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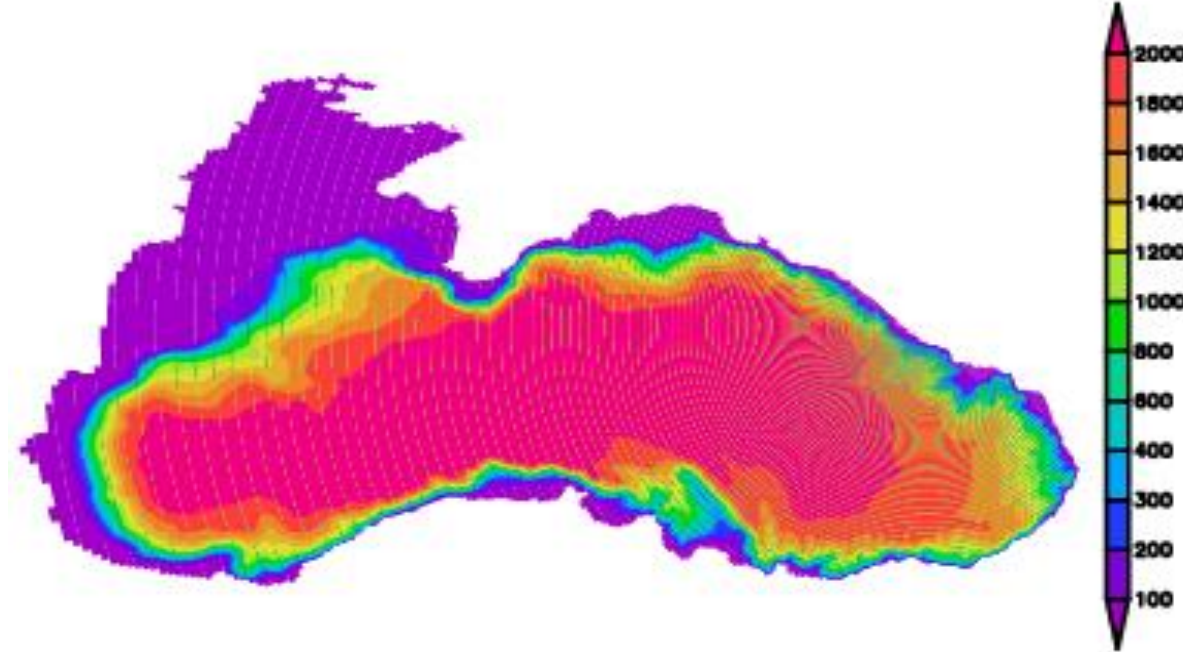
The numerical modelling of the Black Sea (BS) is performed by using INMOM (Institute of Numerical Mathematics Ocean Model). The model is based on the primitive equations in spherical s-coordinate system with free surface boundary condition. The numerical algorithm is based on the method of multicomponent splitting and has a flexible modular structure. The splitting with respect to physical processes and spatial coordinate is used. A computational method is proposed of the polluting substances (PS) transport in the BS region adjacent to the Great Sochi. It is based on INMOM application for the BS in two versions: M1 and M2. In the M1 INMOM has a uniform spatial resolution ~ 4 km, while M2 has non-uniform one with refinement to 50 m in the BS region near Great Sochi coast. The M2 is used only during the periods of PS transport computation for which the initial

hydrothermodynamic conditions are taken from M1. Both versions reveal complexity of the BS circulation nature, however, M2 more adequately reproduces eddy circulation due to higher horizontal resolution in its eastern part. Hence, a suggestion is made that BS eddy structure simulation requires model resolution ~ 1.5 km, and the major factor of quasistationary Batumi anti-cyclonic gyre formation is the topographical features in this part of the sea. A computation of PS distribution from the rivers Sochi, Host and Mzymta and from 18 pipes of deep-water sewage production was performed for the high-water period from 01.04.2007 to 30.04.2007. It is shown that the significant contribution to PS distribution from these punctual sources is made by whirlwind mesoscale formations generating complicated 3-dimensional PS distribution.

