Natural Catastrophes in the Global Change Epoch: New Geography and New Interactions

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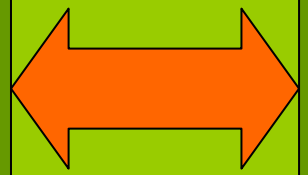
The Global Change

Natural

(may be influenced by human activity)

- ***Climate change,***
- ***Desertification,***
- ***Biotic processes,***

etc.

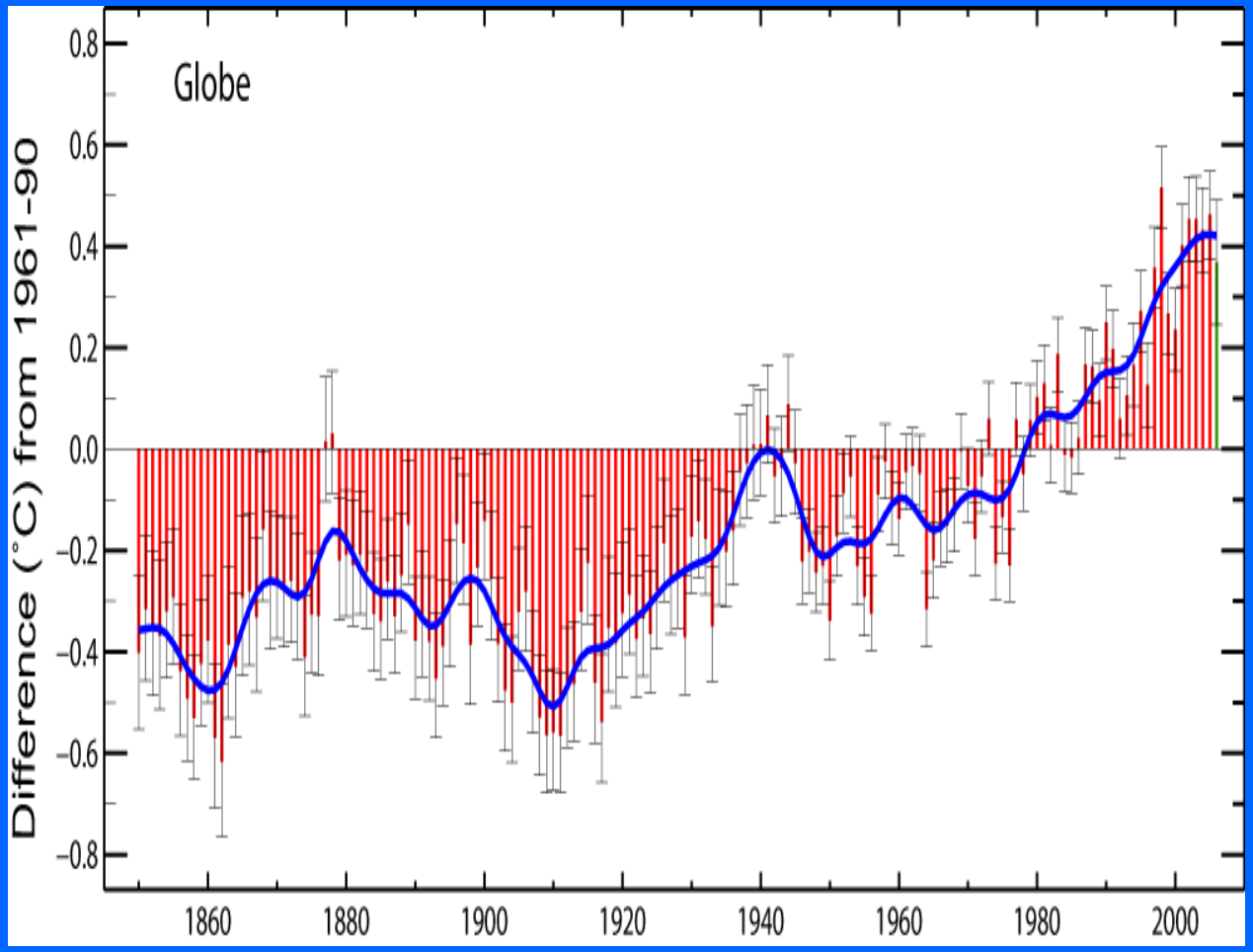


Anthropogenic

- ***Land use change***
- ***Migration of species with transport,***

etc.

