Climate change and adaptation in the Carpathians

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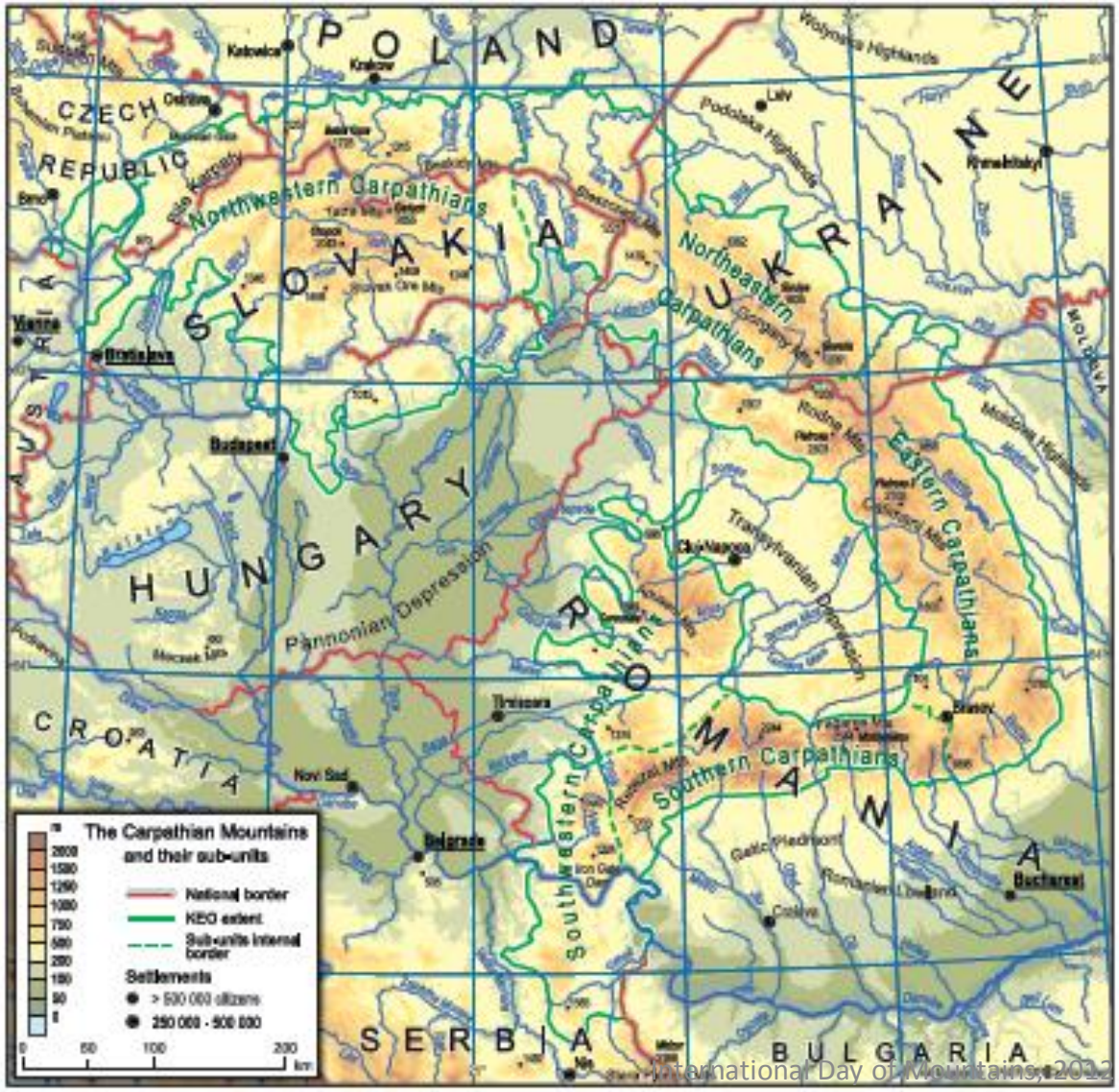
Carpathians

- Length about 1500 km^2 , second longest in Europe
- Highest peak is 2655 m
- Area is 190000 km^2

Location

Map of the Greater Carpathian Region



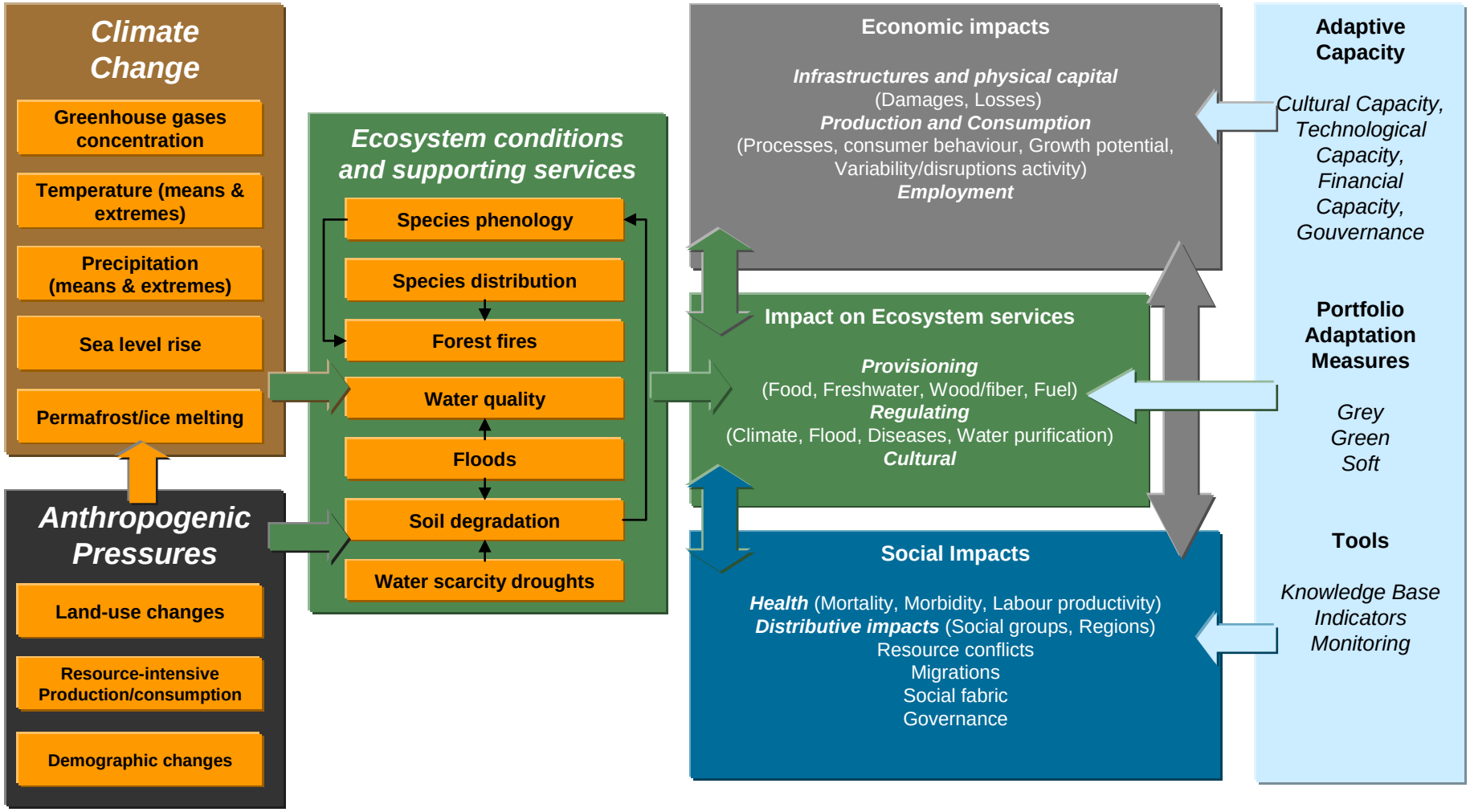
Area of the square around is about 500000 km^2 (appr. the territory of Spain)

Problems

- Less studied regions
  - Carpathians
  - Southeastern-Europe
- Smaller countries mostly with complex topography
- Specific climatological and meteorological effects:
  - The basin is open to south
  - Could water pillow
  - Summer drying
  - etc.

Environmental pathway of vulnerability and adaptation

Jacques Delsalle, Evdokia Achilleos, DG Environment, Unit D1 – Protection of Water Resources



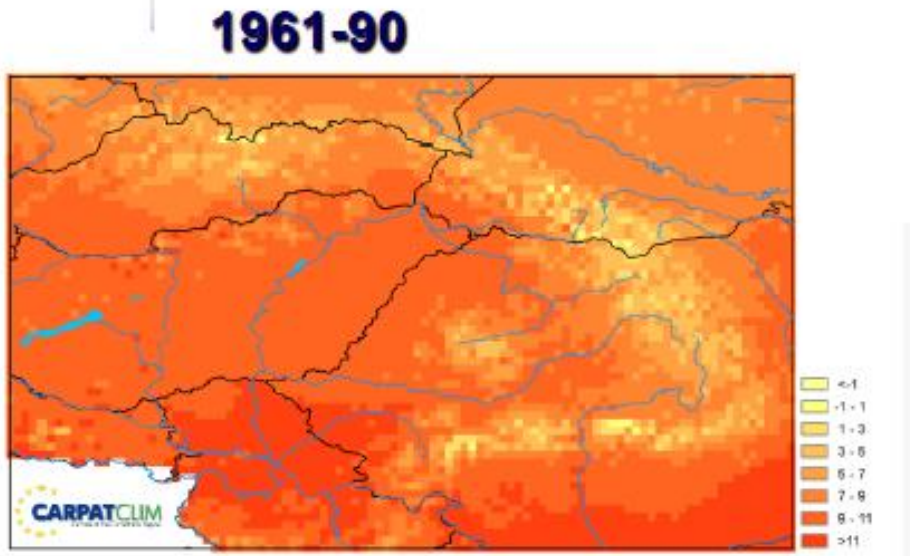
EU Carpathian projects

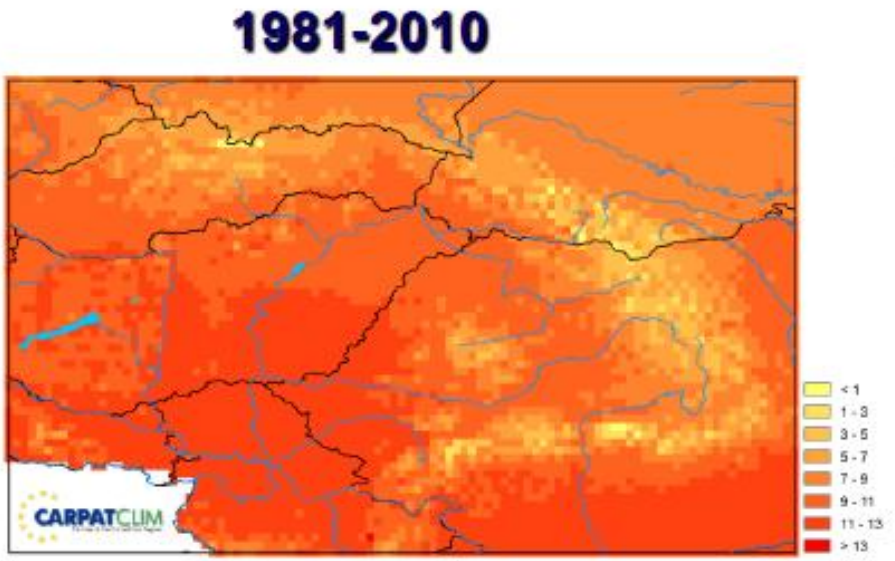
- Climate of the Carpathian Region (CARPATCLIM)
- Integrated assessment of vulnerability of environmental resources and ecosystem-based adaptation measures (Service contract CARPIVIA)
- In-depth assessment of vulnerability of environmental resources and ecosystem-based adaptation measures (Framework contract CarpathCC)