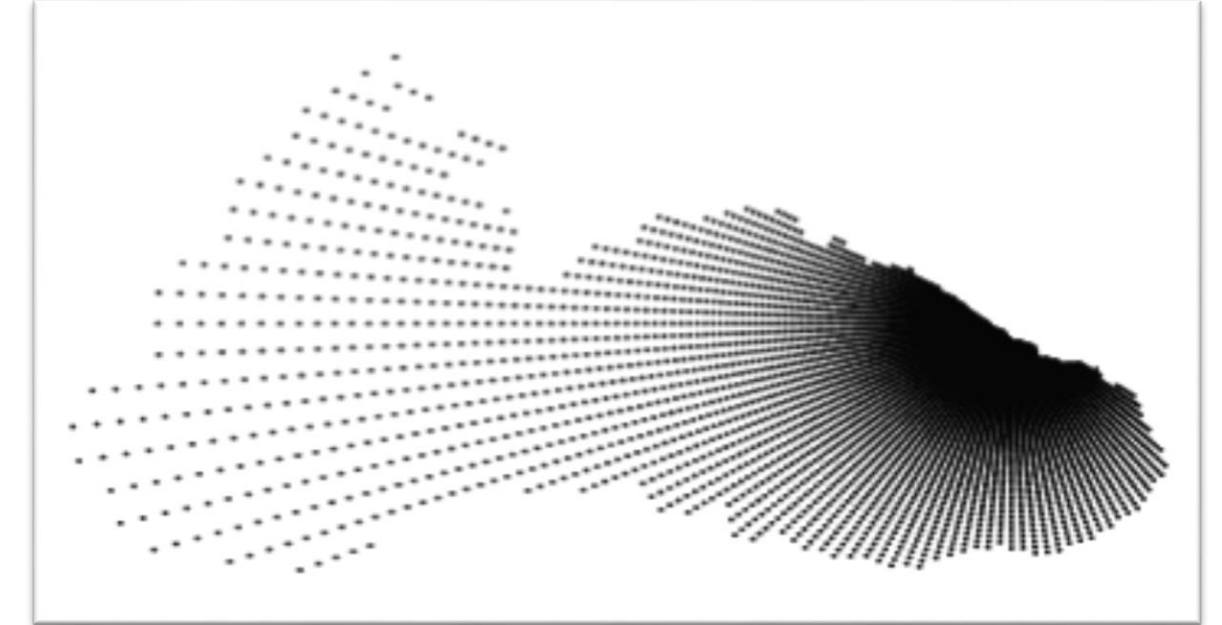
Great Sochi model grid area:

- Model north pole is set at village "Read Rock"
- Non-uniform spatial resolution up to 50 m near model north pole and about to 5-9 km in the west part of Black Sea.
- 759x600 – model grid
- 20 non-uniform sigma levels

GEBCO Black Sea Topography [m]

