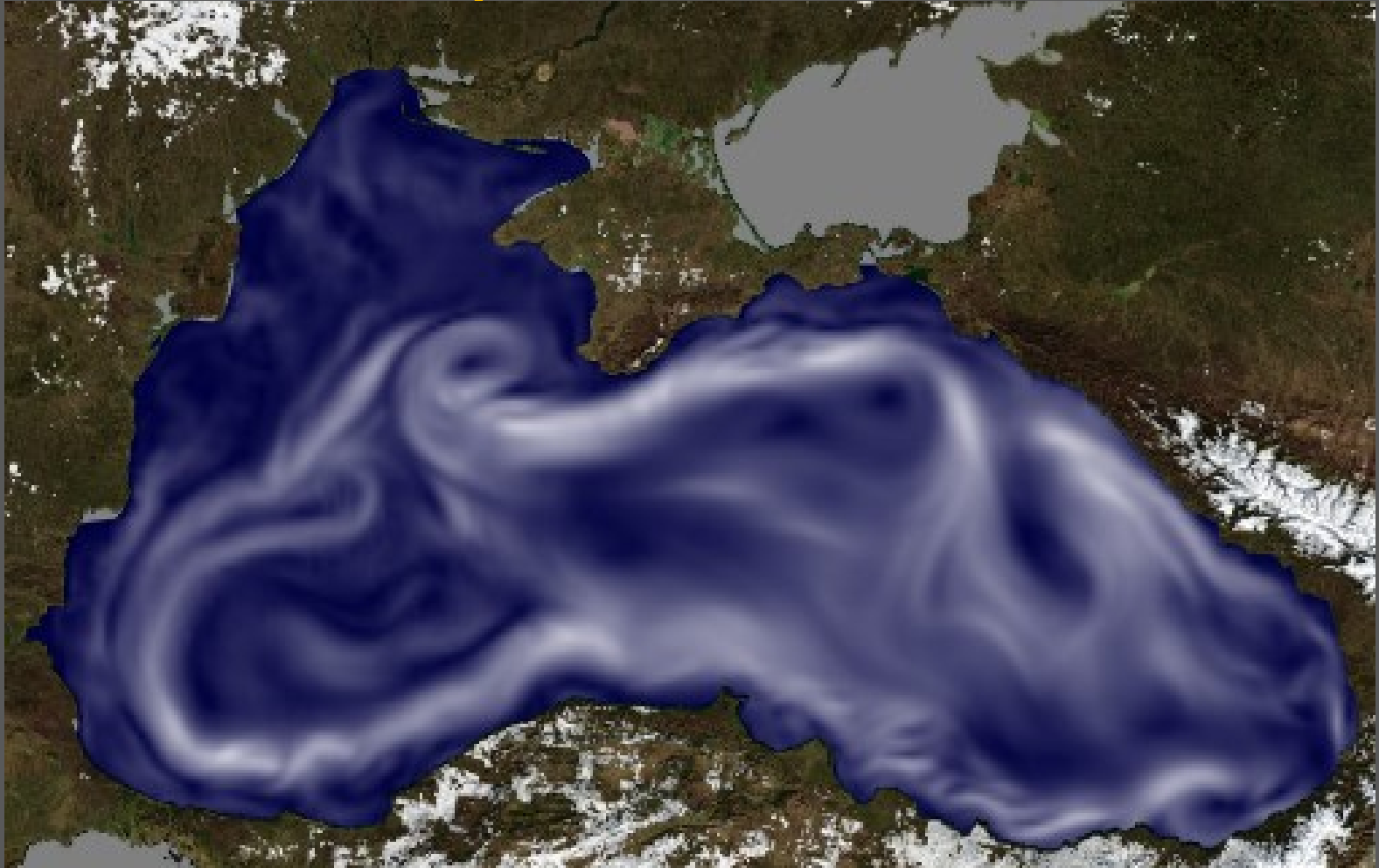


Operational (real-time) monitoring:
options for its inclusion as
integrated part of national
monitoring programs,
cost effectiveness
(PA3)



Operational monitoring in the Black Sea: Why and what for?



The Black Sea is highly spatially and temporarily variable system

Regular basic vs. operational

- Regular basic (complex, common, standard) monitoring is a mandatory activity, which is financed from the state budget and is related to the implementation of national or international legislation.
- Operational monitoring includes but not restricted to real-time collection of data by satellites, radars, automatic devices working for radiation control etc.
- There is no evidence to the effect that operational (real-time) monitoring is in place as part of the state (mandatory) monitoring of the Black Sea.