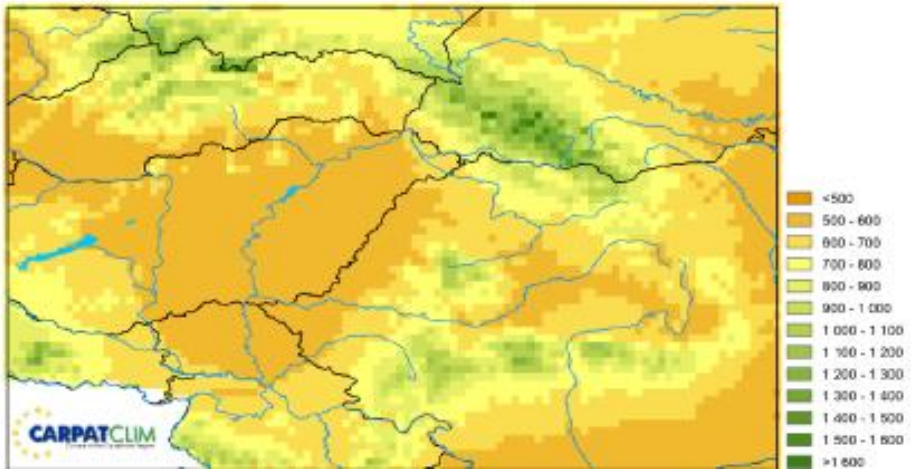
CARPATCLIM results

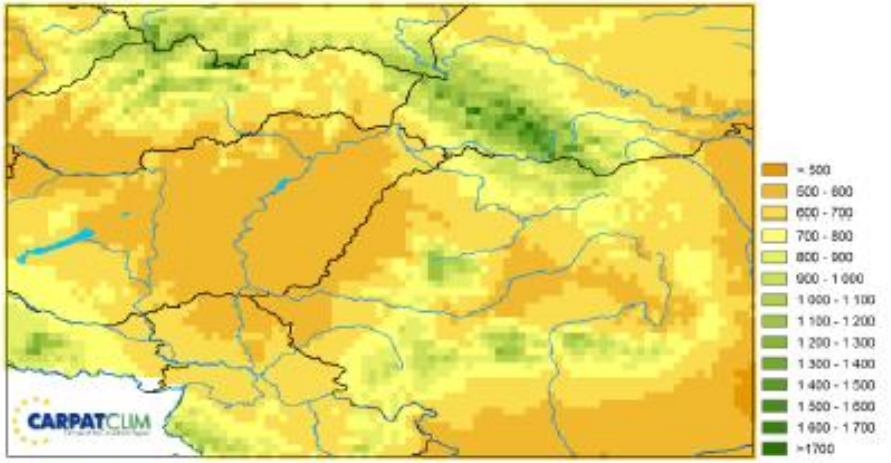
- High-resolution (10 km*10 km) freely available databases
- Data availability on monthly and daily level
- Time frame: 1961-2010
- Results shown below based on Lakatos et al., 2012

Temperature and precipitation averages

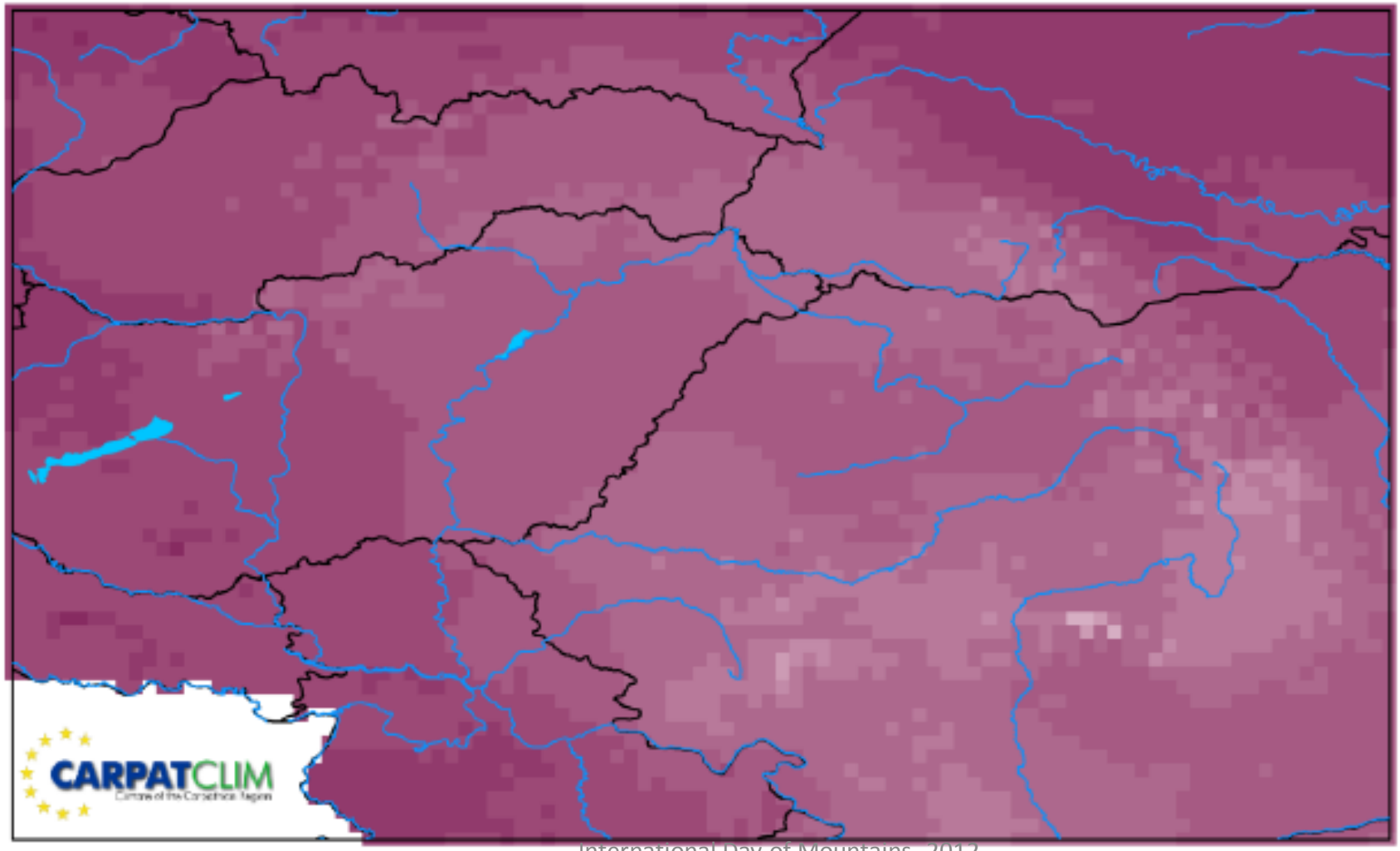




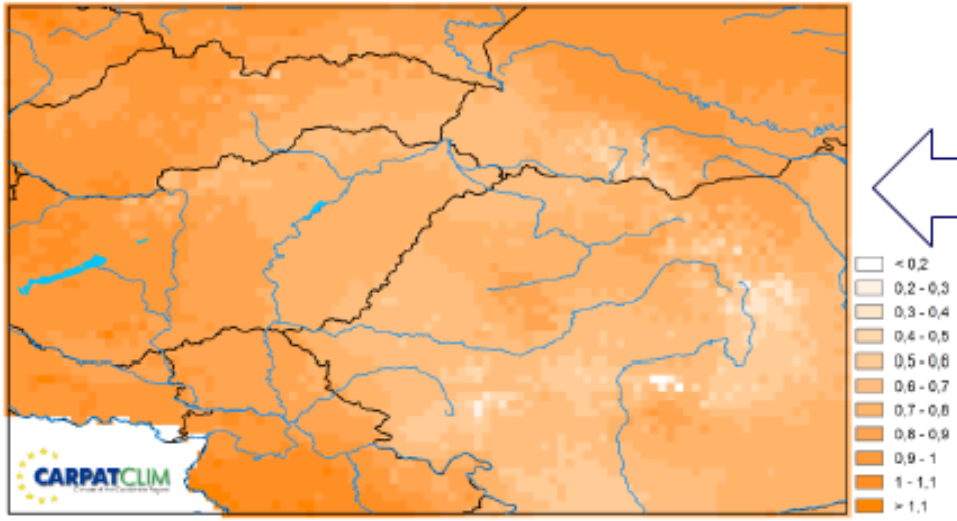




Temperature changes, 1961-2010

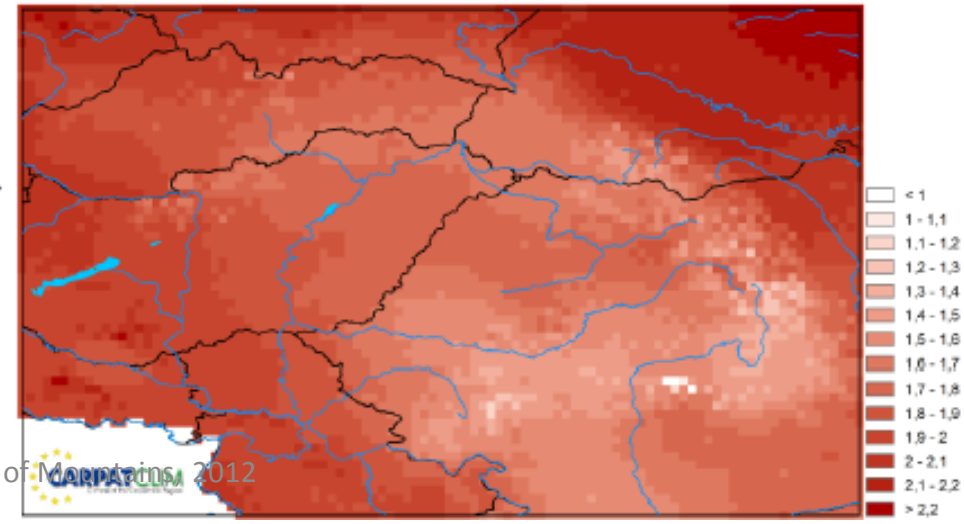


Estimated temperature changes according to the bounds of the 0.1 significance confidence interval, yearly, 1961-2010