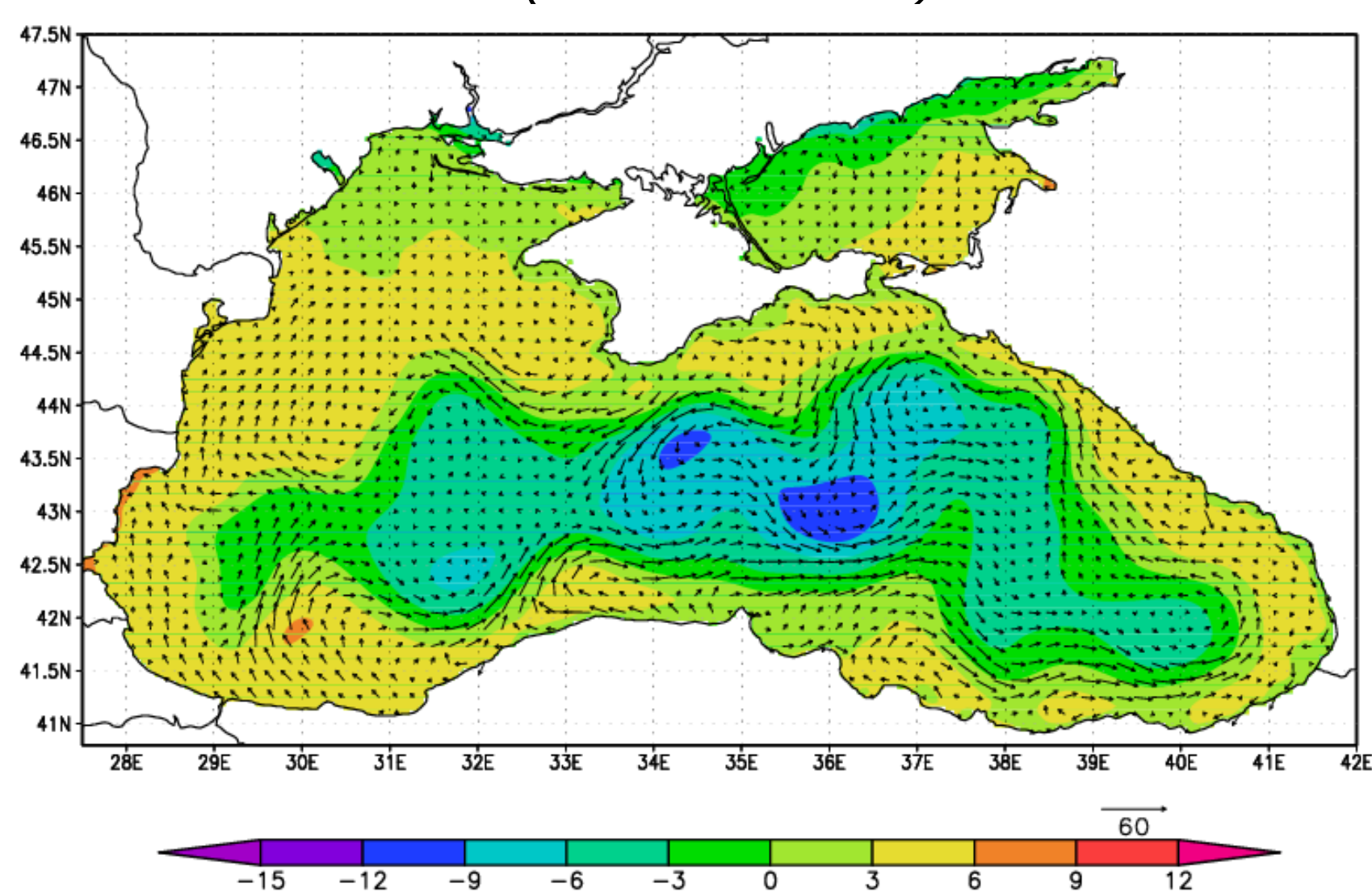


Model grid area

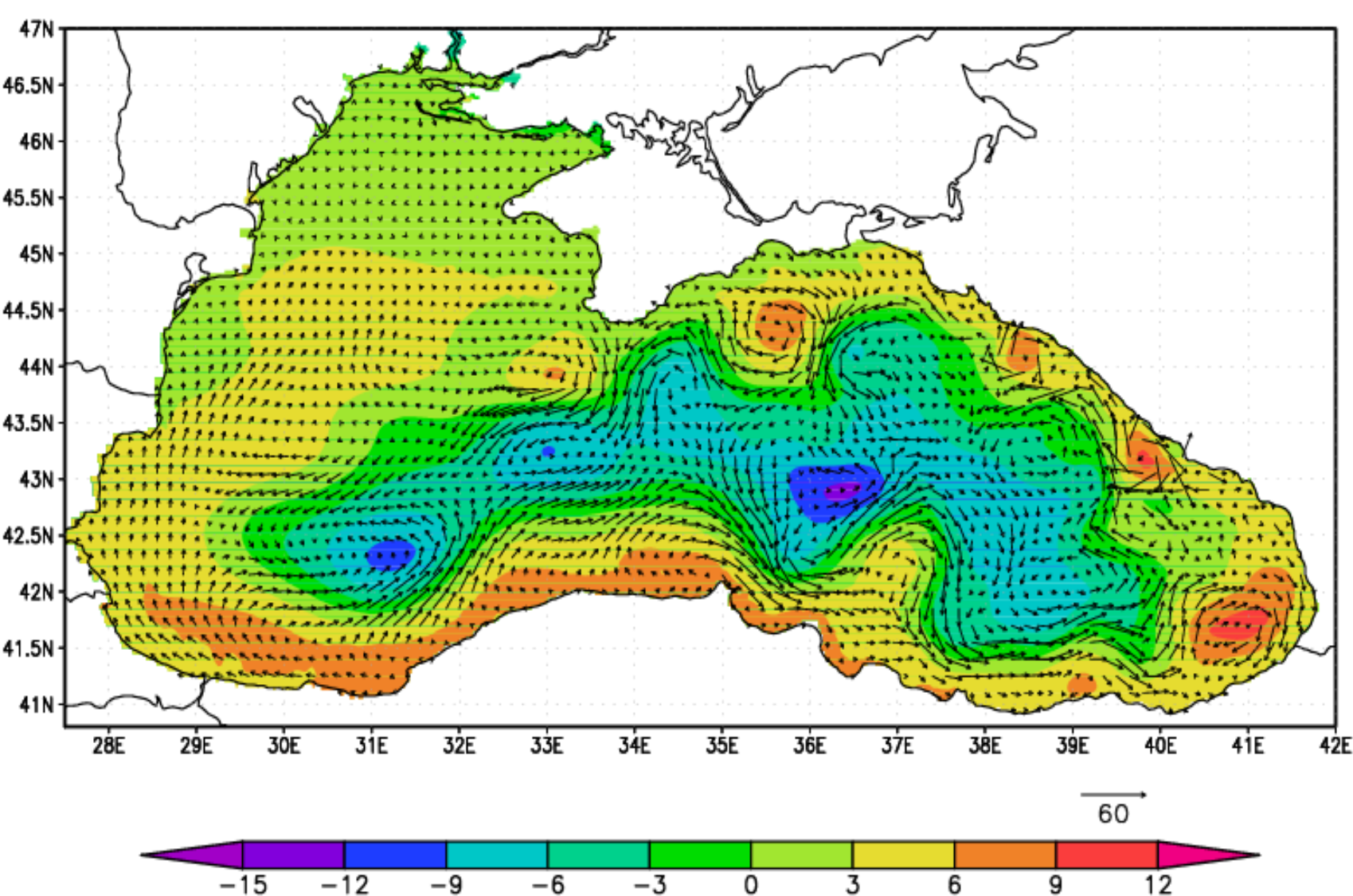


Black Sea velocity (vectors) and sea surface height (color) calculated by 15 April 2007

Black and Azov sea circulation model (BAS)
(4 km resolution)