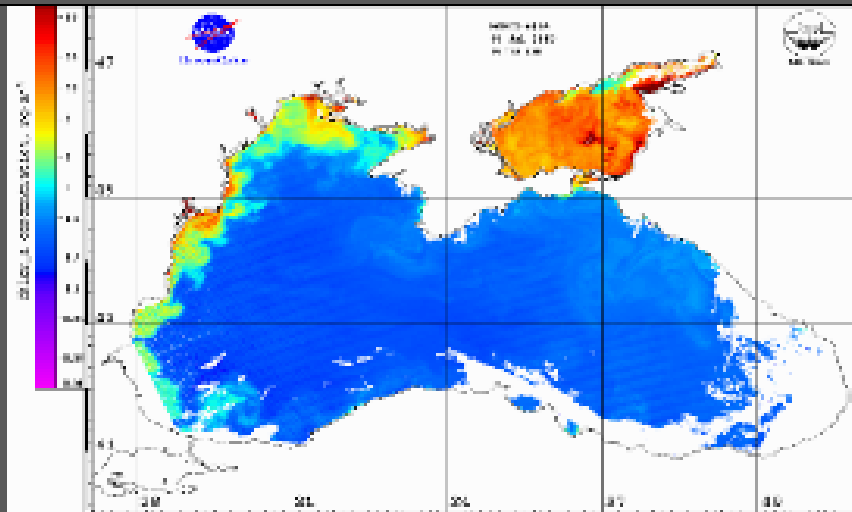
Operational monitoring options

- Sea level, sea surface roughness, wave height, meteoparameters, etc. at coastal stations;
- Satellite monitoring (sea surface temperature, optical parameters, chlorophyll and suspended matter concentration, oil pollution, surface roughness, wave height, direction, storms position and pathways);
- Drifters (surface layer temperature, temperature profile, currents, meteoparameters, etc.);
- Argo (temperature & conductivity) profilers;

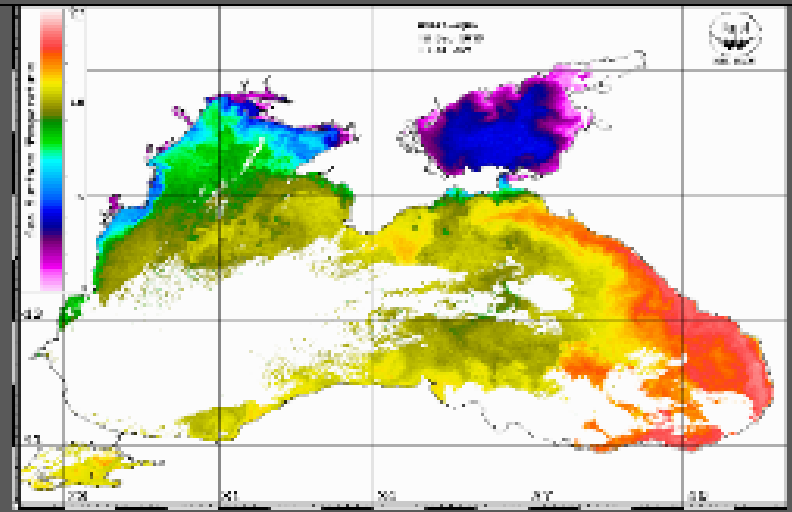
Operational monitoring in the Black Sea

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- ScanEx (<http://www.scanex.ru/ru/index.html>) & MHI (<http://dvs.net.ua/mp/index.shtml>)

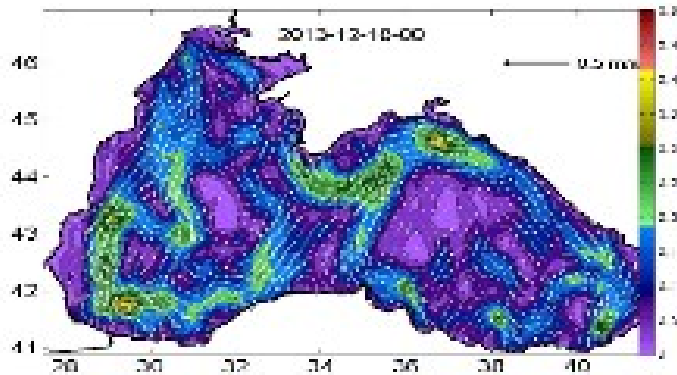
Satellite



Chlorophyll_a concentration



SST (sea surface temperature)

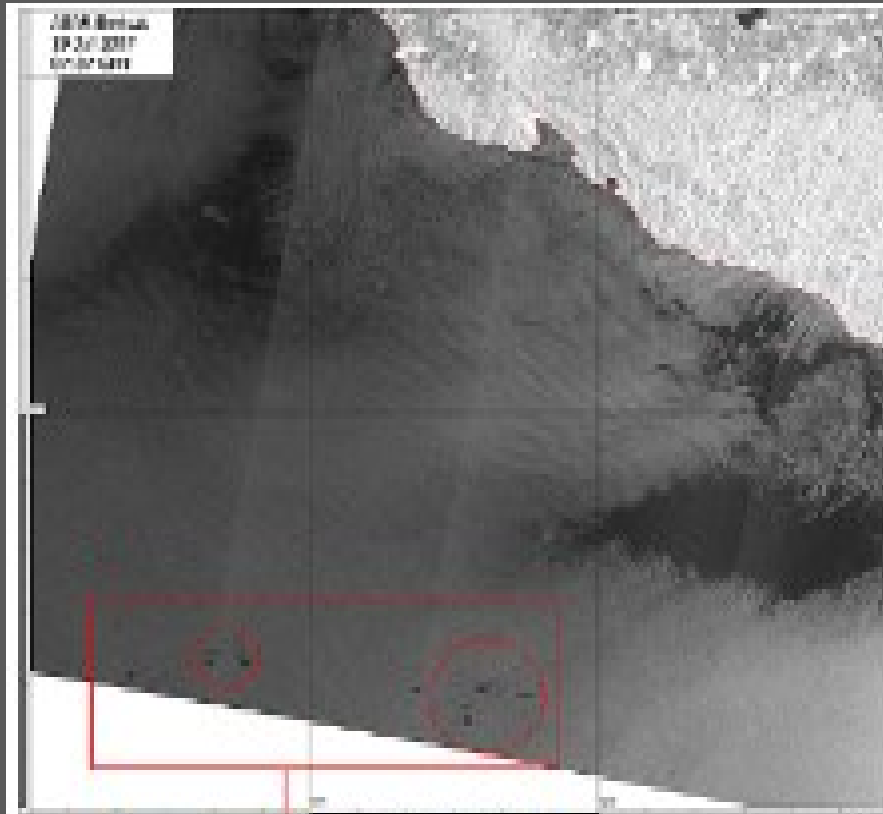


Sea surface currents velocity (altimetry data)