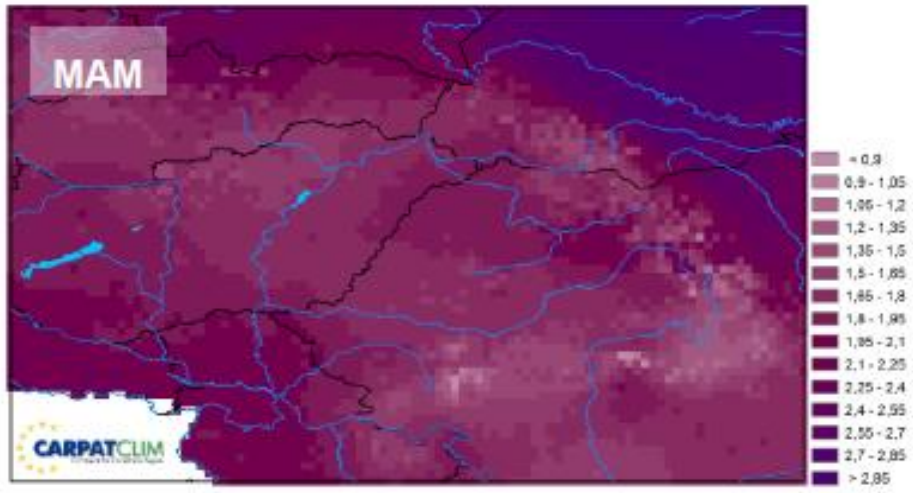


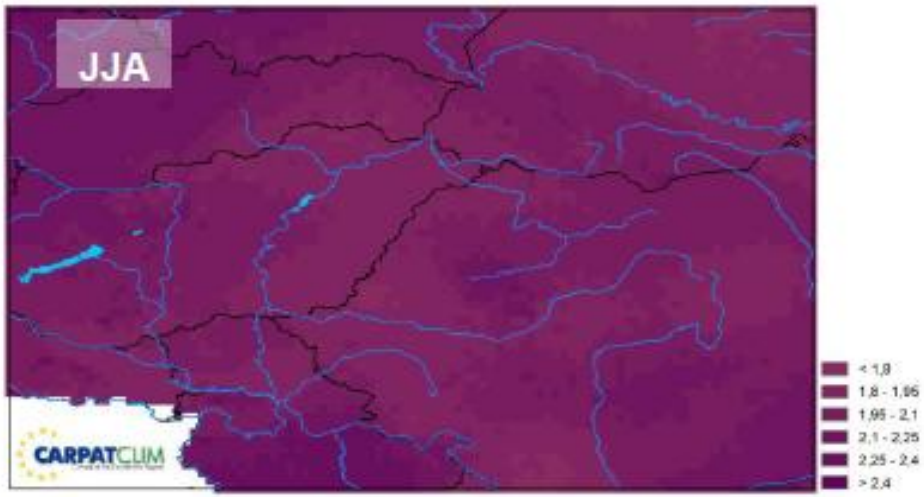
lower bound estimation

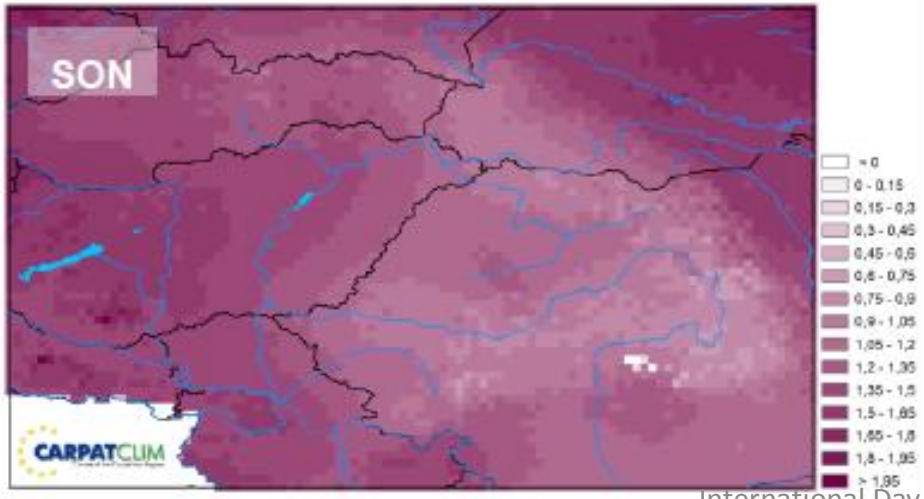
upper bound estimation

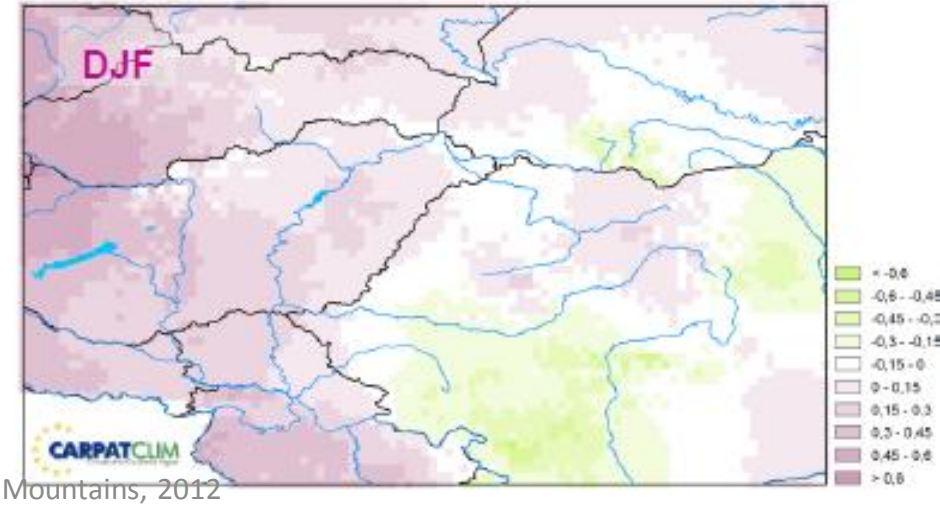


Seasonal temperature changes, 1961-2010

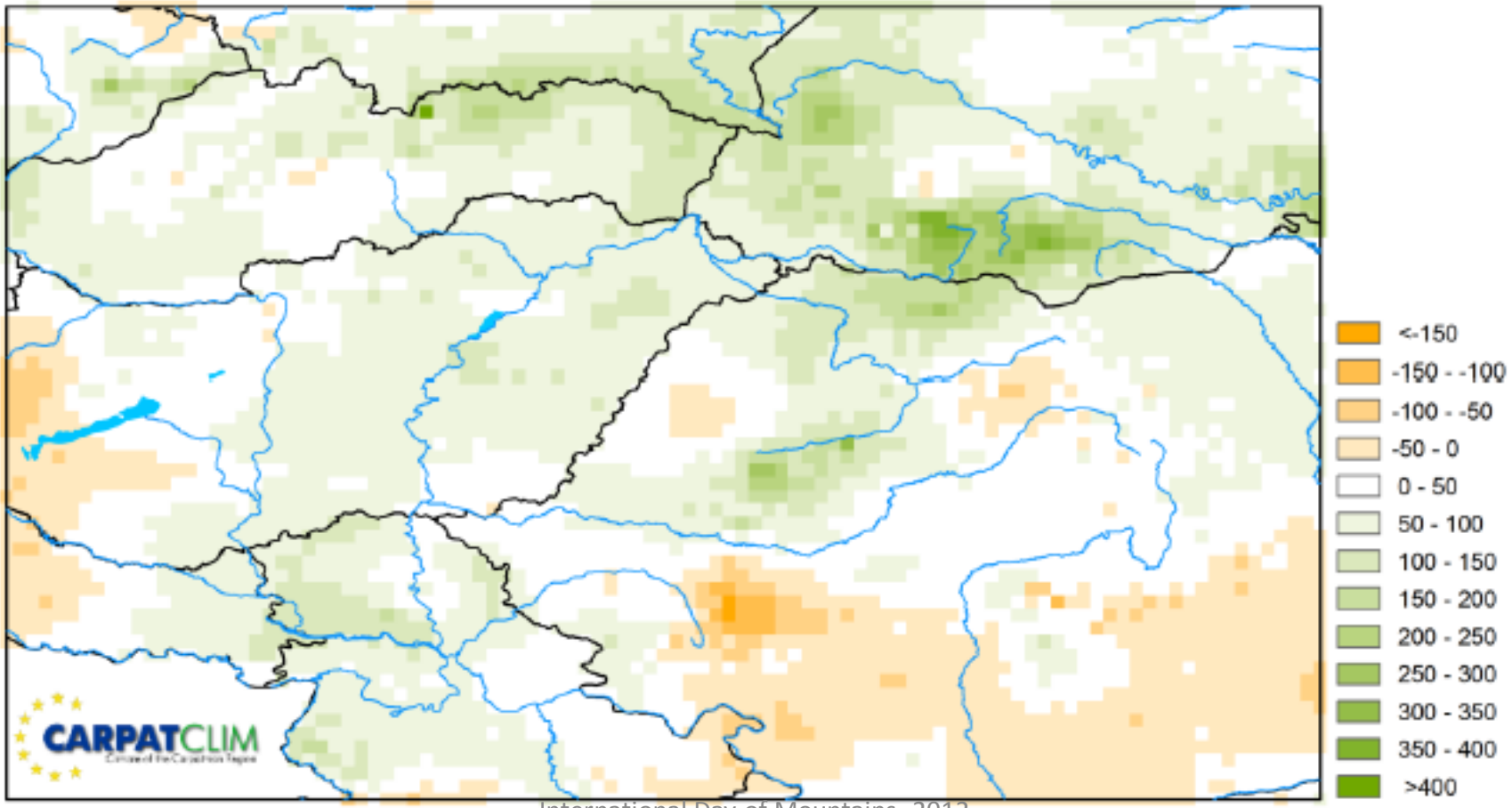




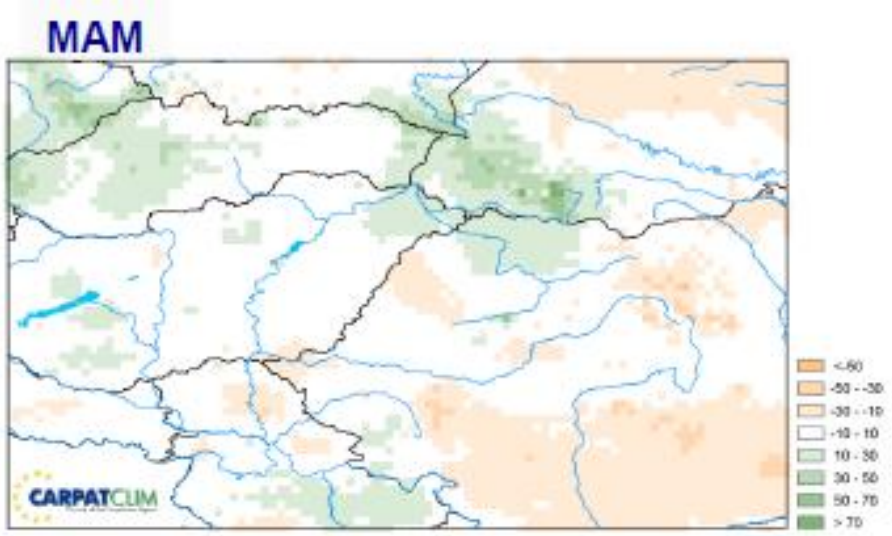


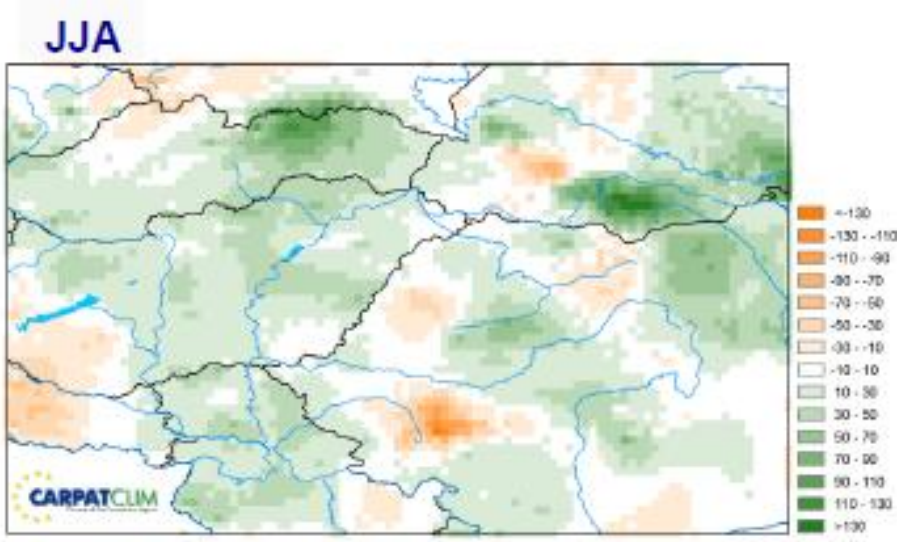


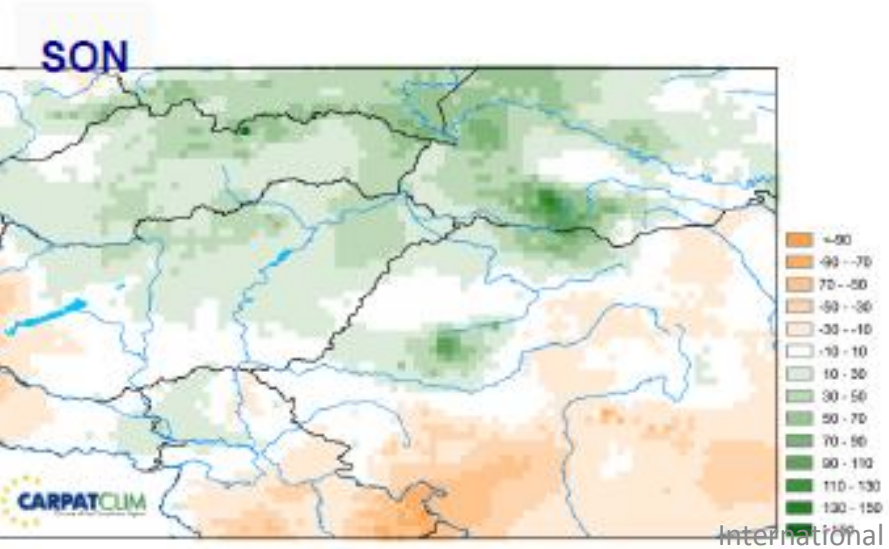
Change of the annual precipitation sum 1961-2010