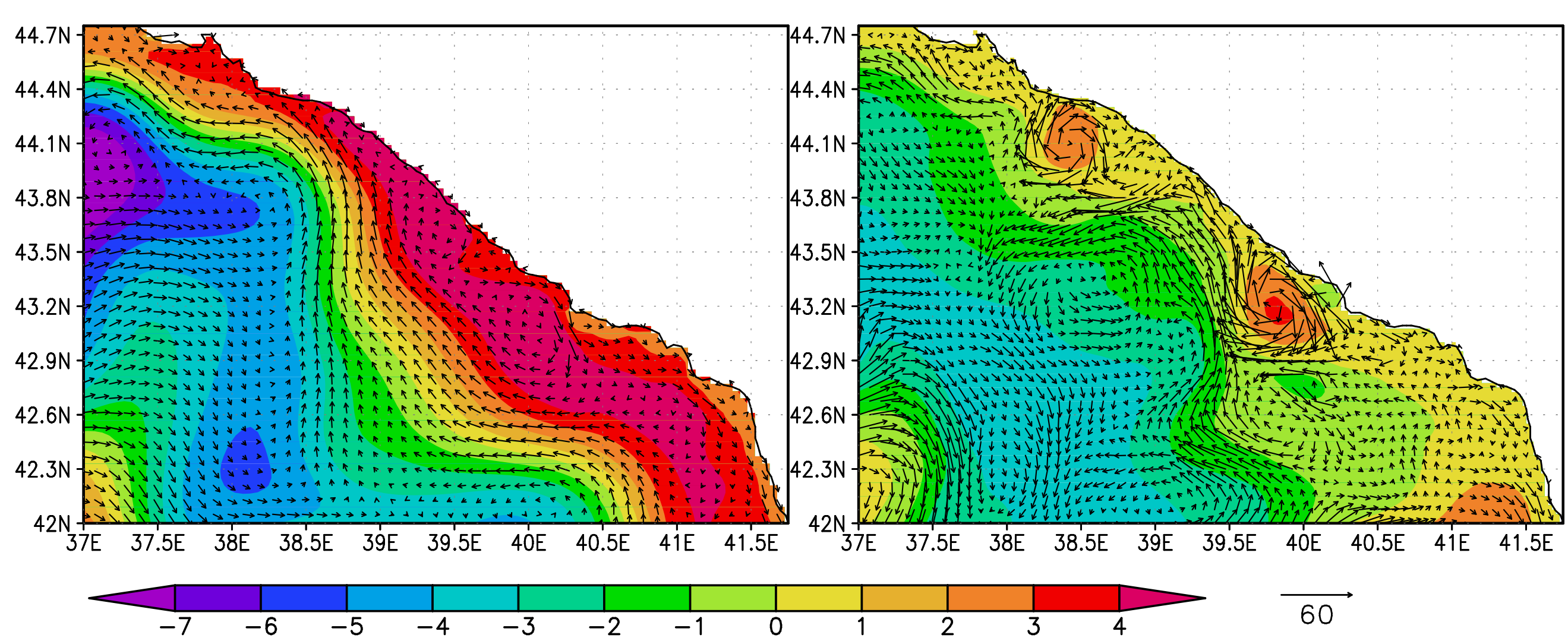
Great Sochi circulation model



Black Sea velocity (vectors) and sea surface height (color) calculated by BAS model (a) and regional Great Sochi model (b) for the same time 15.04.2007