Climate change



Observed effects:
In mid-latitudes, winter warming prevails; less frosty days; the minimum temperatures have grown.

Weather extremes frequency: on global scale, the tendencies are unclear.

Many experts suggest them to be more frequent in some regions (incl., e.g., both heavy rains and droughts).

Climate change related hazards

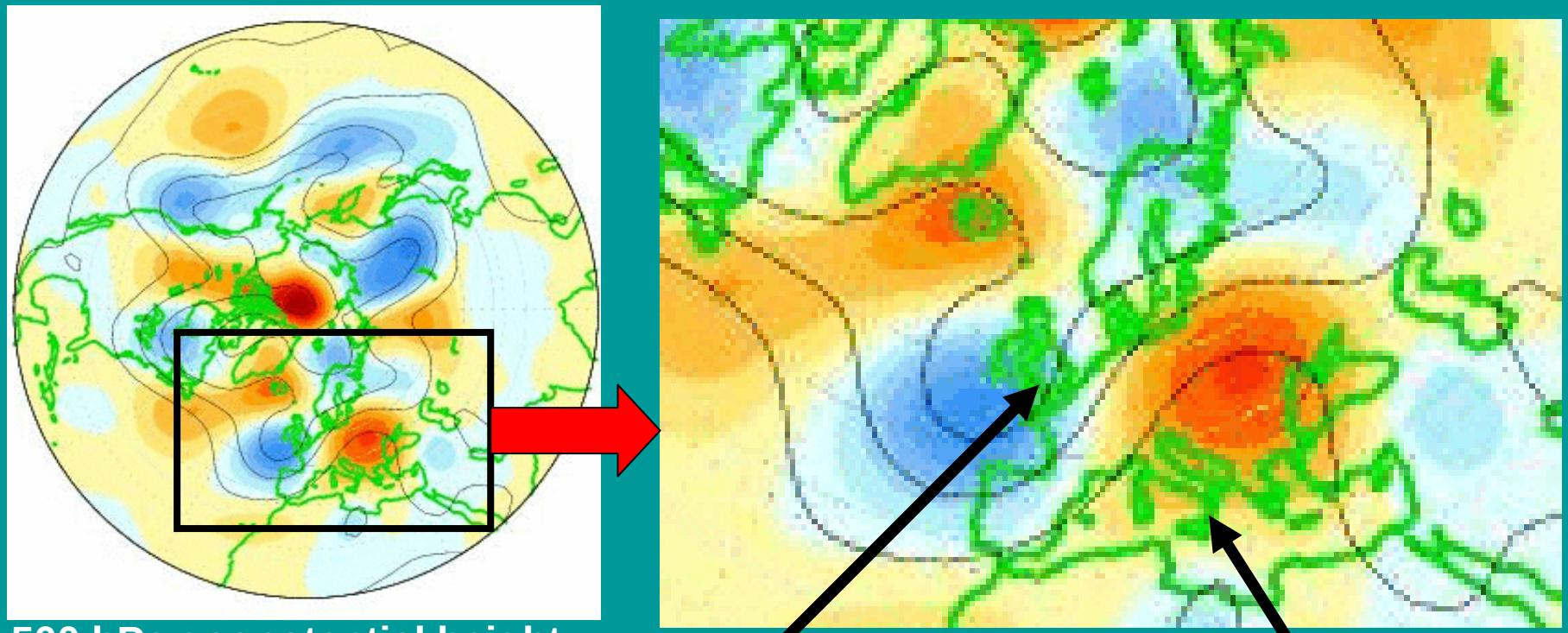
Shifts in the seasons (longer thunderstorm season)

Possibility for winter hazards to return

More icebergs due to land ice sheets degra-dation

Deeper permafrost thawing

July, 2007: heavy rains in floods in UK and forest fires in Mediterranean result from the same circulation mechanism - *blocking*