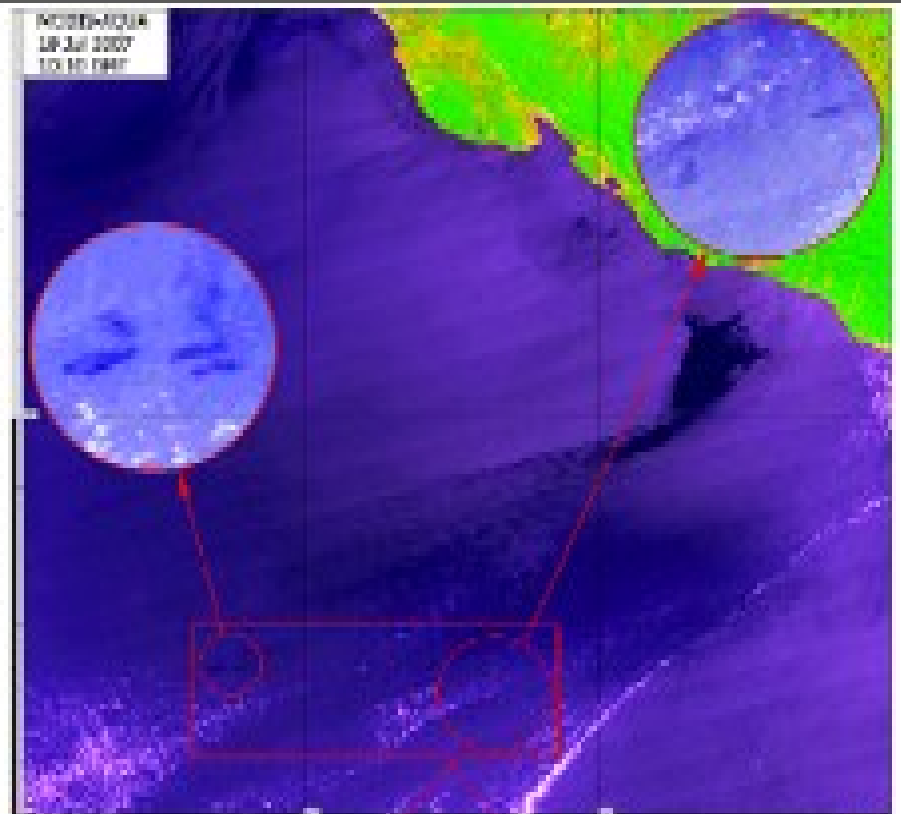
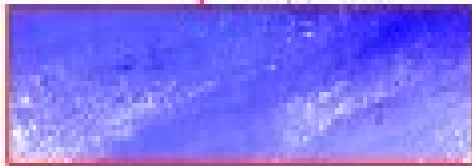