a

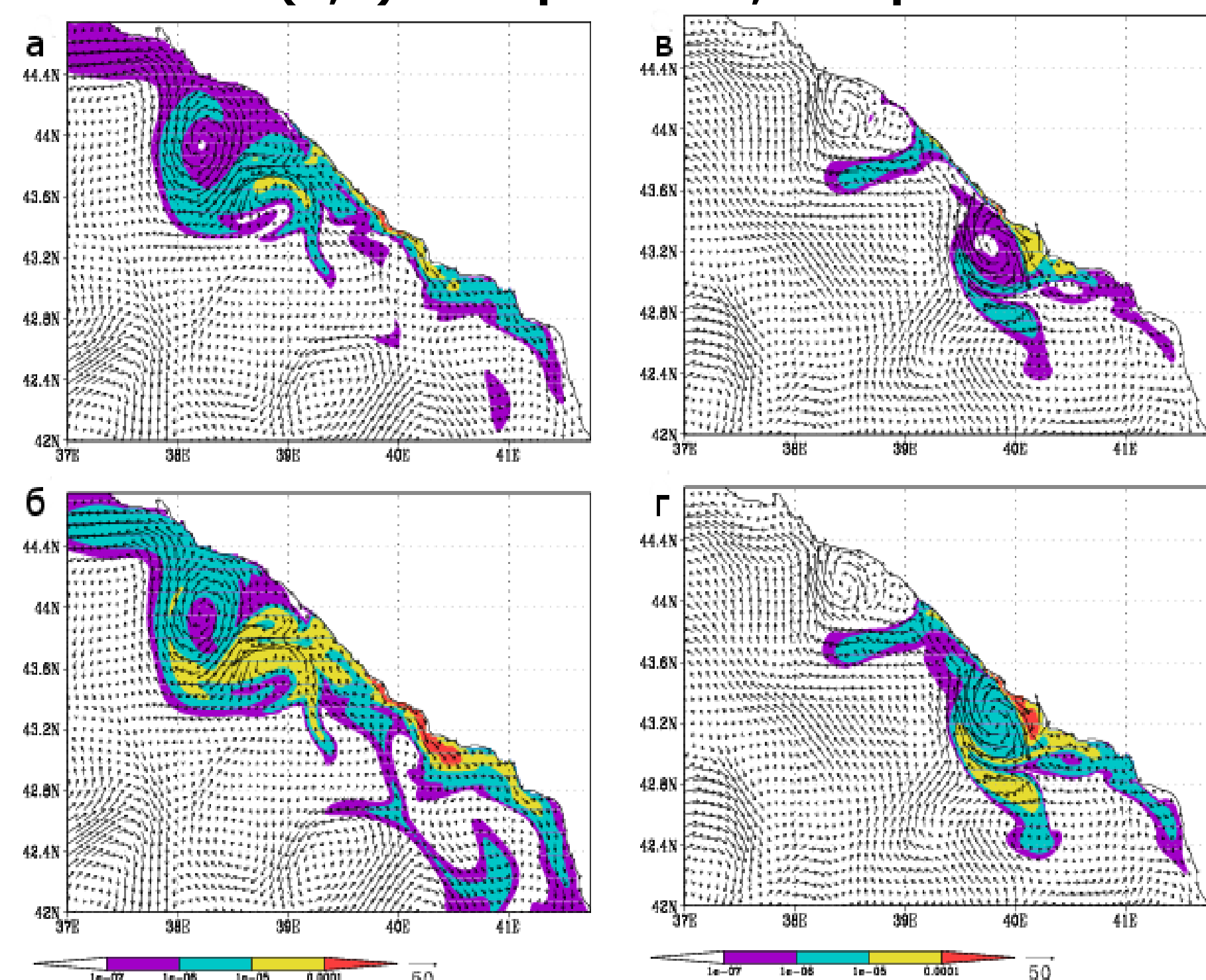
b



Both versions reveal complexity of the BS circulation nature, however, M2 more adequately reproduces eddy circulation due to higher horizontal resolution in its eastern part.

Calculated by regional Great Sochi model sea level and velocity fields more adequately reflect eddy circulation in the eastern part of Black sea (Batumi, Caucasus and Crimea anticyclonic eddies).

Pollution distribution near Great Sochi from rivers(a,c) and tubes (b,d): 15 April 2007, 30 April 2007