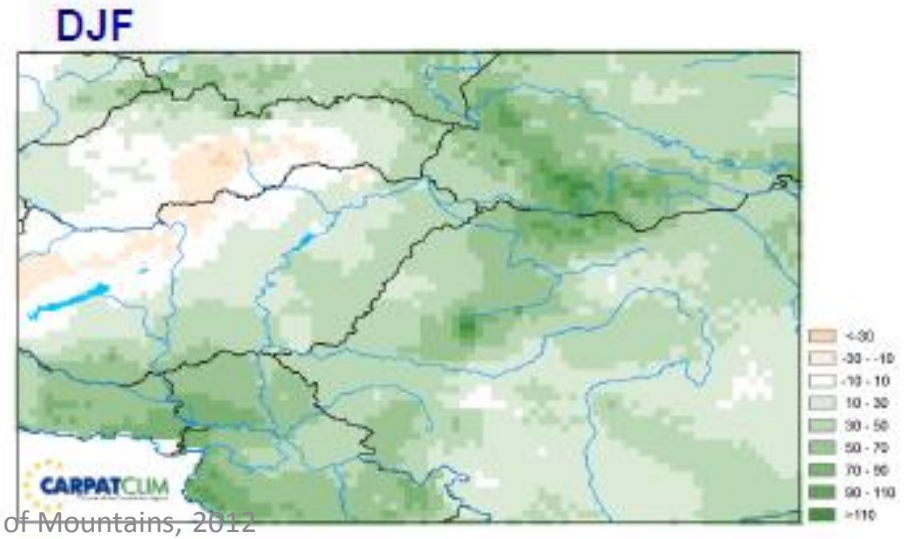


Change of the seasonal precipitation sums 1961-2010

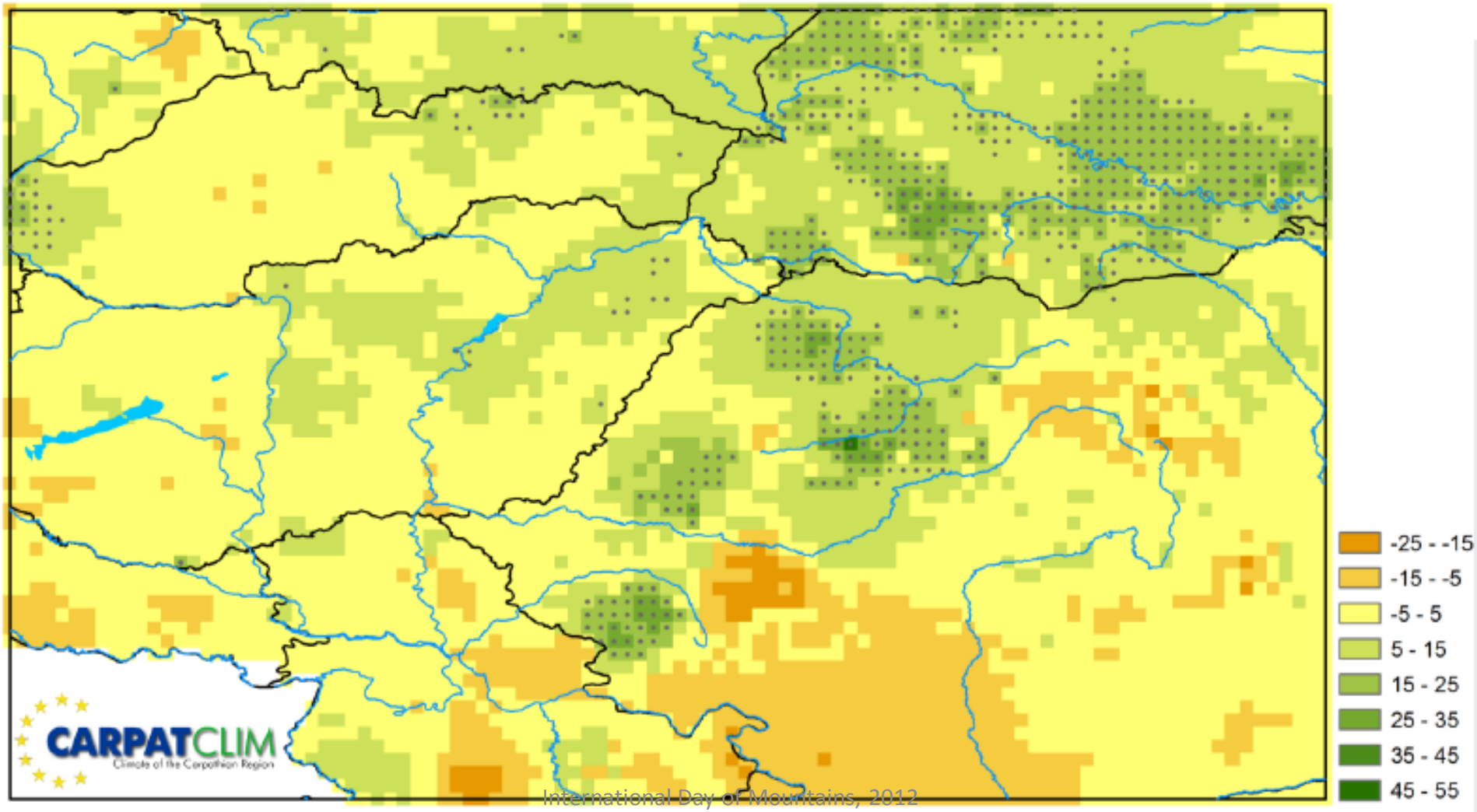




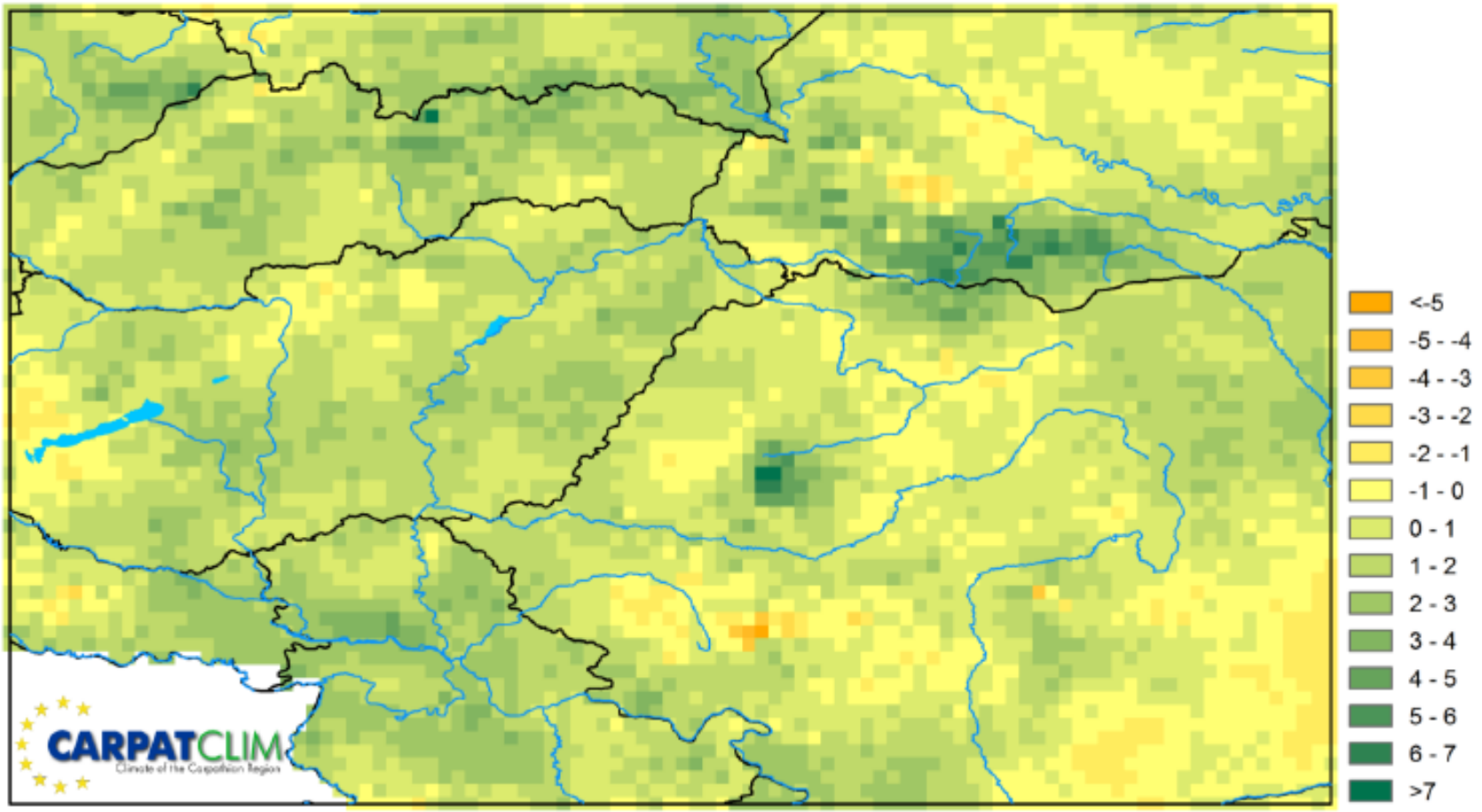




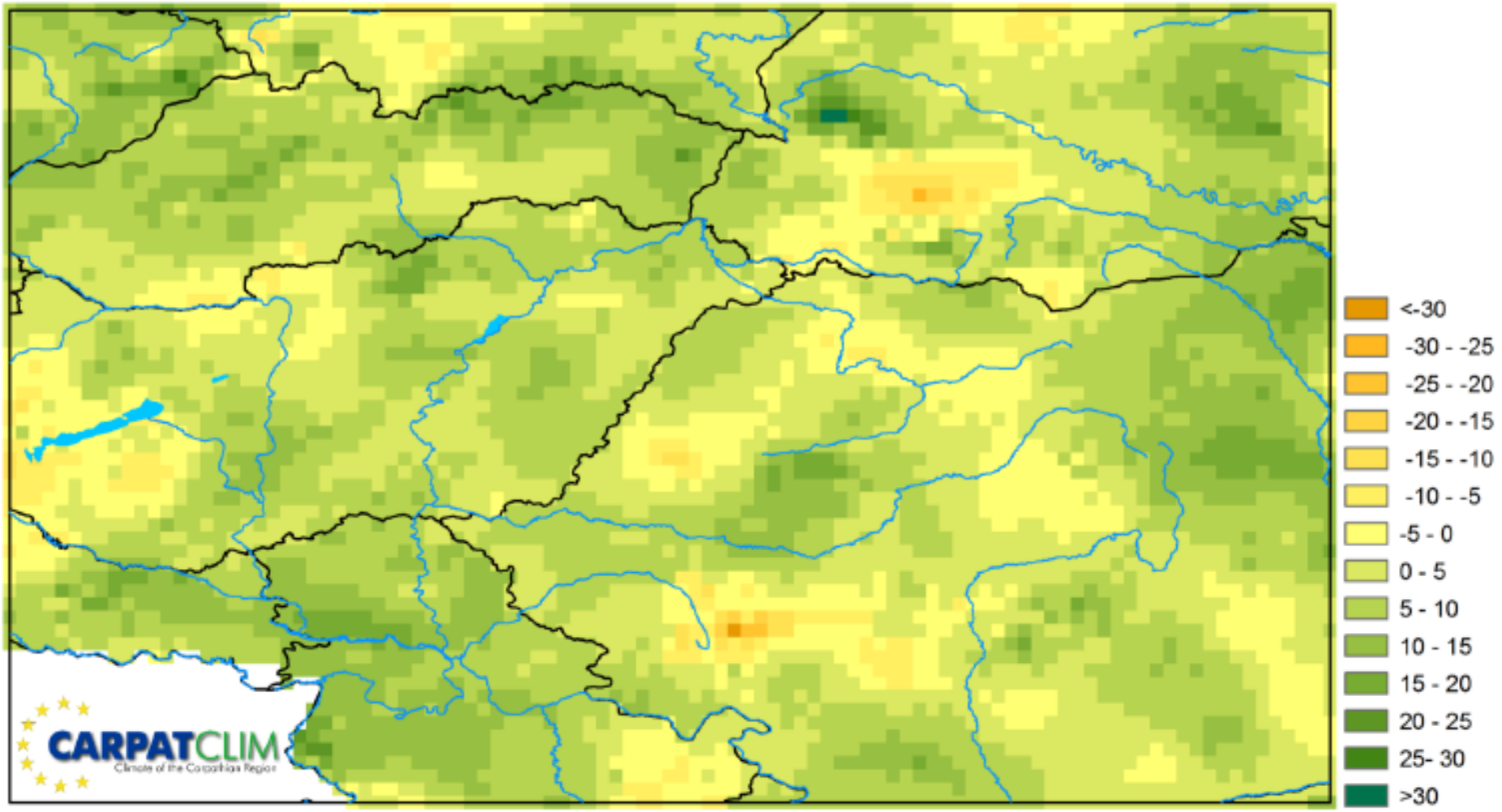
Change in the number of wet days 1961-2010



