First Session of South-Eastern Europe Climate Outlook Forum (SEECOF-1)

Climate Change Projection for South Eastern Europe

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Main objectives

- consider a small ensemble of climate change scenarios projected to the period 2070-2100, and identify the likely changes in South Eastern Europe.
- better understand the level of variation within a few of the low-resolution grid boxes, by obtaining a high-resolution projection for a small area.
- assess the impact of likely future changes, vulnerability and.
- make recommendations for adaptation to impacts of likely climate changes.

Study area covers Southeastern European countries Croatia, Bosnia and Herzegovina (B&H), Serbia, Montenegro, Albania and the Former Yugoslavian Republic of Macedonia (FYROM).

Method

Low- and high-resolution projections of future climate

MAGICC/SCENGEN v. 4.1. - low-resolution projections (5*5 degrees) of future global-mean temperature

2080s:

- different IPCC scenarios - HAD300
- A2ASF under different GCMs
- A2ASF under HAD300 (for seasonal changes)

High-resolution regional data (resolution 50 km) for actual climate and climate change projections are provided by the **Hadley Centre.**

version of the RCM - HadRM3P

Low resolution projections

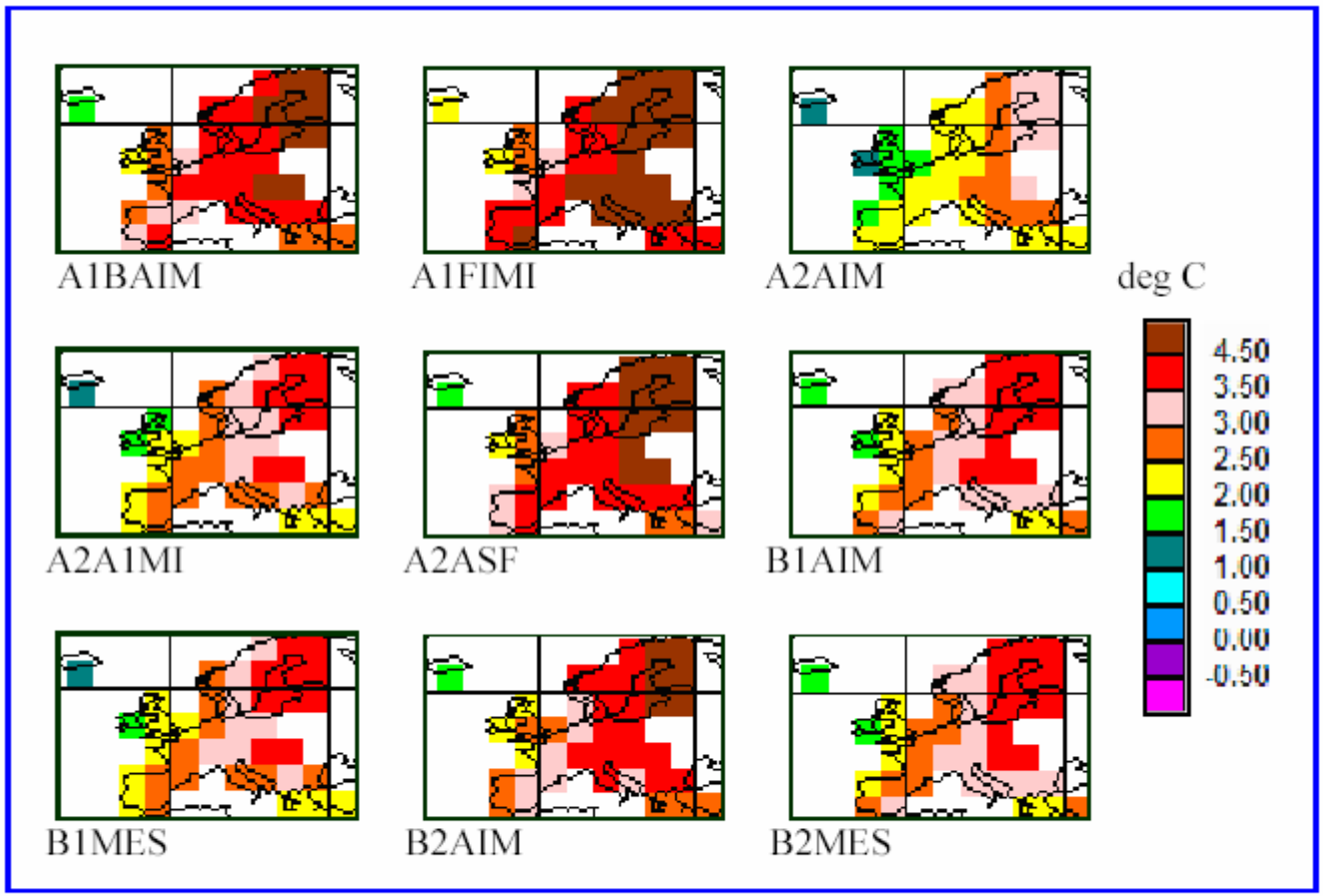


Fig. 3 Annual temperature changes (°C) for the 2080s, for different climate scenarios, region Europe

HAD300

Low resolution projections cont.

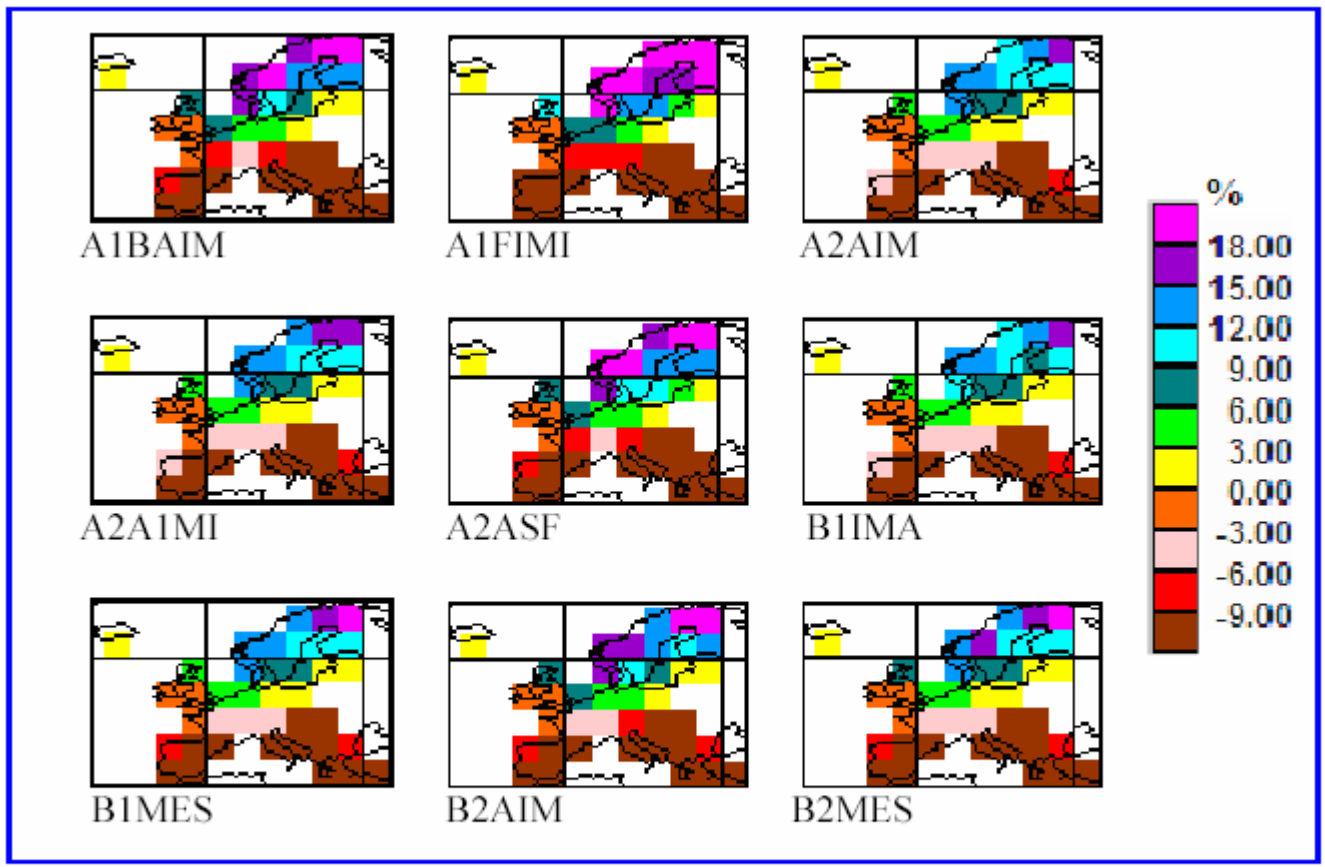
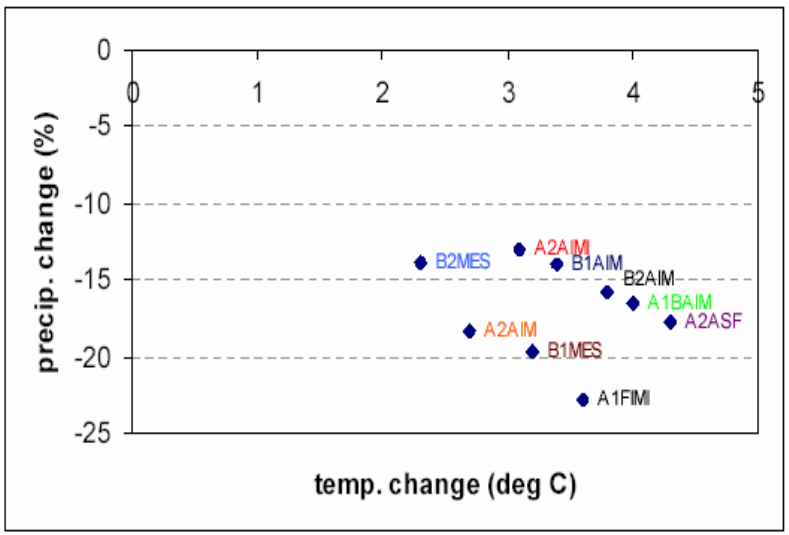
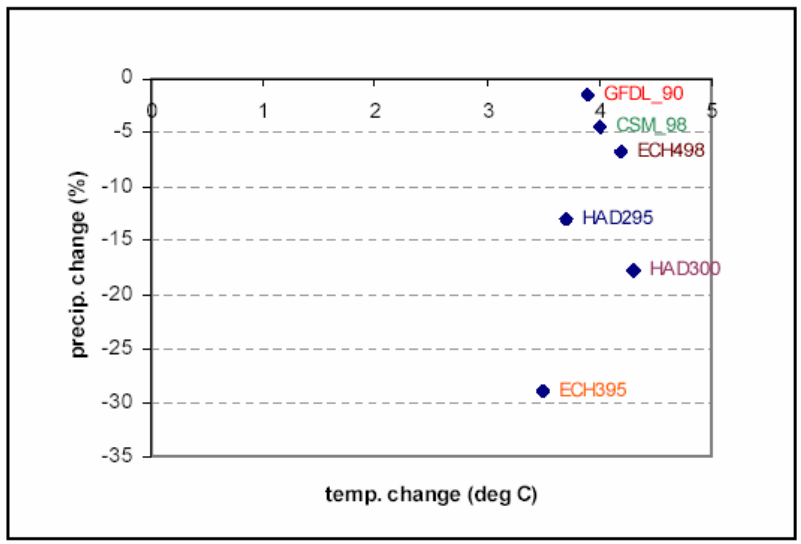