Azov Sea ice coverage

Oil pollution



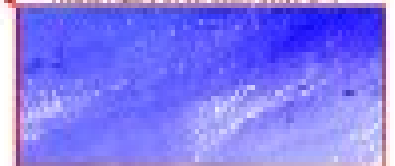
2014 Monitor, 18 Jul 2007, 00:07 GMT



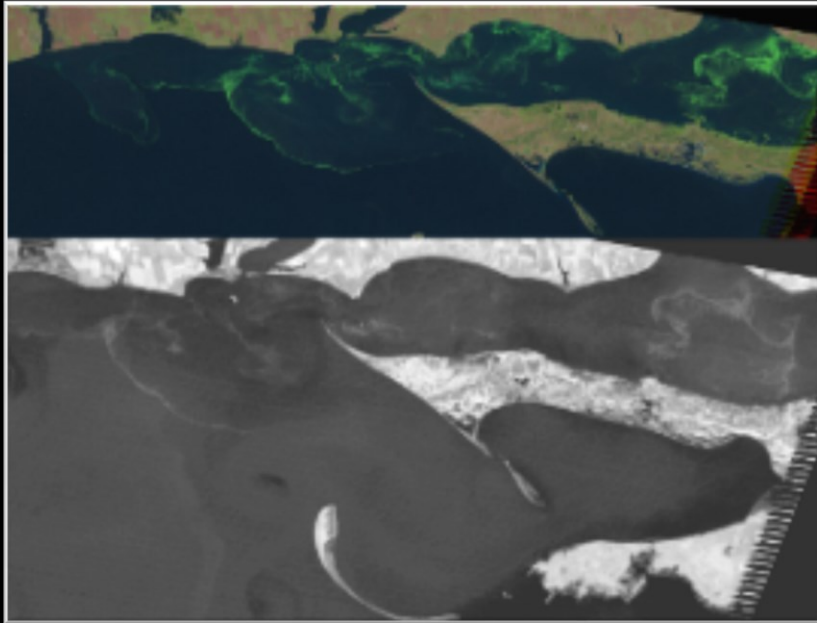
2014 Monitor, 18 Jul 2007, 10:10 GMT



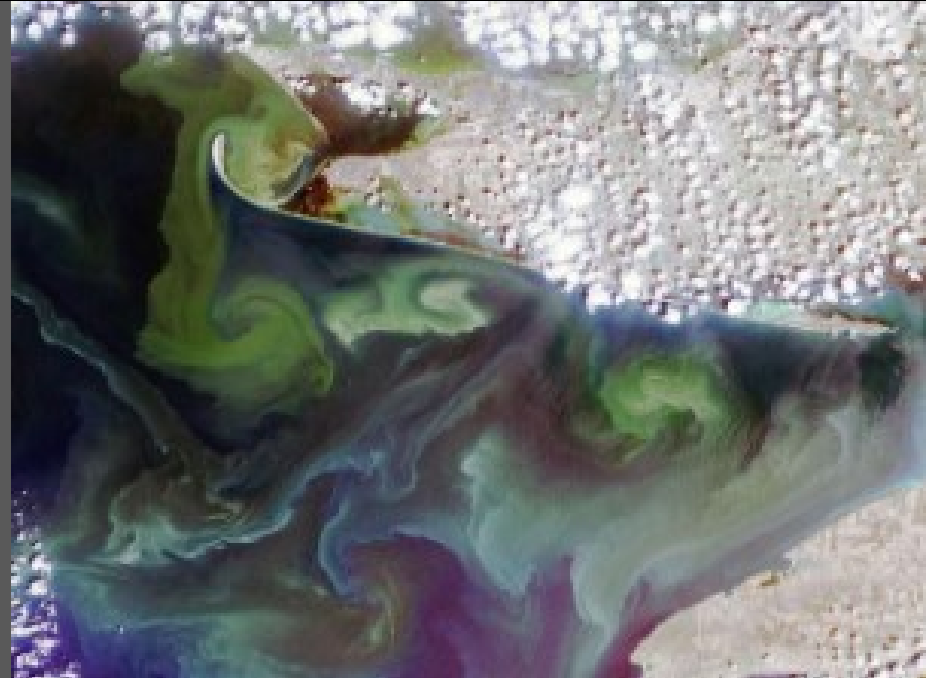
2014 Monitor, 18 Jul 2007, 11:10 GMT



Algae bloom

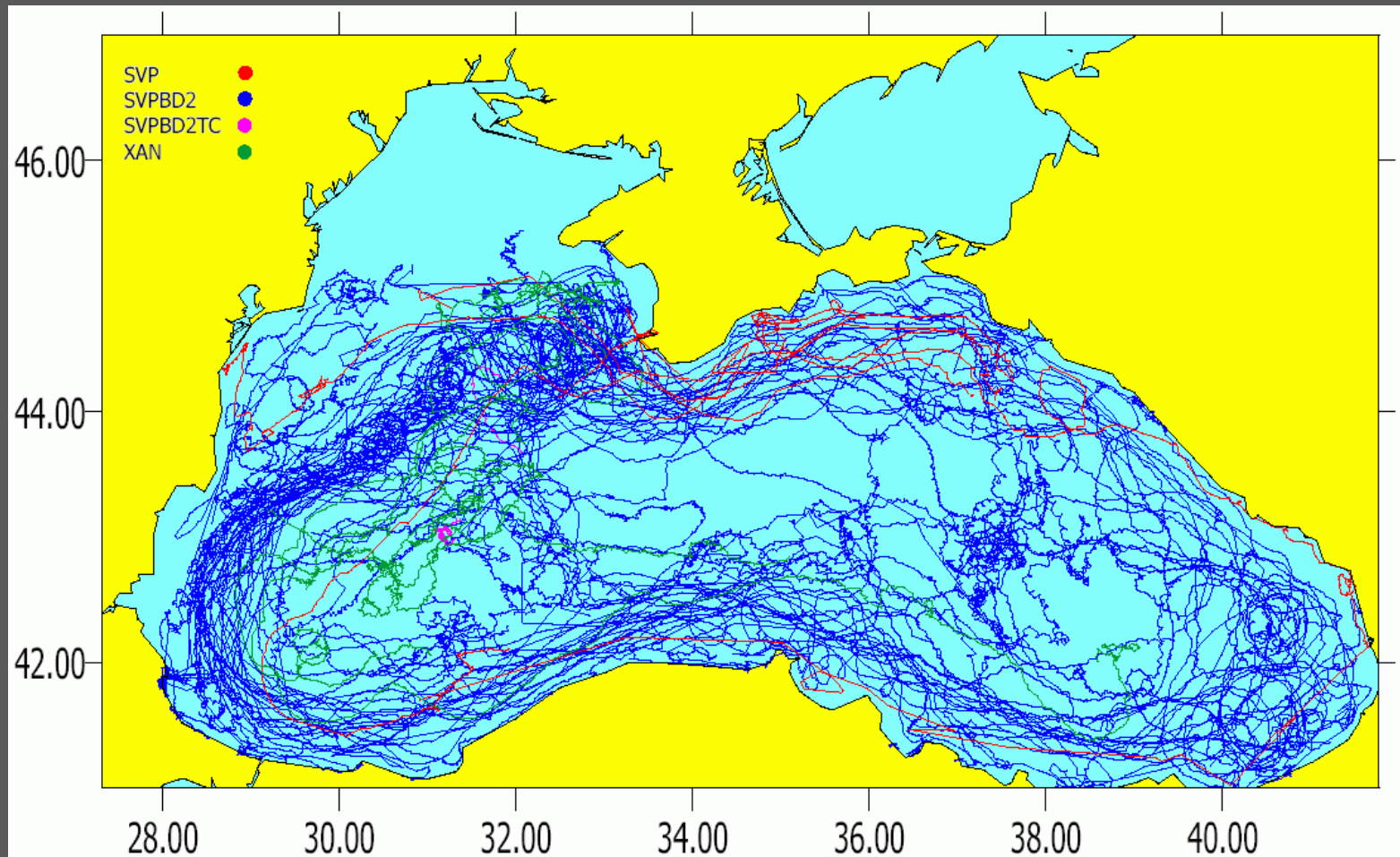


Blue-green algae bloom in the north-western part of the BS (upper panel – optical, bottom panel – thermal)