Change in the number of days with precipitation above 20 mm, 1961-2010



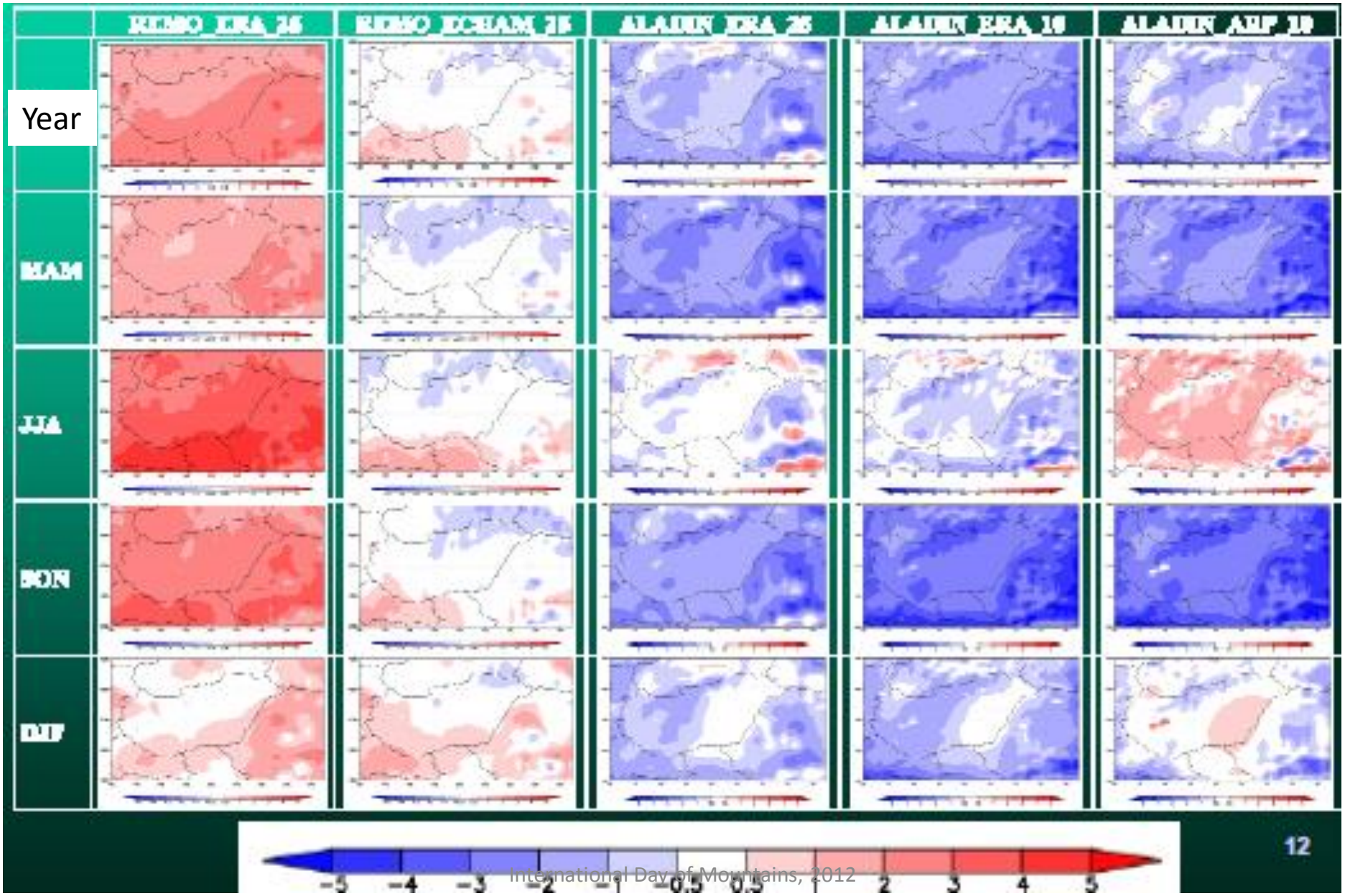
Change in the maximum daily precipitation sum, 1961-2010



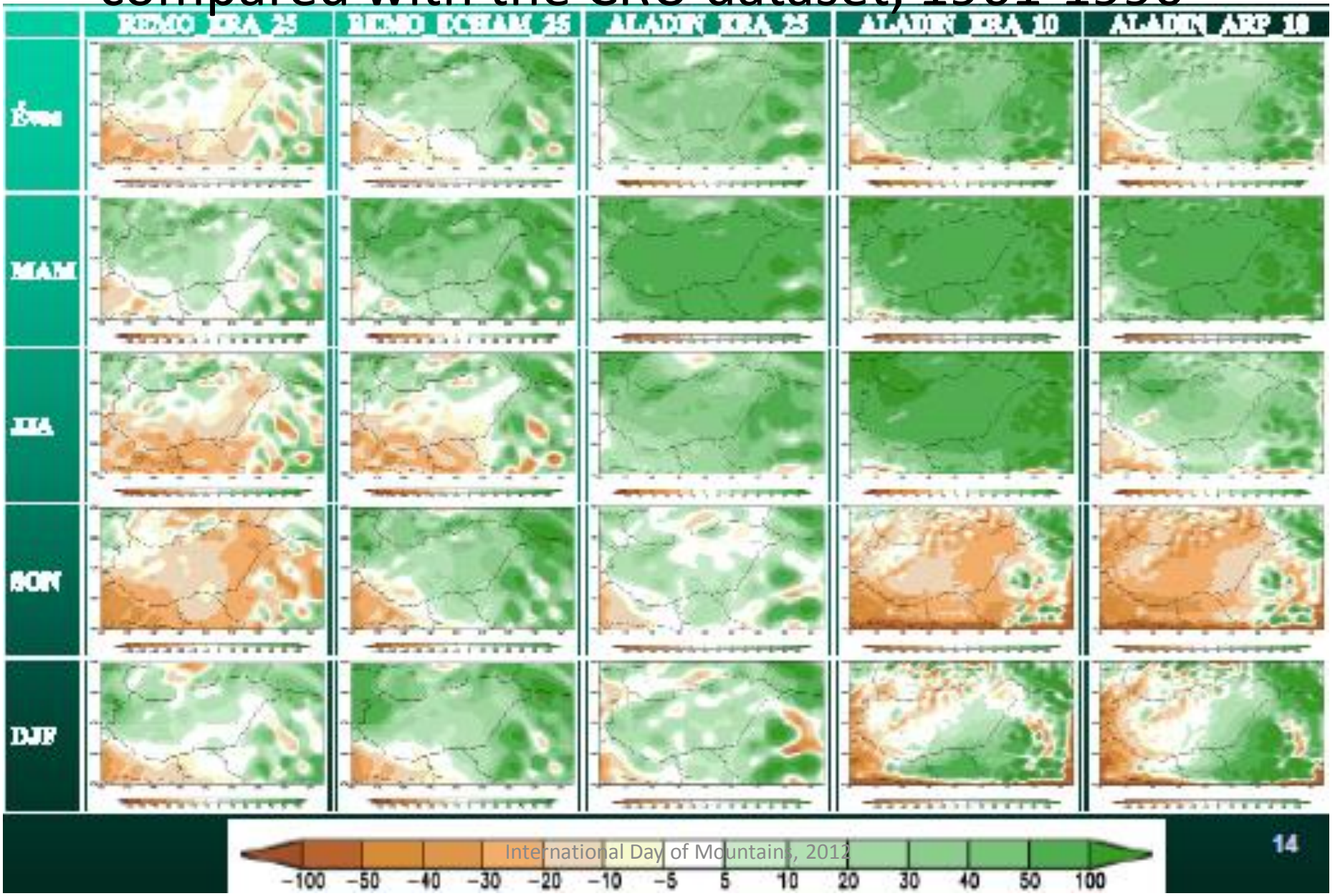
FUTURE

(SZABÓ, P. ET AL, 2010)