Fig. 4 Expected annual precipitation changes (%) for the 2080s , HAD300, different climate scenarios

Low resolution projections cont.



Future changes in annual temperature and precipitation under different scen
for the 2080s, gridbox: 40.0N - 45.0N ; 20.0E - 25.0E



Future changes in annual temperature and precipitation under different
GCMs for the 2080s, gridbox: 40.0N - 45.0N ; 20.0E - 25.0E

Seasonal changes

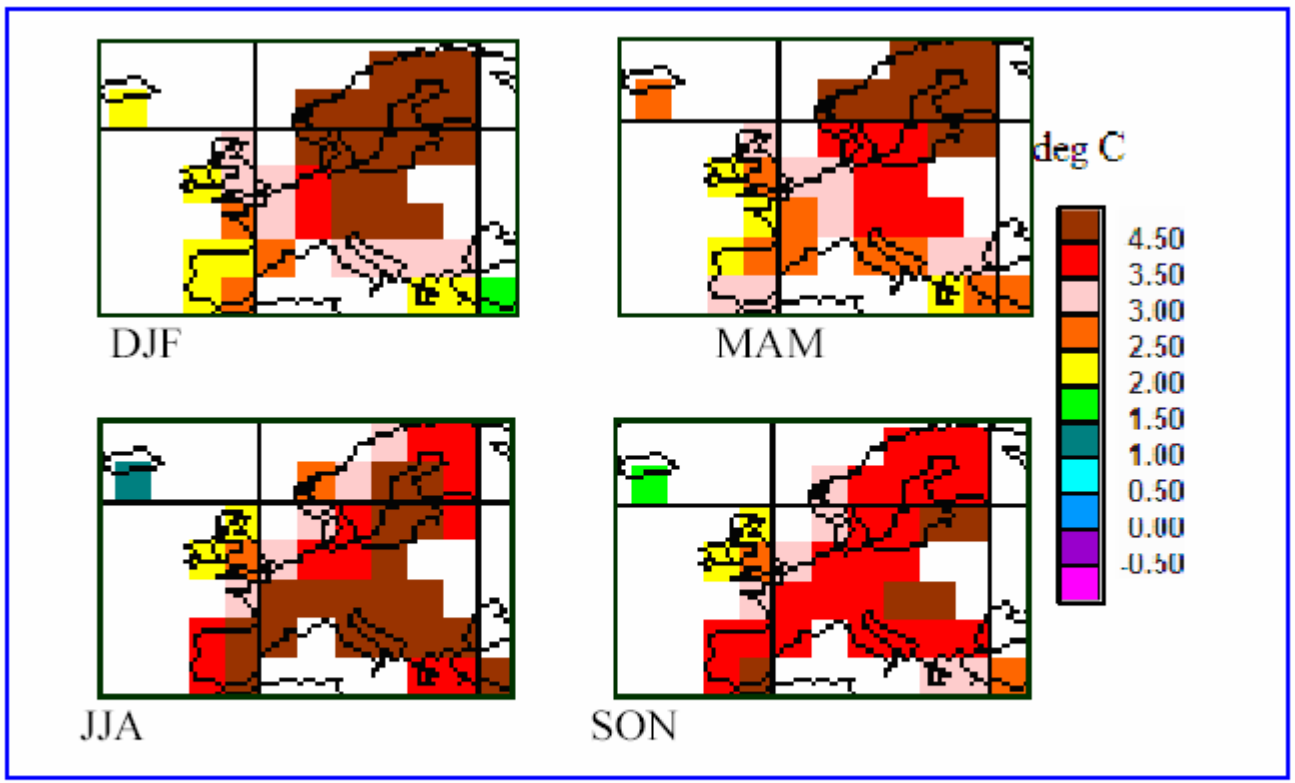
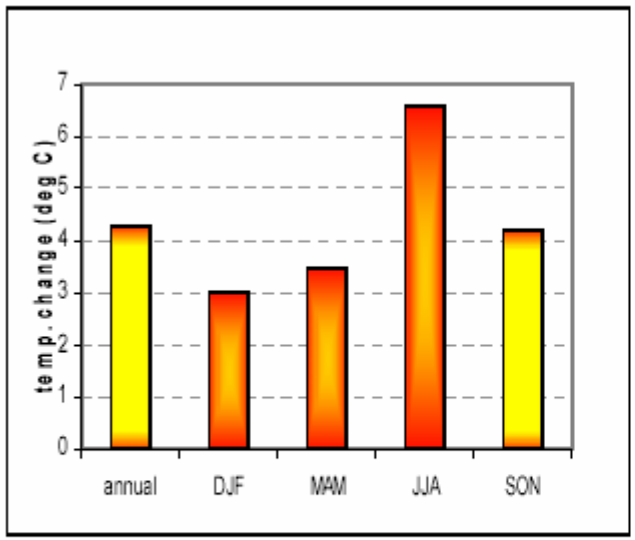


Fig. 9. Future projections of seasonal temperatures (°C) under the A2 ASF emissions scenario, HAD300