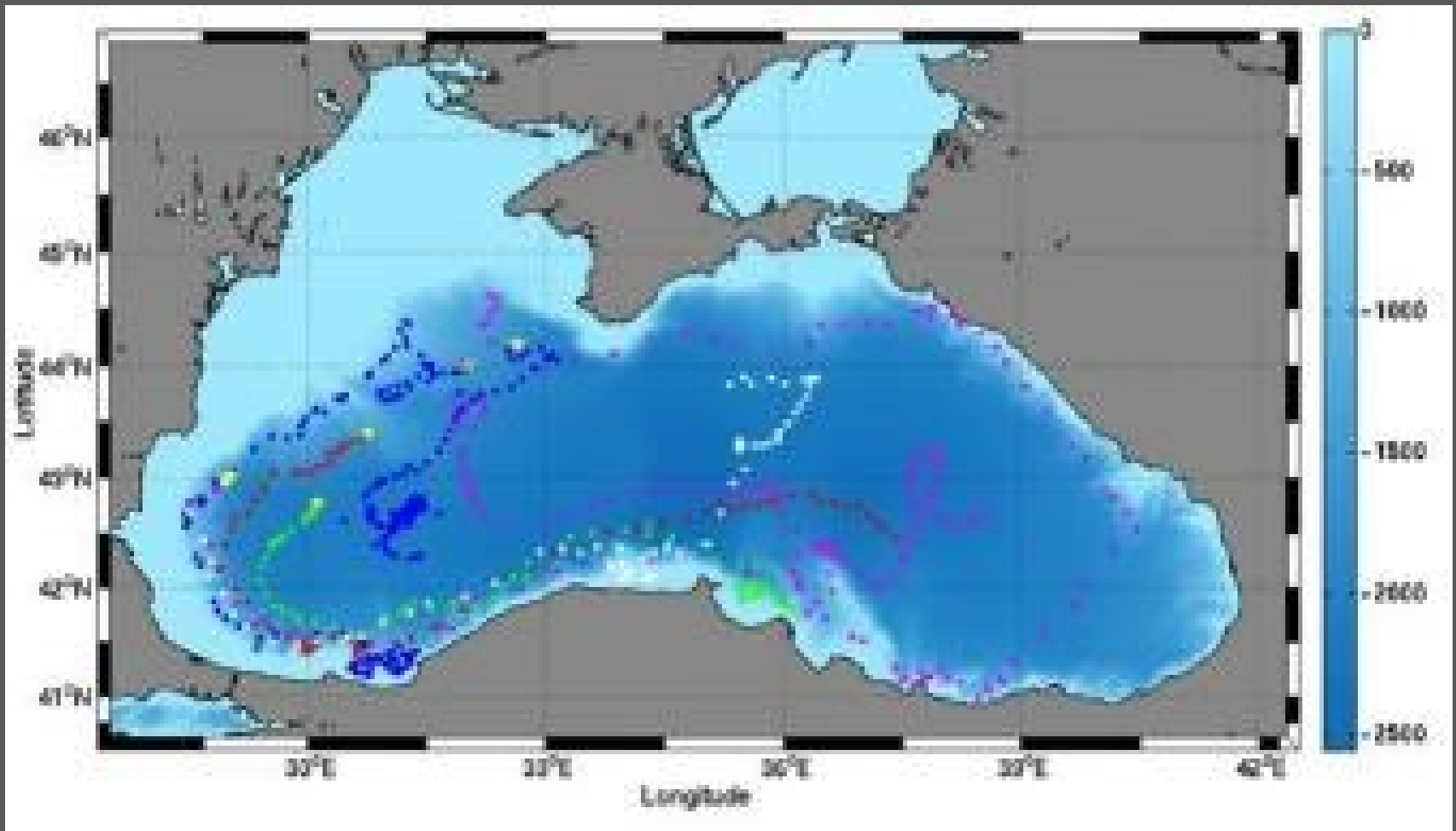


Bloom and submesoscale eddies (induced by the Dniepr River in the north-western part of the BS)