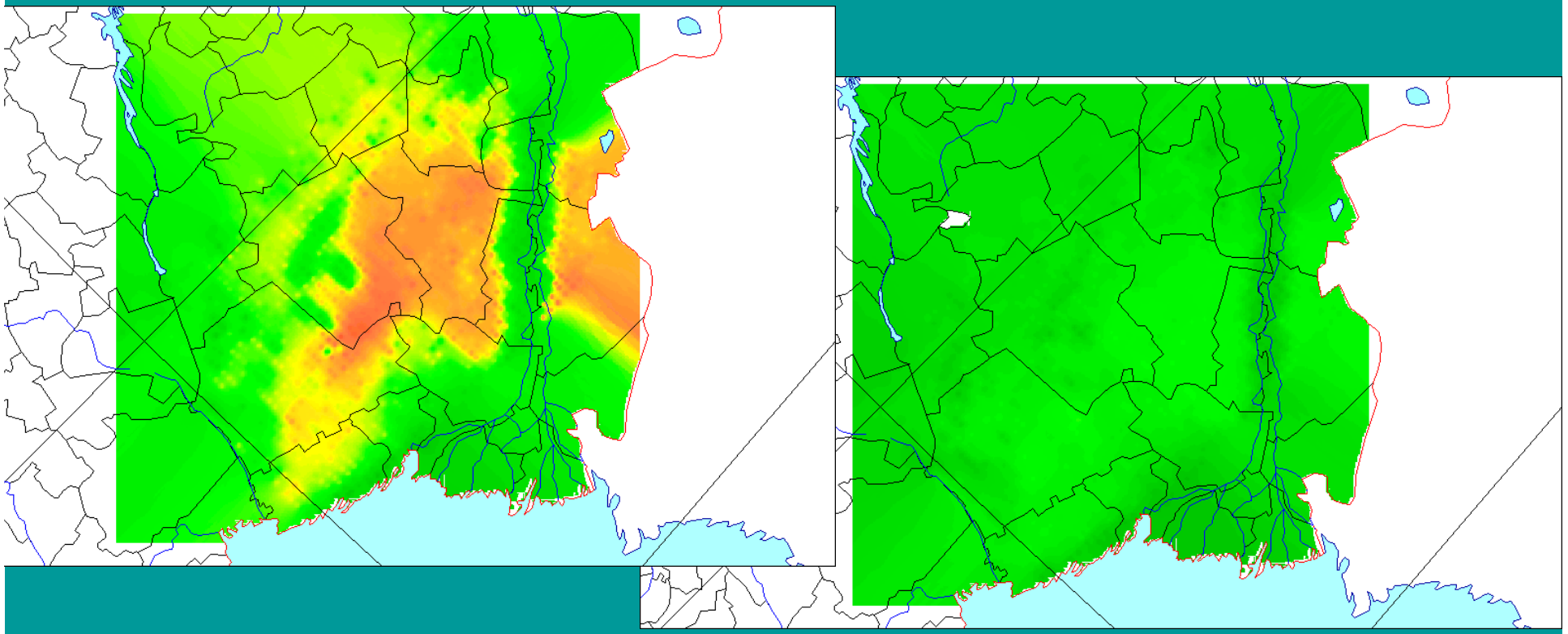


500 hPa geopotential height
(NCEP data)

Desertification

Complex process (dry weather, vegetation degradation, overgrazing, natural cycles, etc.).

