HYDROMETEOROLOGICAL CENTRE OF RUSSIA

SOCIO-ECONOMIC BENEFITS OF METEOROLOGICAL AND HYDROLOGICAL SERVICES

CASE STUDIES

ITEM	DESCRIPTION
Sector	Marine forecasts
Sub-sector	Sea level forecasts
Case Study Name	Forecast of significant surge in the northern part of the Caspian Sea
Case Study Description	Description of the case study in general terms
Location	Northern part of the Caspian Sea
Tools employed	An operational forecast model system for the Caspian Sea
Description of application	• An operational forecast system uses a 3D hydrodynamic baroclinic model of the Caspian Sea • Forecast surface pressure fields obtained by the limited area atmospheric model run in Russia Hydrometeorological Centre for 48 hours ahead are used as the meteorological input. • The Volga river daily run-off observed (that is the volume of the Volgogradskoe reservoir discharge water) is taken into computations as the Volga determines the background sea level distribution in the northern part of the sea. • To specify the level and current initial condition the model uses forecast fields obtained by the previous calculation. • The bathymetry correspond to the modern mean sea level of the Caspian Sea is used. • The computational grid covers the whole Caspian Sea and adjacent near-shore areas with the mesh size of 3 nautical miles (5,5 km). • A special algorithm of drying and flooding treatment is used.
Outcomes of application	In April, 2005 a significant negative surge was registered in the north-western part of the North Caspy, and the positive one occurred in the end of the month. According to the data observed the sea level range at the station of Is. Tuleny was 139 cm. The minimum value of (-61 cm relative

	to the mean sea level value at this point) was observed at 0 am 1 April, while the maximum one (78 cm) was observed at 6 pm 28 April. Moreover, the critical seamark was exceeded at 12 am 28 April. By calculations the minimum sea level value was -60 cm (6 am 1 April) and the maximum one was 80 cm (9 pm 28 April). So, the calculated sea level range is 140 cm. The sea level ranges by the data observed and calculated as well as the moments of the lowest and highest sea levels are in close agreement.
Cost/Benefits	In the great extend the area of the Northern Caspy is subjected to positive and negative storm surges accompanied by strong currents. In case of extreme storm surges bringing destruction to the coasts (for example, storms of 1952 and 1995 result in disastrous effects), surge waves penetrate far into the coastal line (sometimes for several tens of km) flooding vast dry lands. Since the Caspian coasts are densely populated, catastrophic surges may have consequences and even lost lives. Forecasting of negative surges is also important as besides threatening the navigation safety they threaten the normal working of nuclear power water reservoir-coolers located at the coasts.
Characteristics of the Case Study	Brief description of the evolution of the case study
Consultation mechanisms	Consultations between specialists of Russia Hydrometeorological Centre and local Hydrometeorological Office
Structural interface	
Delivery mechanism	WEB-site of Russia Hydrometeorological Centre
Feedback mechanism	Description of feedback mechanism between providers and users
Review Mechanism	Description of review mechanism between providers and users
Other	Other relevant information as required
Lessons learnt	Until recently mostly regression prediction methods have been used in operational practice for forecast of storm surges. However, these methods are too short-range and have some other important limitations, such as possibility to produce forecasts only for one station and availability of long term qualitative observational series.

	Over the last decades operational forecast of current fields in coastal regions has become more important, both for coastal management and for security aspects. In this aspect one of the key components is high-resolution numerical modelling, which however requires accurate forcing and handling of boundary conditions. Thus, when there are no long term routine observations of marine factors, the only effective means of obtaining information has become numerical modelling (in conjunction with verification by the archive data) and forecast (prediction) methods based on them. Nowadays existing storm surge forecasting and warning systems are based on 3D models. They have been developed highly enough to work as operational techniques and are successfully used to provide marine safety and to produce warnings about dangerous sea level raises and falls as well as to minimize negative consequences of natural and man-caused disasters.
Best Practise Advice	Suggestions on which of the above elements should be included as best practise advice/guidance
Possible future advances	It seems sensible to make some improvements such as ▪ To include actual data on all 7 rivers flowing into the Caspian Sea into the model. ▪ To use the monthly averaged density (or temperature and salinity) fields in the calculation. ▪ To develop a procedure of automatic background sea level setting (and/or predicted level improvement) using the data assimilation algorithm. ▪ To develop software for graphical interpretation of calculation results to make them more "user-friendly".
Comments	Option for additional comments
URL	
Others	