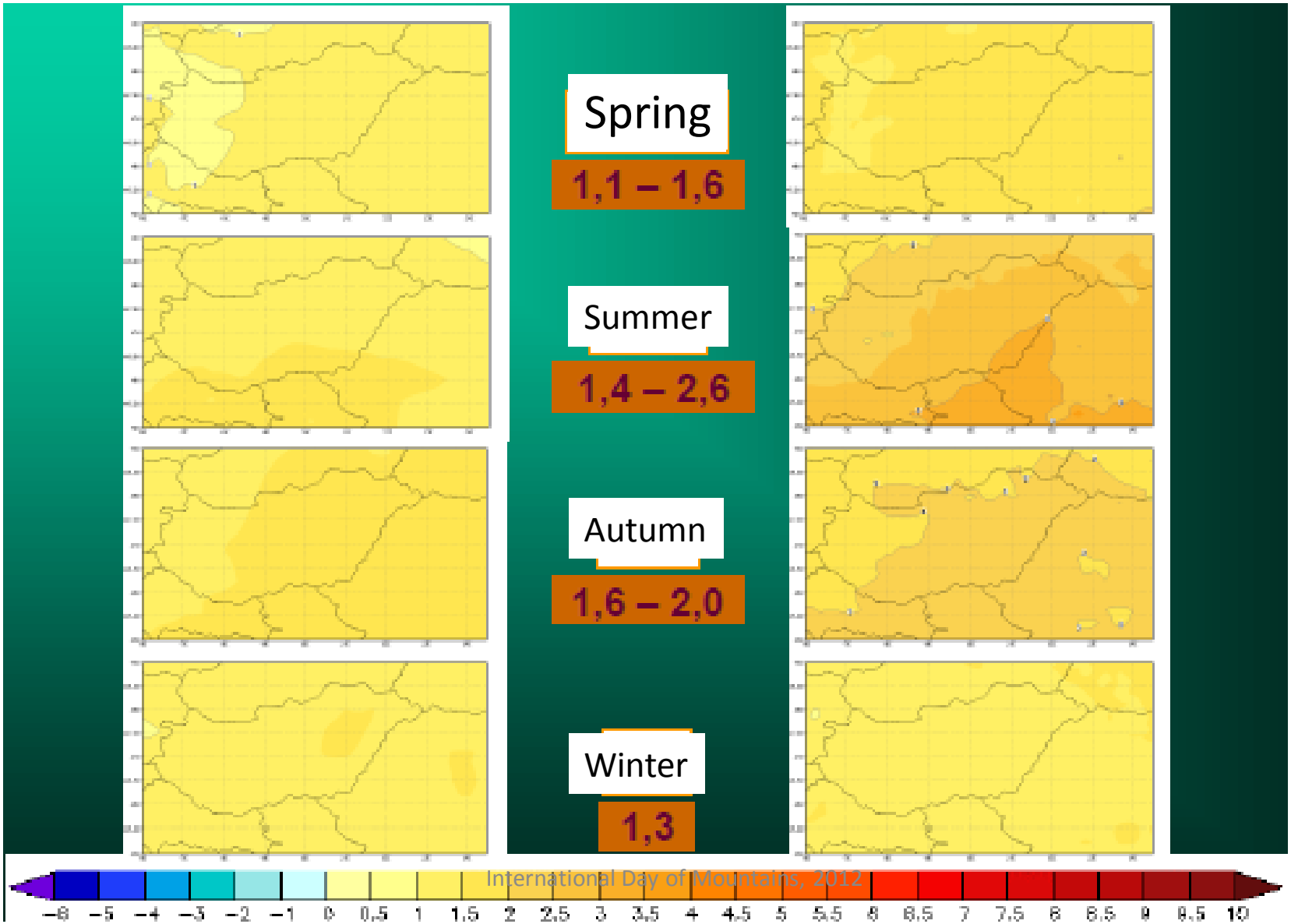
Model outcomes for 1961-1990, compared with the CRU dataset



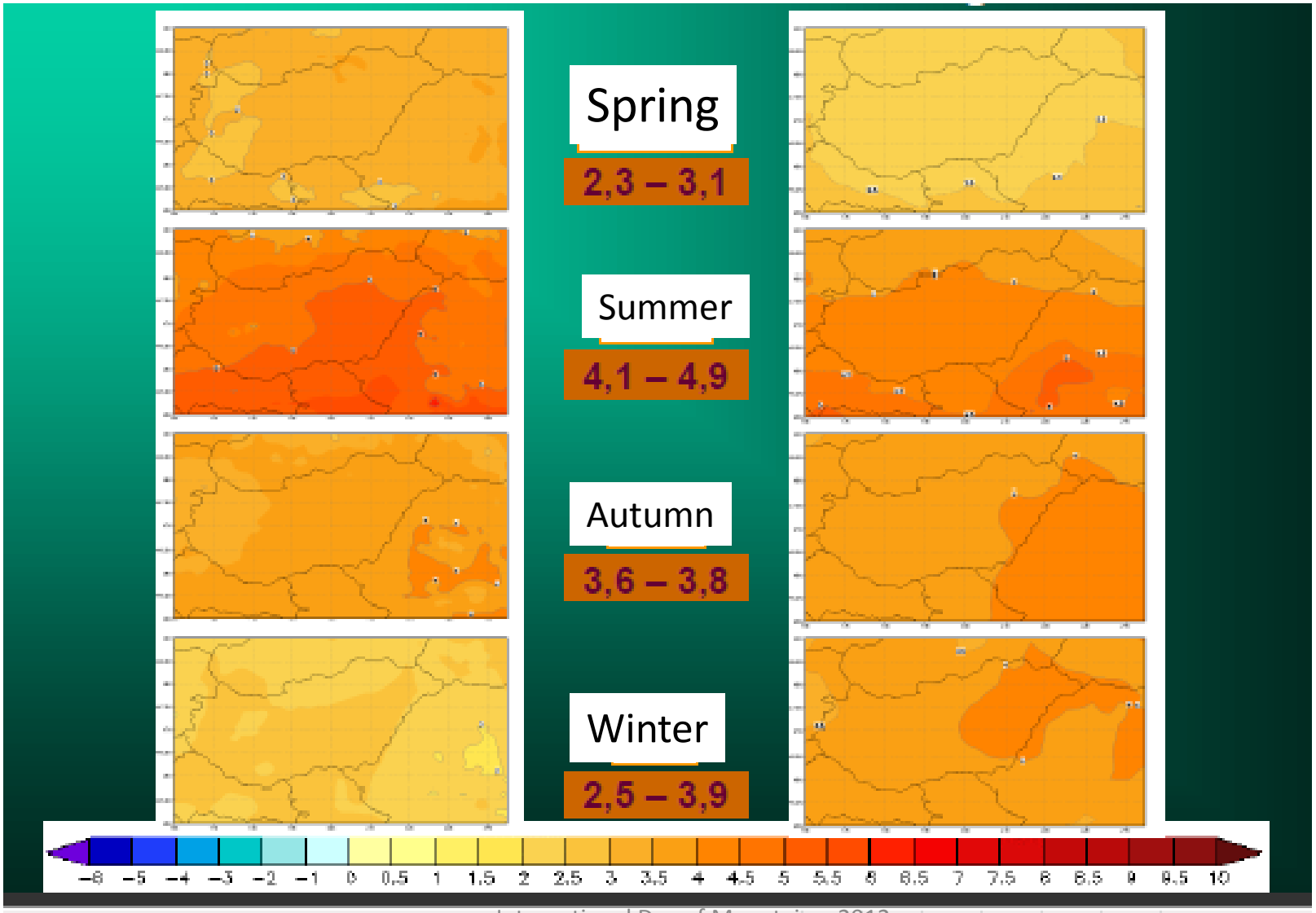
Modelling of the present precipitation climate compared with the CRU dataset, 1961-1990



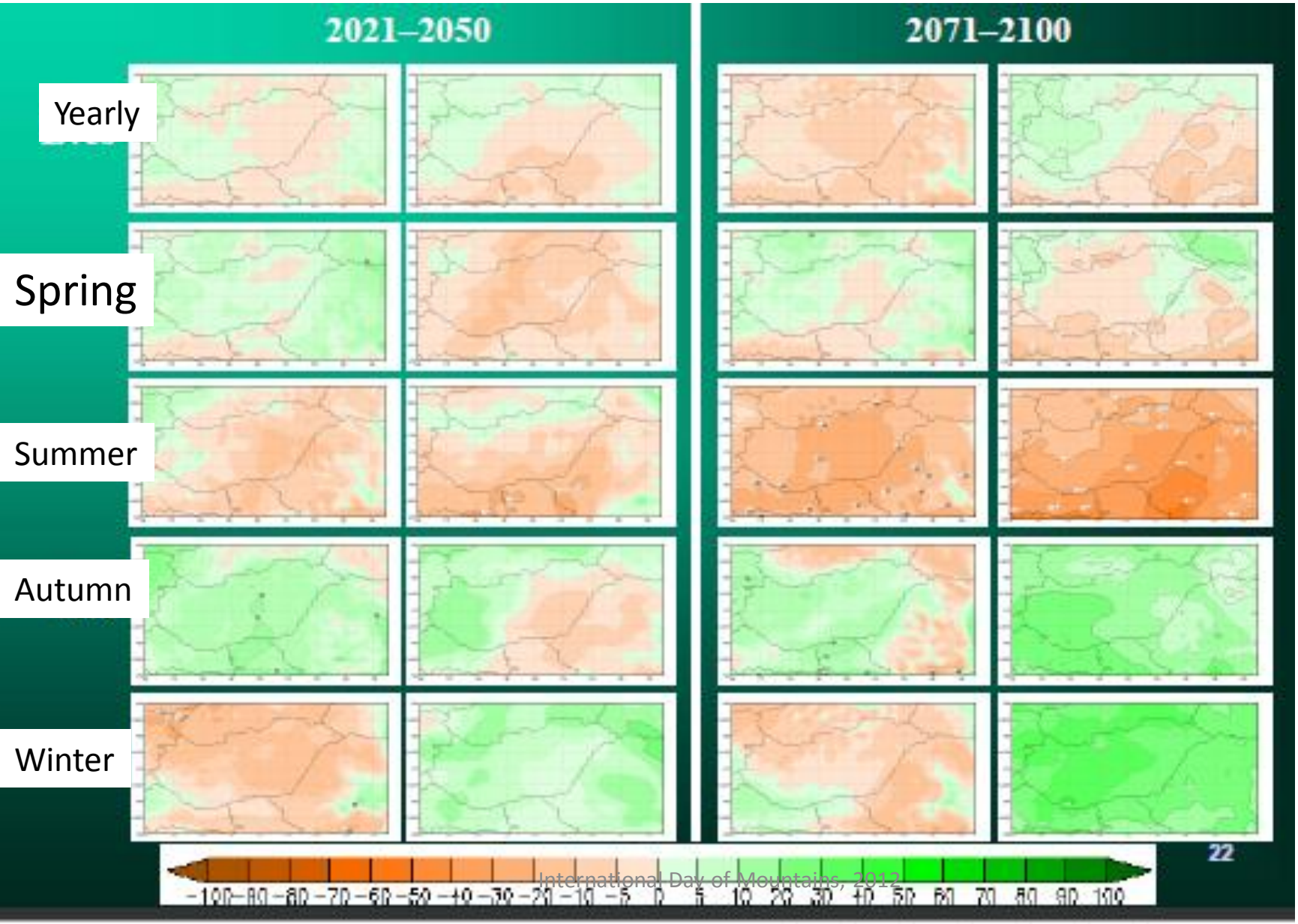
Seasonal temperature change for 2021-2050 compared to 1961-1990