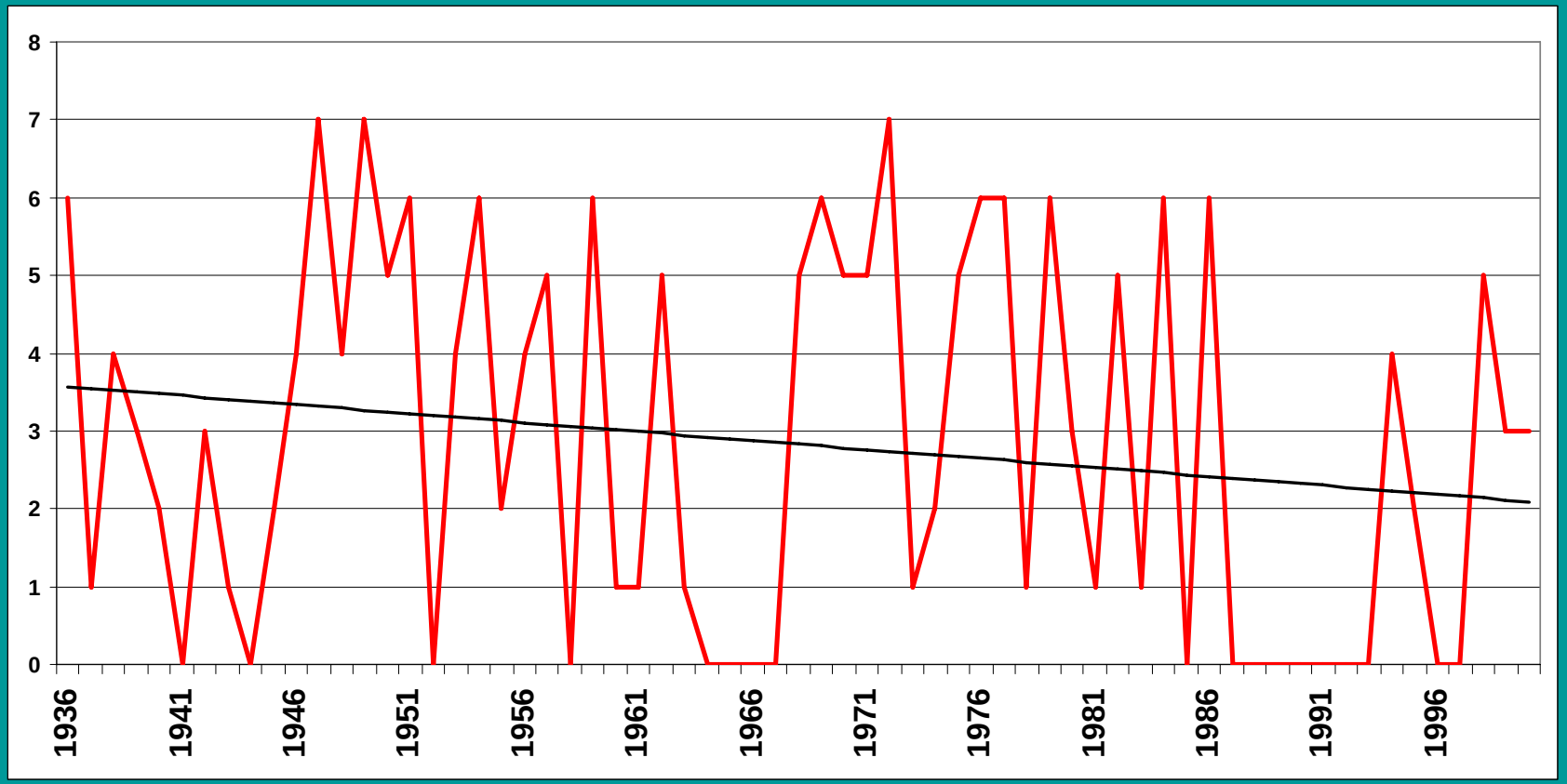
Desertification is weakening in the Caspian lowland in 1990s, mostly due to natural reasons



NDVI average for May-September

of 1986 (left) and 1993 (right)

Climatic dryness index time series
Area: 46-47N, 44-45E (Elista, Caspian lowland)