Drifters



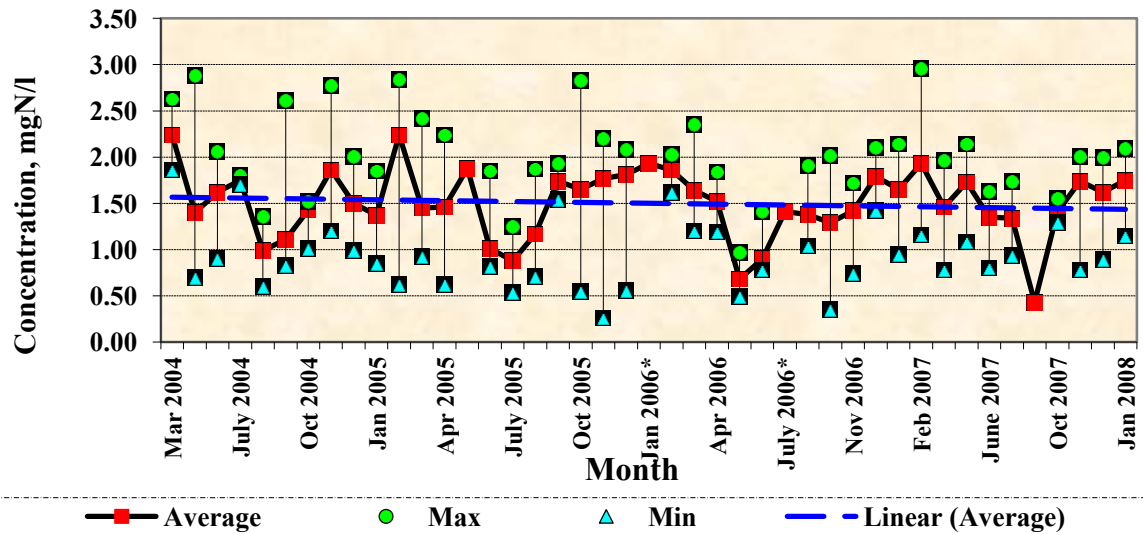
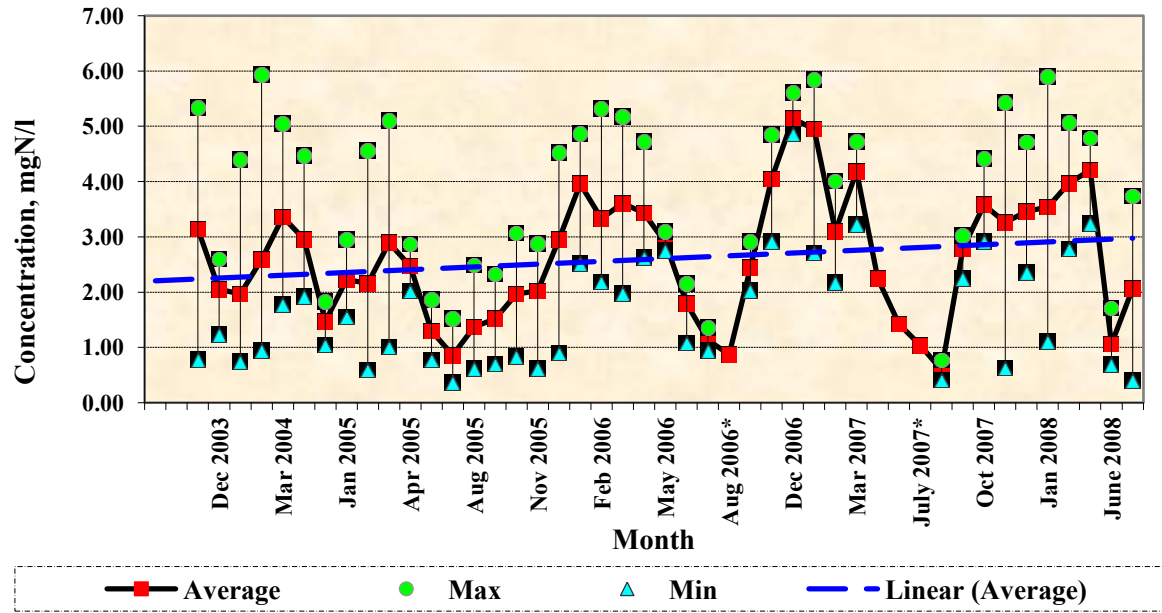
ARGO profiling