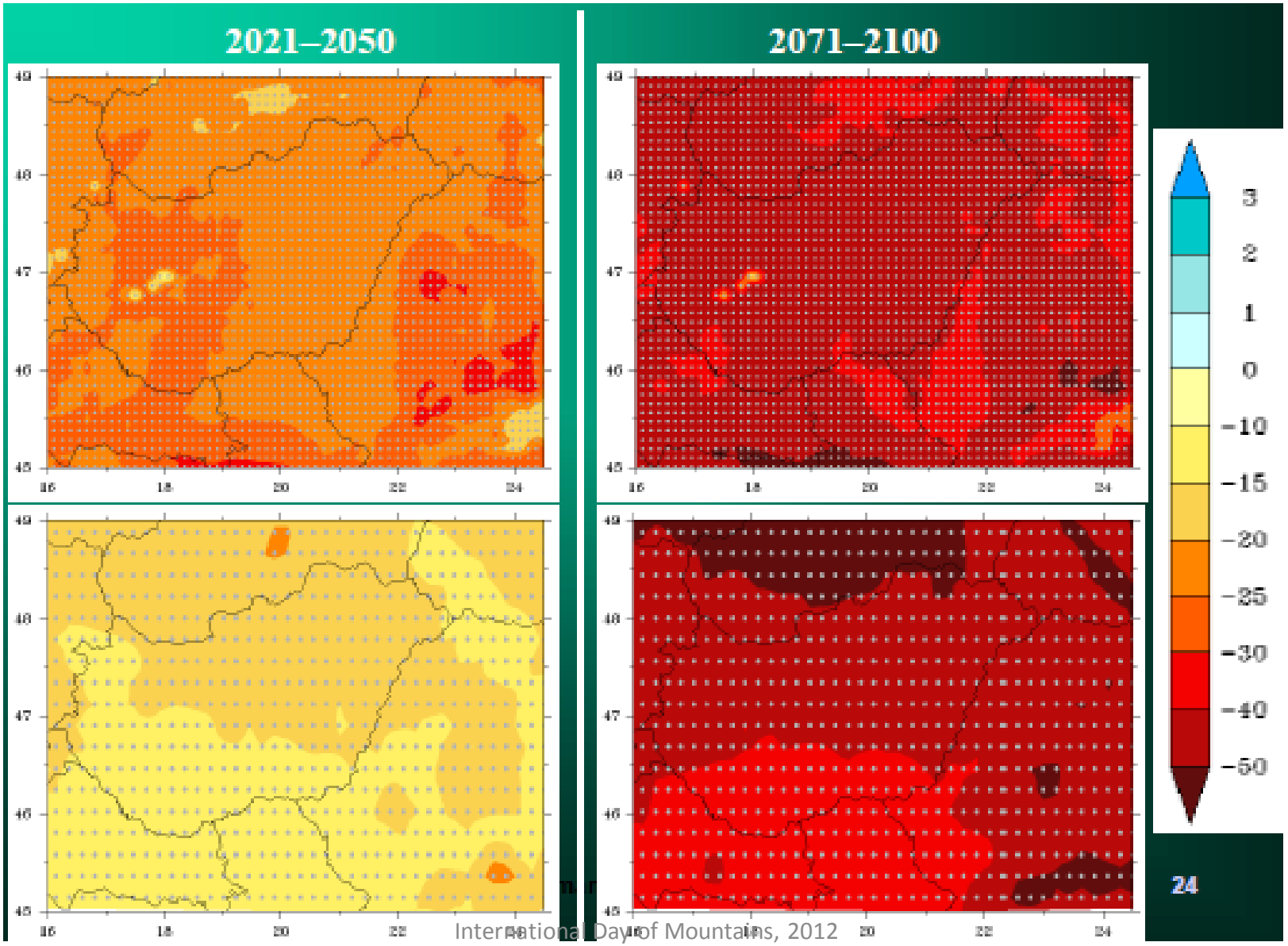
Seasonal temperature change for 2071-2100 compared to 1961-1990



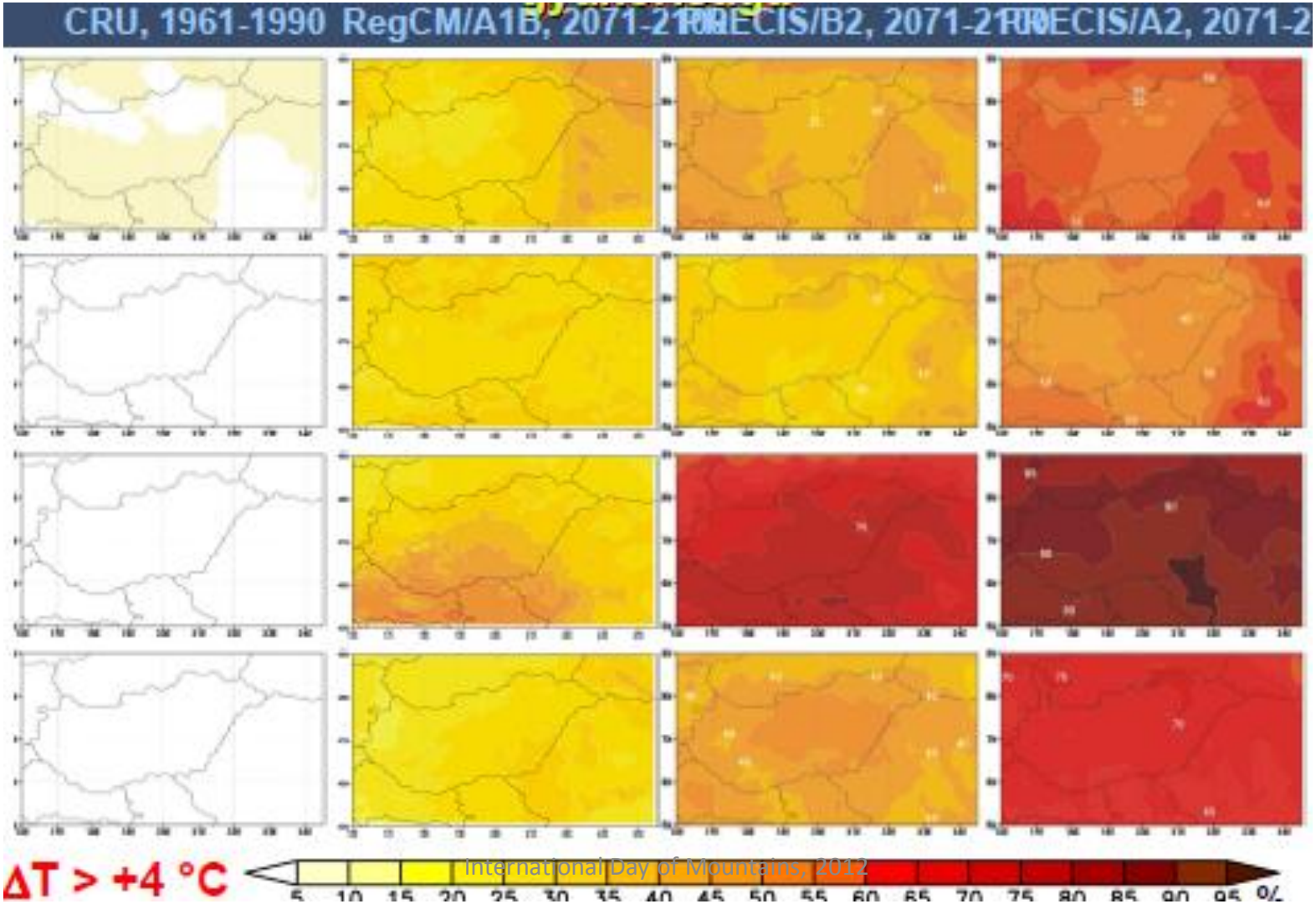
Seasonal and yearly precipitation change for 2021-2050 and 2071-2100 compared to 1961-1990