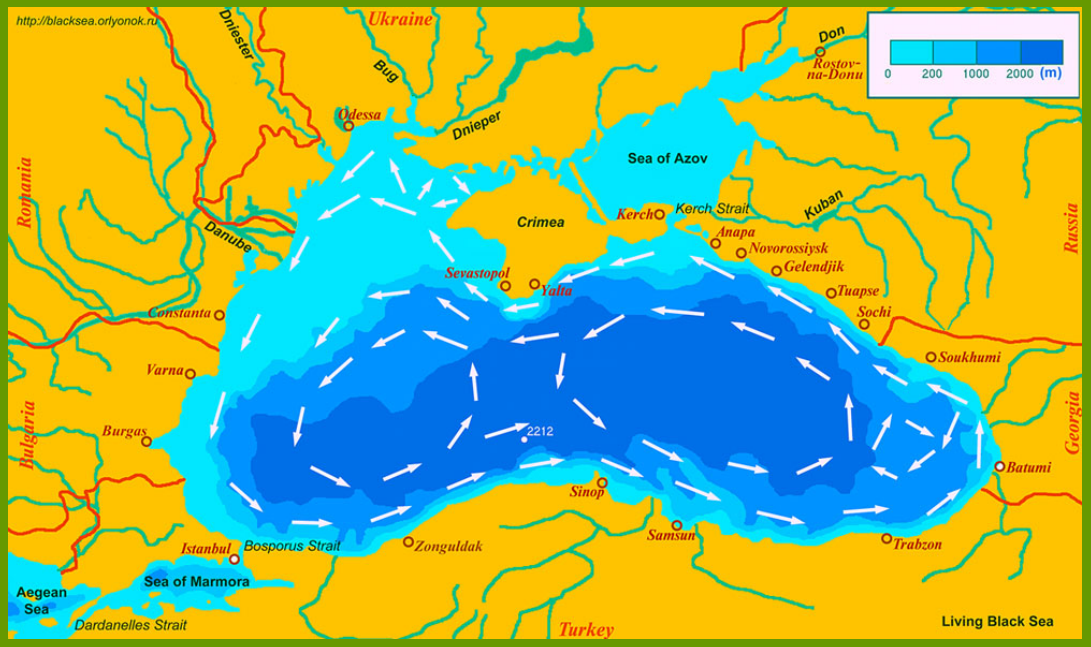


Land use change

Complex process leading to significant transformation of heat/water exchange on land.

Black sea:

Internal sea with salinity half of that in the ocean. Numerous endemic species, unique ecosystem.



<u>Catastrophic anthropogenic migration</u>

The predator-like comb jelly *Mnemiopsis leidyi* eats zooplankton on which many fish feed, gobbles up fish eggs and fry.

It arrived to Black Sea with ballast waters from the North American coast in 1980s, and in 5-7 years adjusted to the local conditions. After that, fish amount has decreased by about 10-12 times.

Snow avalanches – the “white death” of the mountains.

Under warmer climate, more “wet” avalanches with heavier snow.

Changes in the local geography of avalanches.

Positive experience of the IG RAS in participation in research projects on the geography of disasters and natural hazards

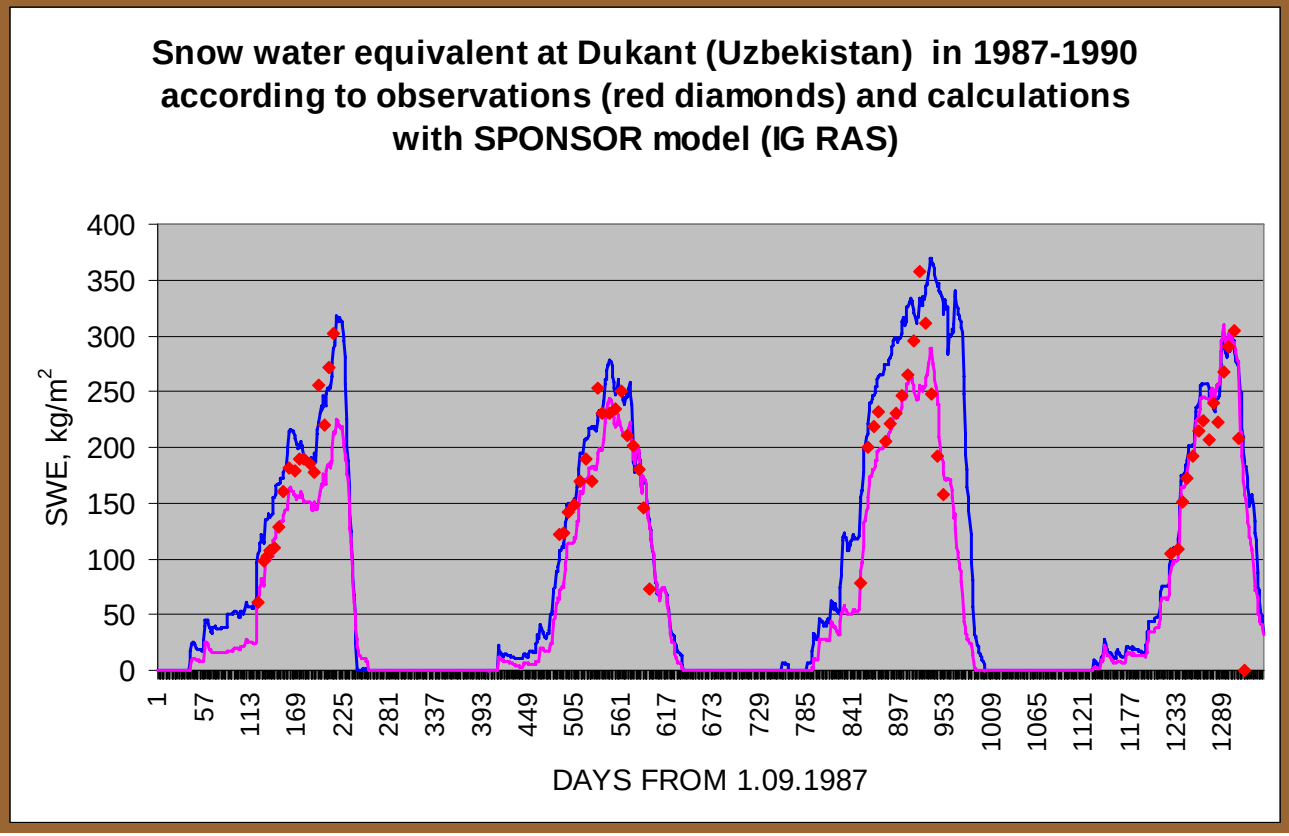
Main fields:

1) Basic research programs of the Russian Academy of Sciences (Environment and climate change; Natural hazards ; Processes in the polar regions of the Earth; Natural and socio-economic factors of the environment changes);
2) Joint projects realized together with other scientific and governmental agencies (such as Hydrometeorological Service, universities, etc.)
3) Applied studies ordered by the Ministries of Emergency Situations; Regional Development; Economy and Technologies; Natural Resources

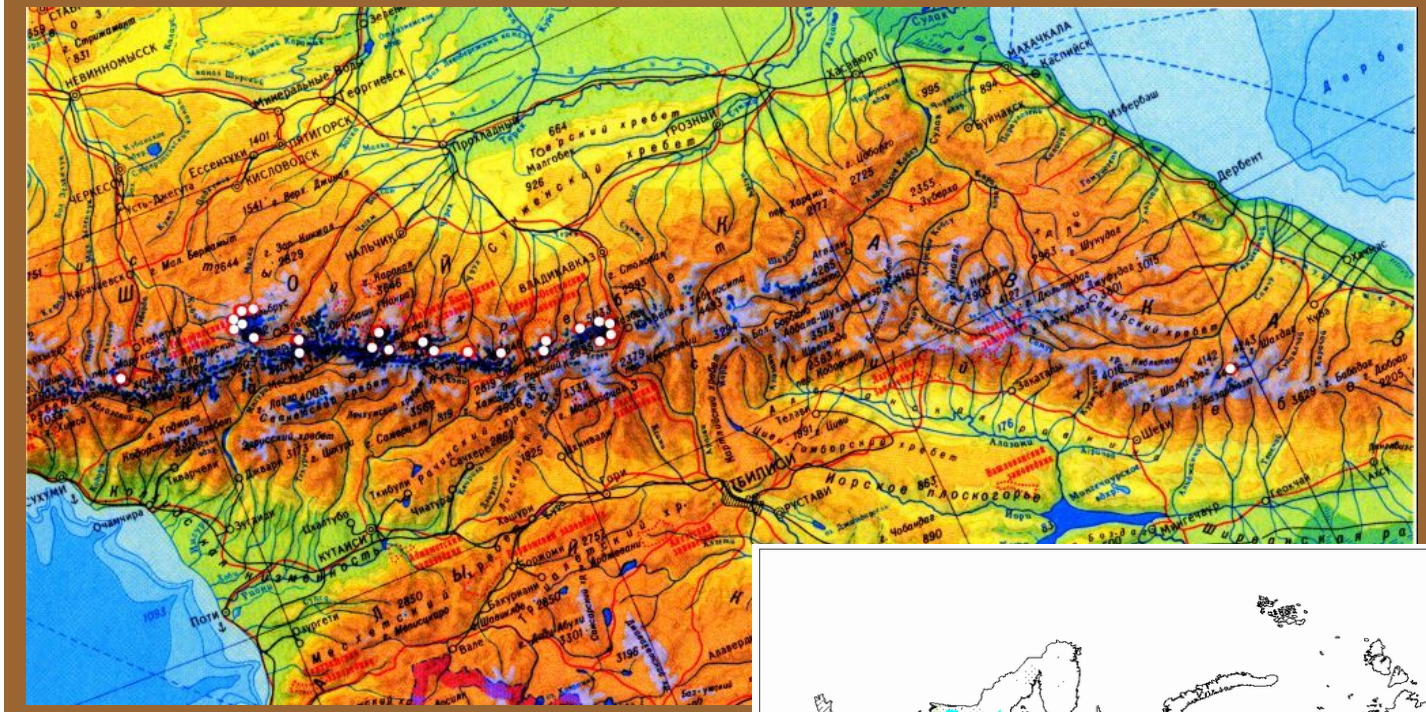
   (*Regional analysis of the natural hazards ; Mitigation studies; Spreading of the population under climate/environment changes; Conservation projects; Biotic changes; GIS applications*).