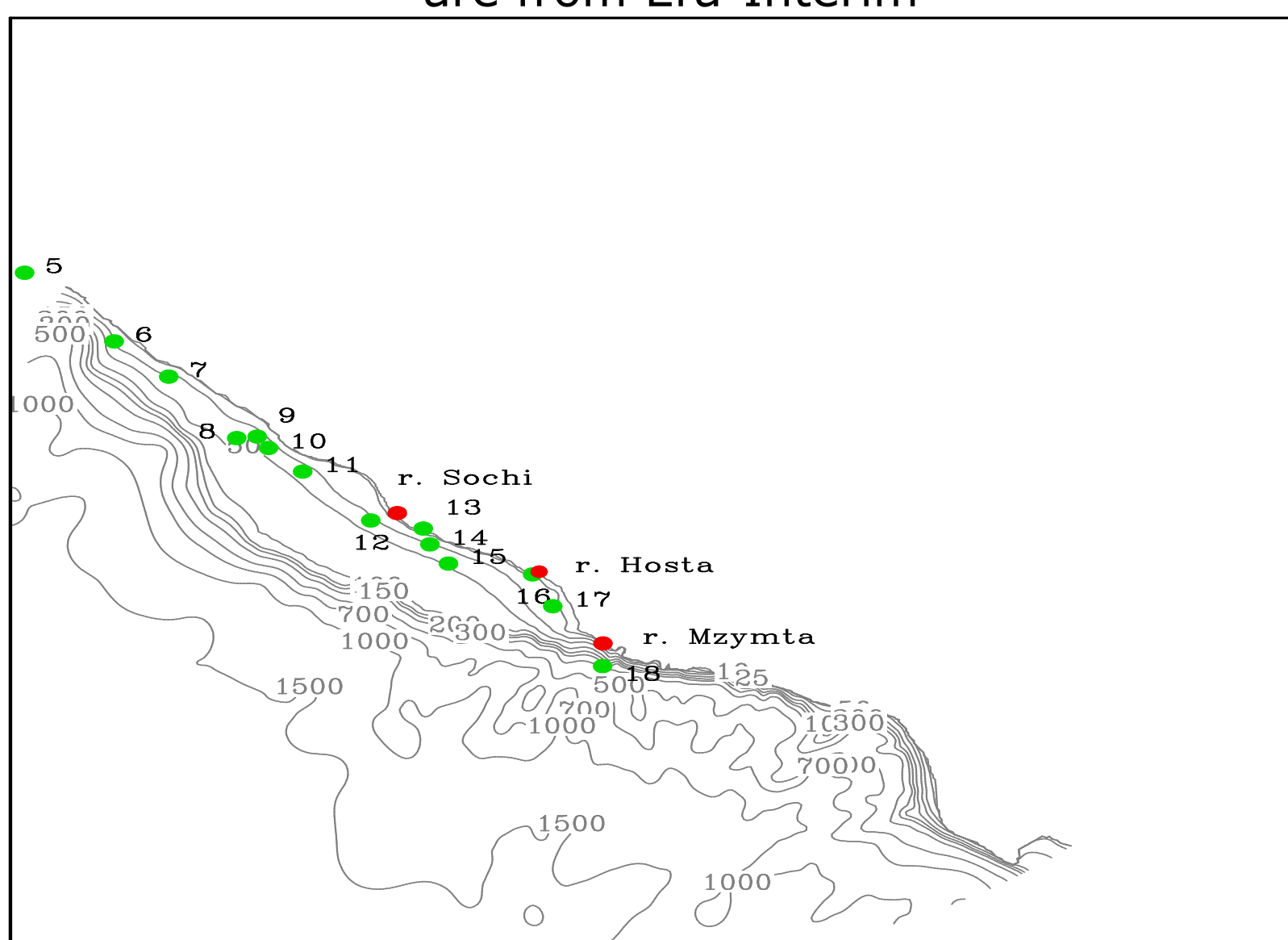


Experiment scenario

Pollutions flow from 18 sewage pipes and 3 rivers (Sochi, Hosta, Mzymta)

Initial hydrological fields are from BAS model

Duration – 1 month (April, 2007)/ Atmospheric forcing are from Era-Interim



Conclusions:

- Regional Great Sochi model more accurately reproduces eddy circulation in the eastern part of Black Sea due to higher horizontal resolution.
- Adequate simulation of Black Sea eddy structure requires model resolution ~ 1.5 km. The major factor of quasistationary Batumi anti-cyclonic gyre formation is the topographical features in this part of the sea.
- The significant contribution to polluting substances distribution from punctual sources near Sochi is made by eddy mesoscale formations generating complicated 3-dimensional polluting substance distribution.