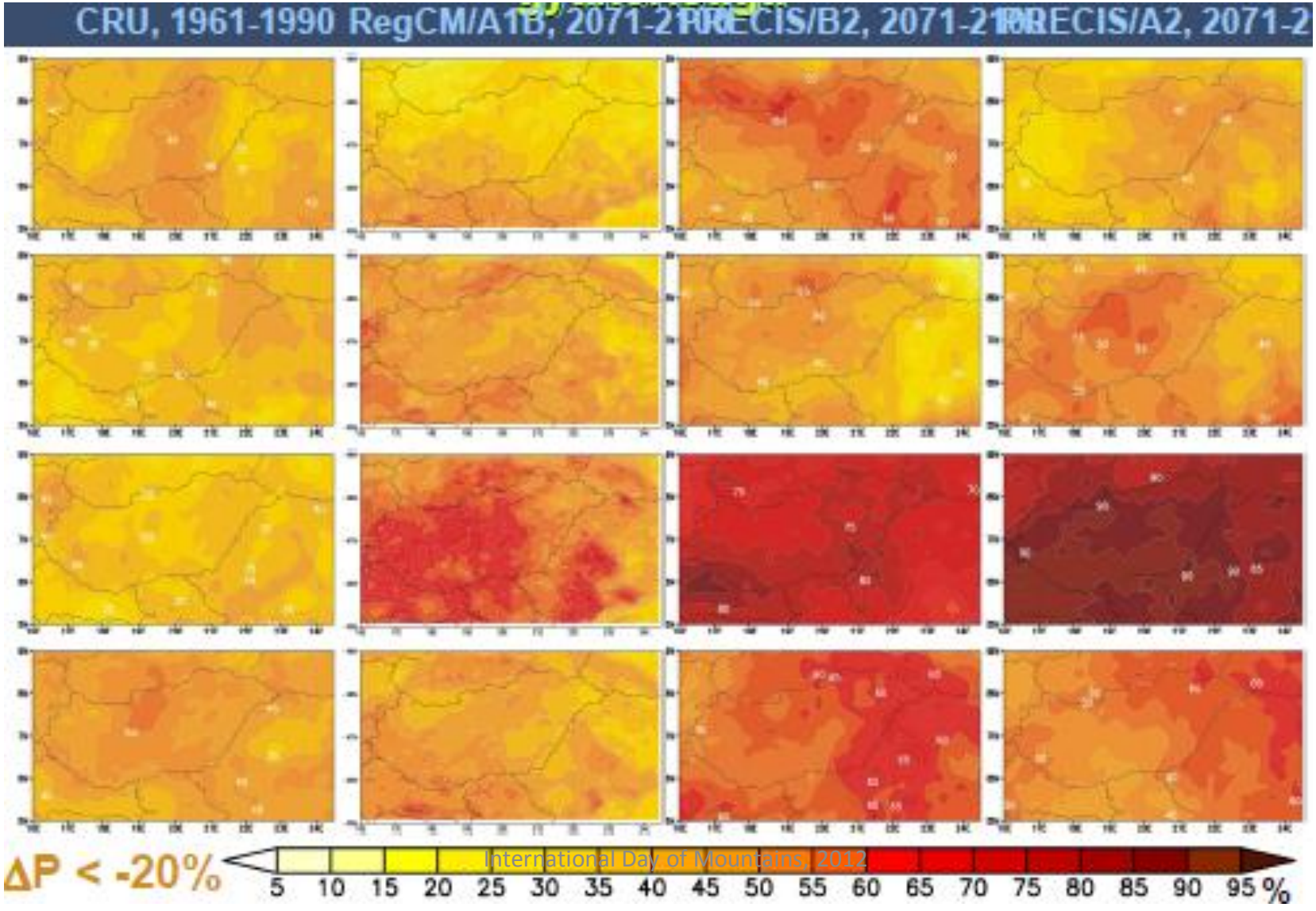
Change of the number of frost days



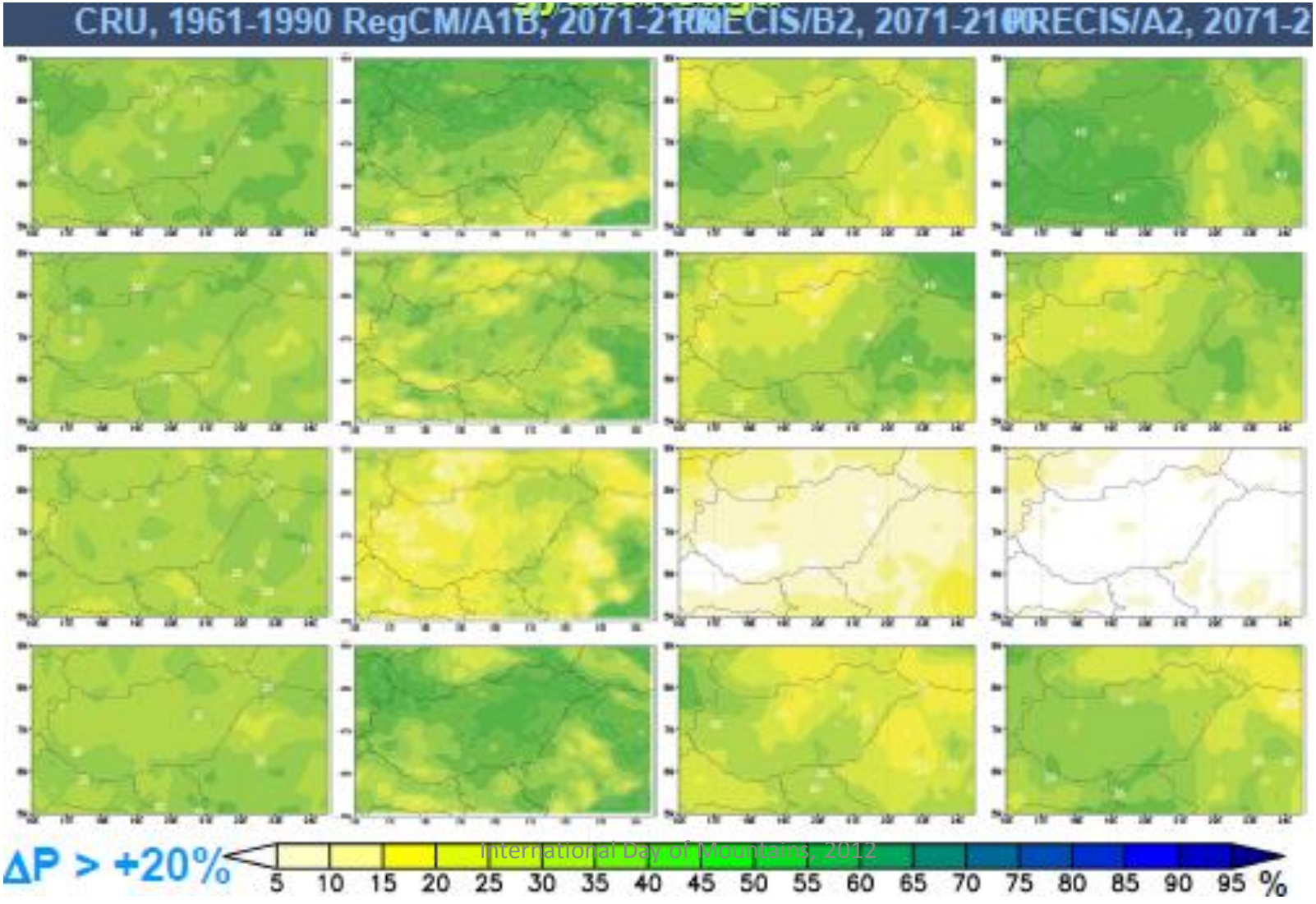
Change of the frequency of the months with anomaly at least 4°C (Bartholy et al., 2010)

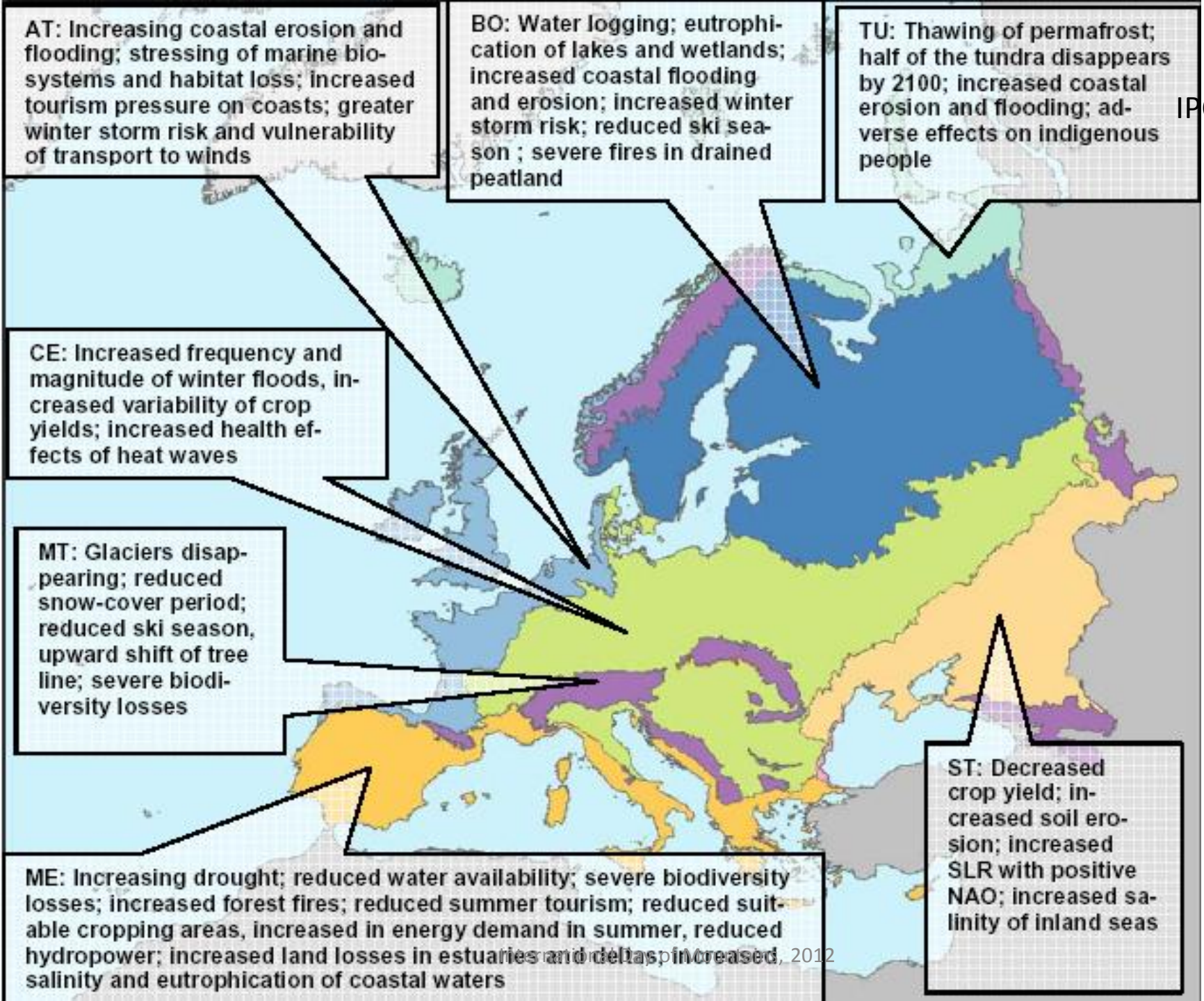


Change of the frequency of the months with precipitation deficit at least 20% (Bartholy et al., 2010)



Change of the frequency of the months with precipitation surplus at least 20% (Bartholy et al., 2010)





IPCC, 2007

Impacts on nature connected sectors

- Impacts on Forests
- Impacts on Grasslands
- Impacts on Wetlands
- Impacts on Agriculture
- Impacts on Water
- Impacts on Tourism
- Risks to Governmental Policy Objectives

Sectorial climate change impacts

(Example)

Event	Water resources	Agriculture, ecosystems	Health	Iindustry and society
Heavy precipitation	- floods - decreasing water quality -- decreasing quantity of available water	-yield losses - delay in the agricultural works - soil erosion	- increasing number of fatalities and accidents	-damages of the infrastructure - problems in operation and traffic
Increasing temperature	-increasing temperature of the surface water - increasing evapotranspiration - change in the precipitation types -earlier snow melt	-less available water - increasing vegetation period - change in the ecosystem compositions -shifting of areas - forest- and bushfires -Invazive species	-new illnesses - heat waves -pollen caused allergy	-worsening of the fresh water quality -melting of permafrost and it s effects on the infrastructure - fires

Climate Change adaptation WG at Carpathian Convention

- Decision COP3/15 on Climate change of the COP 3 of the Carpathian Convention: a Working Group on Adaptation to Climate Change under the Carpathian Convention has been established

Workplan

- Preparation of strategic agenda on adaptation in the Carpathians
- Planning of adaptation measures
- Develop communication strategy
- Realization of a clearing house for the Carpathians in the wider EU context

Conclusions

- High spatial variability of the changes
- The models may have problems with the description of tendencies of some basic climate elements
- Strong capacity building is requested
- Establishment/improvement of monitoring and early warning systems
- Further research is needed, but on a more coordinated way

Thank you for your attention!