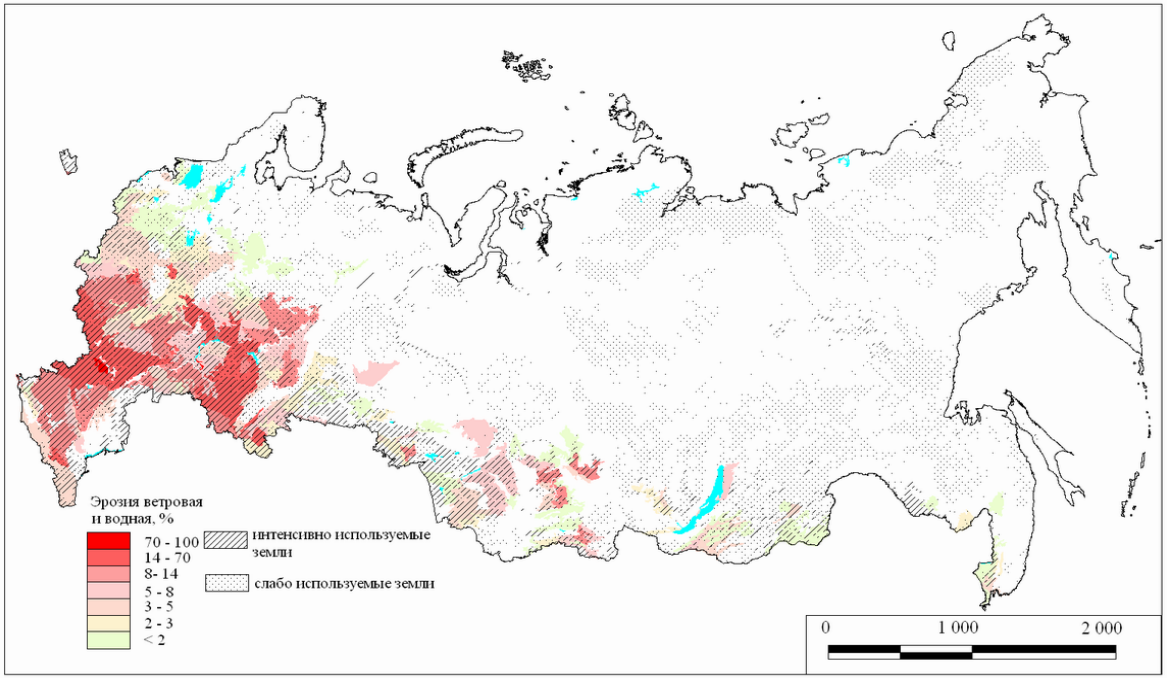
Monitoring the glacial systems

Elbrus mtn – the highest peak in Europe (5642 m), extinct volcano with several surging glaciers. ISS image (direct connection to IG RAS)