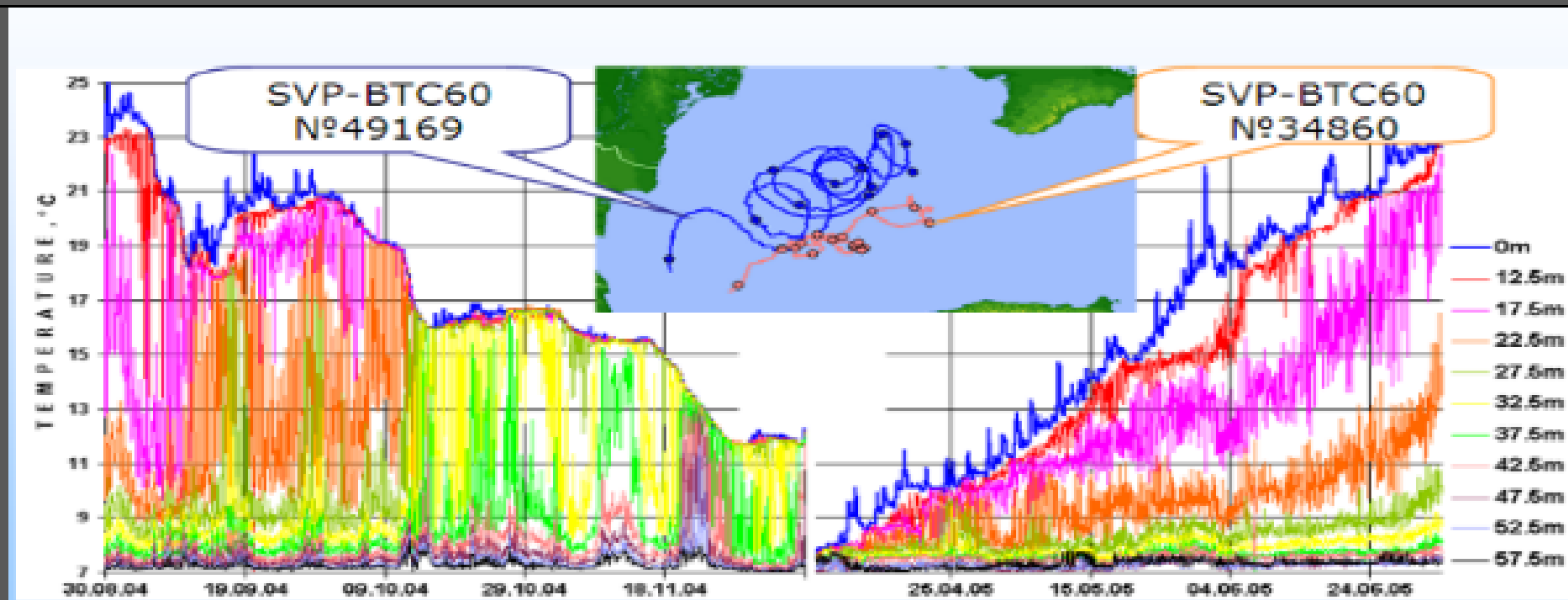
Other real-time observations

- Riverine and other inputs of nutrients and pollutants (poorly developed, but highly important);
- Atmospheric inputs of nutrients and pollutants (only two stations at the moments: Sevastopol & Katsiveli);
- Periodic time-series measurements of oxygen and inorganic carbon & CO₂ at the SOP in Katsiveli).

Atmospheric input of inorganic nitrogen

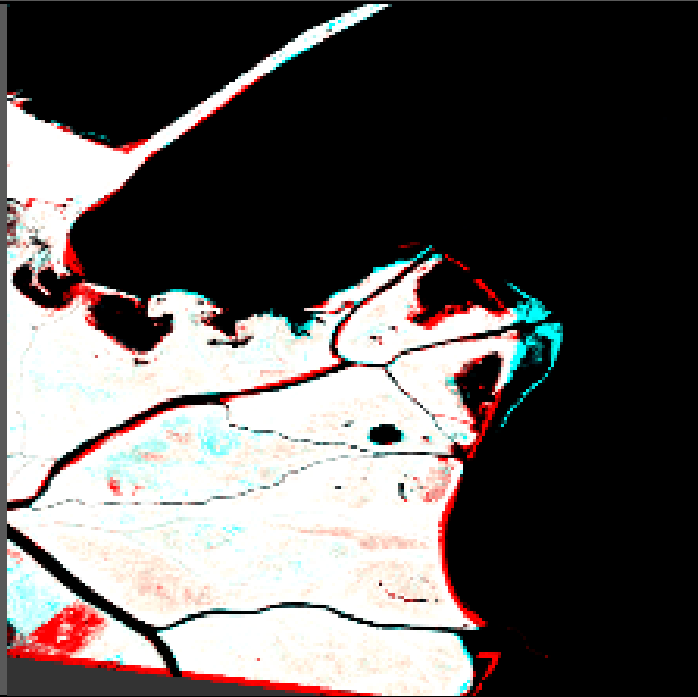


Drifters' temperature profiles

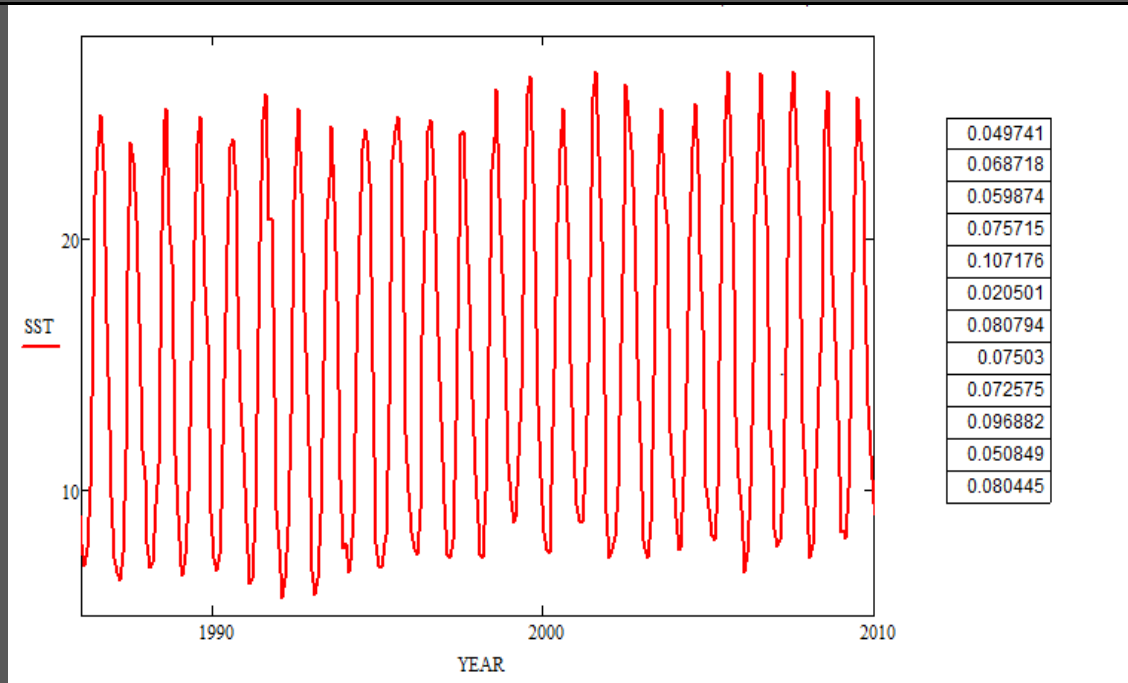


G. Cooling of the water within active layer (on the left) during autumn-winter time and warming – in the spring-summer time measured by drifter equipped with thermistor chain

