

Several ships got abroad

There were losses of human lives and some people are missing.

A large oil tanker was broken down

Oil products and pollutants were spilled and spread over a large area

The ship “NACHICHEVAN” sinking, 11.11.2007
The typical trajectories of Mediterranean cyclones entering to the Russian territory

At November - December, the Black Sea is an additional factor of the strengthening of Mediterranean cyclones.
The NCEP-NCAR reanalysis, Po, H500 for

00. UTC 10.11.2008

00 UTC 11.11.2008

00 UTC 12.11.2008
24-h forecast and reanalysis

This large-scale cyclone developed in the COSMO-ru model domain,

The configuration is almost correct, but the pressure in the center is lower by 5 gPa in COSMO-ru.
The storm in the Kerch Strait may be created only by very strong wind with strict direction as in the figure below.

The convergence can reinforce the wind.
The pressure gradient is not sufficient to cause such winds. Probably - the large-scale circulation of convective origin acts to foster strong winds?
The high convective cloudiness

Meteosat radiative temperature,

24h COSMO-ru forecast
The high convective cloudiness - the meteosat radiative temperature, 30 h forecast
The vertical velocity – forecast for 30 H (06UTC, 11.11.2007)
Summary:

• The COSMO-ru forecasts of the 10-m wind velocity fields determined the storm in the Kerch Strait on November 11, 2007.

• The origin of strong wind was:
  - pressure gradients in the cyclone
  - movements before fast-moving front
  - vertical convective circulation
  - convergence of movements of different types in the Kerch Strait gorge

  - COSMO-ru successfully simulated the configuration of high powerful clouds

  - COSMO-ru slightly underestimated velocity of the cyclone front movement

  - There is a small error in the cyclone depth (?).
Thank You!