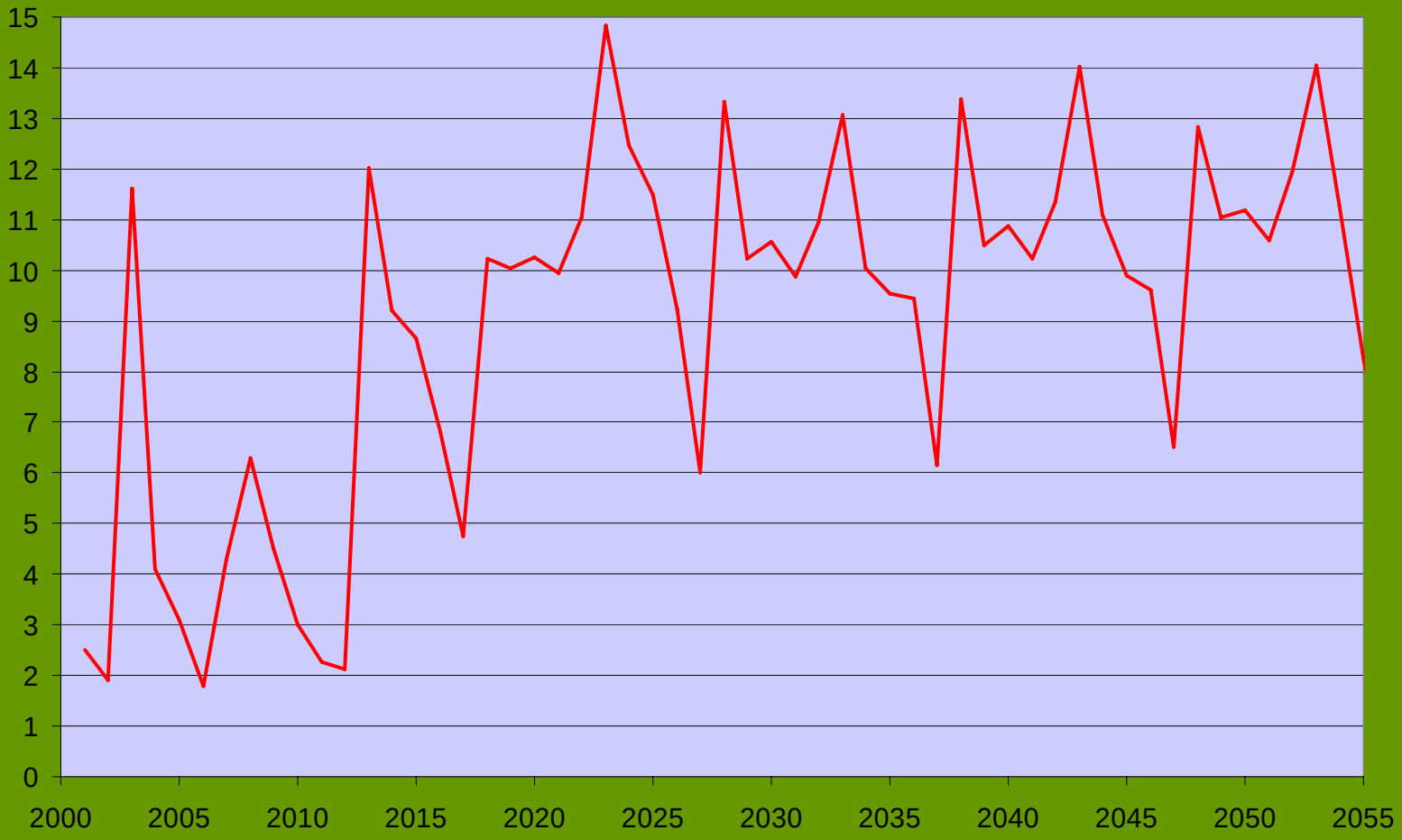
Maps of surging glaciers in Caucasus mountains and wind erosion in Russia – results of studies at IG RAS





Permafrost modeling

Annual maximum soil temperature at 25 cm depth at Marre-Sale (West Siberia) under certain climate change scenario, evaluated by SPONSOR model (IG RAS)



Potential directions for the IG RAS participation in NATO projects on ecological security

1. Listing the natural and human-built objects, requiring monitoring due to the risk of disasters as a result of climate change
2. Adaptation of aerospace sounding for the monitoring of natural disasters connected to the climate change
3. Analysis of catastrophic hydrological anomalies and possible consequences of hydrotechnical constructions collapse
4. Studies of the natural biotic catastrophes connected to the climate change (invasions of species, pests outbursts, etc.)
5. Geographical analysis of natural hazards and disasters and a possibility of their early forecasts and preventive measures on the mitigation
6. Development of the GIS-technologies, modeling, statistical analysis, mapping and information support for monitoring, analysis and management of the disaster consequences

THANK YOU !