Trends and changes



Coastline: blue – coastline position in 1984, red- recent state (Danube River mouth, north-western BS)

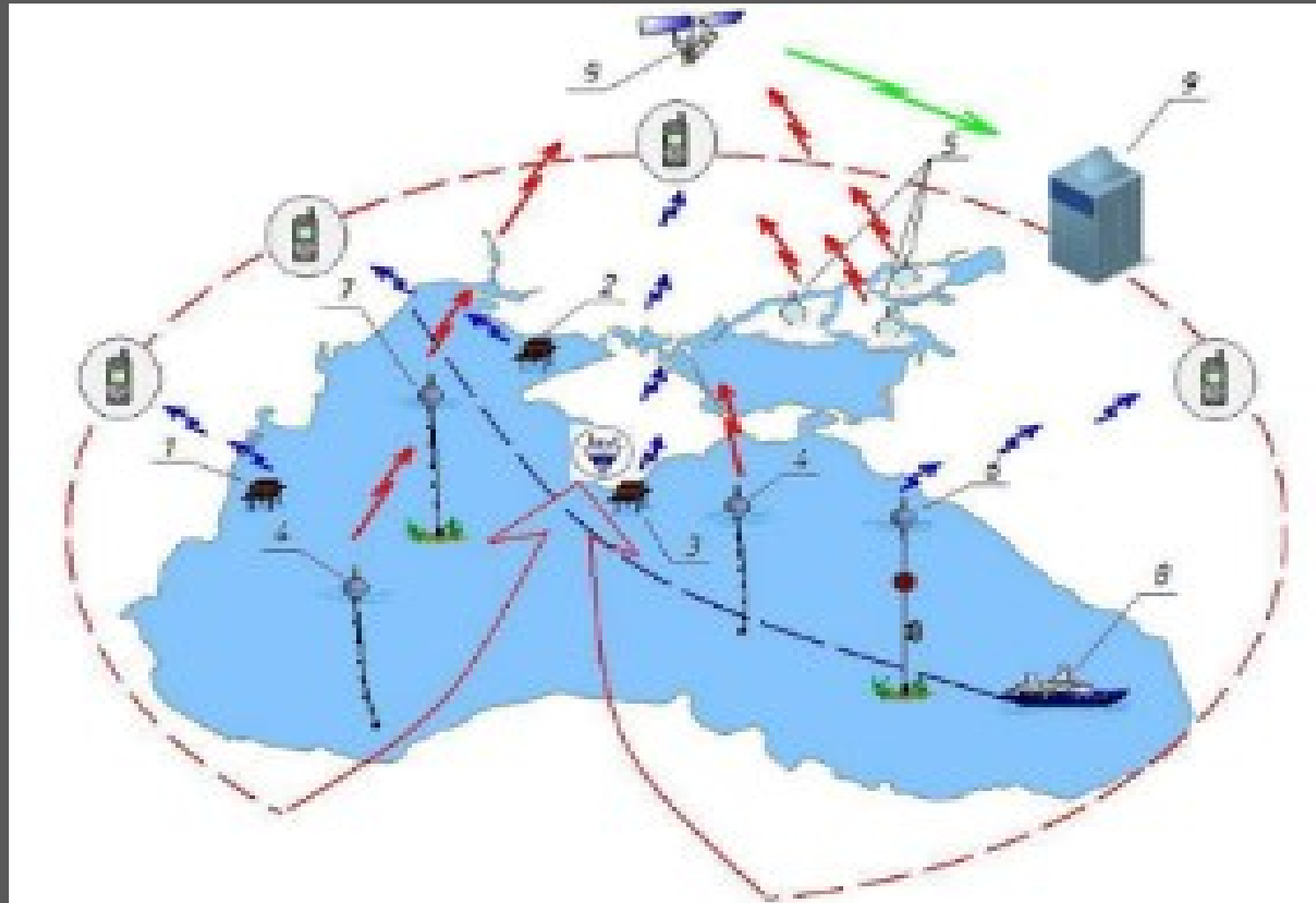


SST variability and trends for each month (the numbers on the right side) (tracing of climate change)

Cost effectiveness of operational monitoring

- CLASS NOAA (Comprehensive Large Array-data Stewardship System), <http://www.class.ngdc.noaa.gov>
- PODAAC NASA (Physical Oceanography Distributed Active Archive Center), <http://podaac.jpl.nasa.gov/>
- Oceancolor WEB NASA, <http://oceancolor.gsfc.nasa.gov/>
- USGS EarthExplorer, <http://earthexplorer.usgs.gov/>
- EASA's Link to Earth Observation, <http://earth.esa.int>
- AVISO, <http://www.aviso.oceanobs.com/en/>

Options for the Black Sea monitoring program



Options for national monitoring programs

- To make real-time data requested for national reports and environment state assessment;
- Training for satellite and drifters data access, management, analysis, etc.;
- Black Sea Data center for real-time observations;
- Some national funds, of course, to support national and basin-wide activities (jointly utilized equipment, data management, drifters, etc.)

Final remarks and suggestions:

- Operational (real-time) monitoring should become an integral part of the BS monitoring programmes;
- The only real possibility to do it is to start with environmental assessment making real-time observation needed.