Expected changes



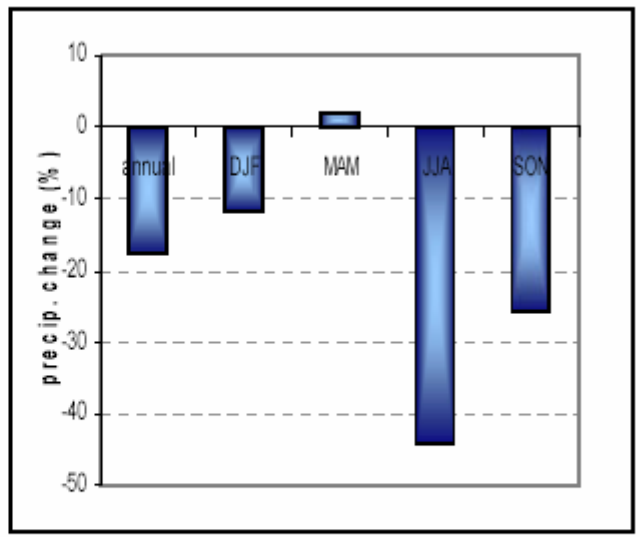


Fig.11 expected changes in temperature and precipitation patterns under the A2 ASF emissions scenario, HAD300, gridbox (40.0N - 45.0N, 20.0E - 25.0E)

High resolution

air temperature (1.5 m)

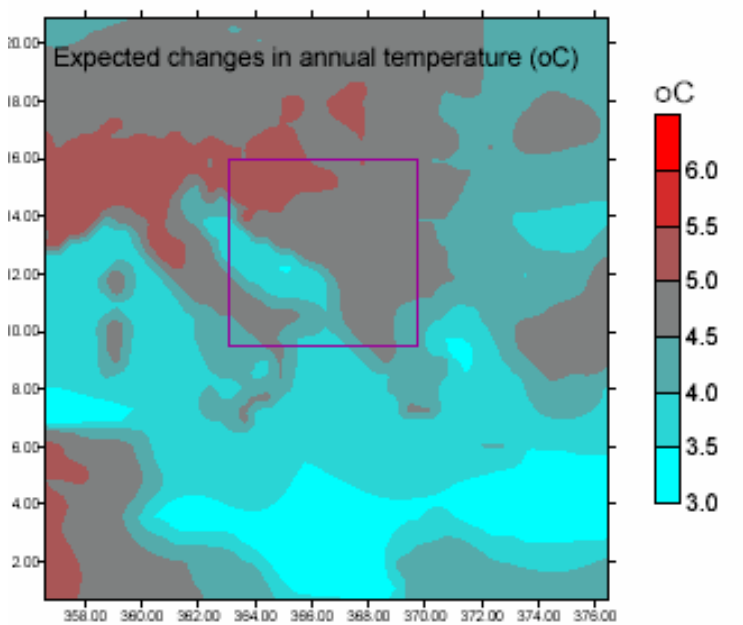


Fig. 12. Projected changes for the 2080s, annual temperature (°C)

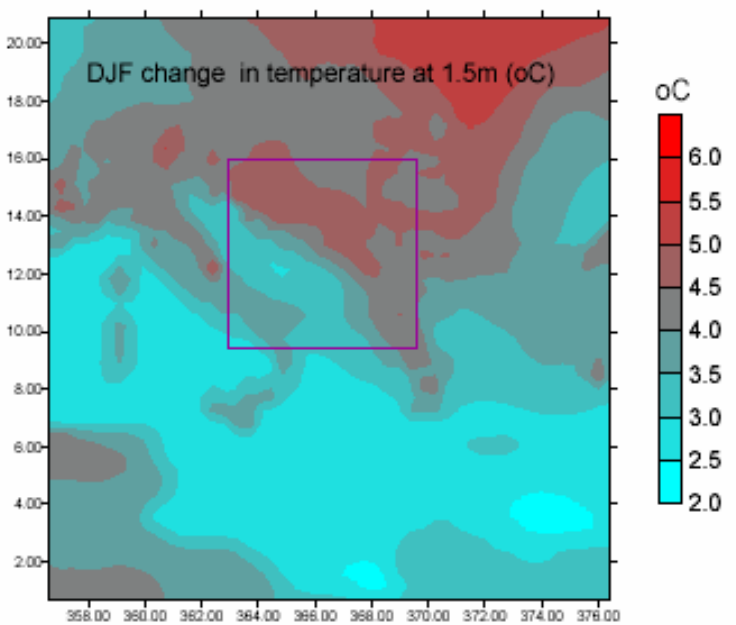


Fig. 13. Projected changes for the 2080s, winter temperature (°C)

increase in annual air temperature higher than 5°C over the region.

warmer winters (3.8-5 5°C)
strong influence in earlier snowmelt,
Impact in runoff , winter tourism, etc.

Air temperature

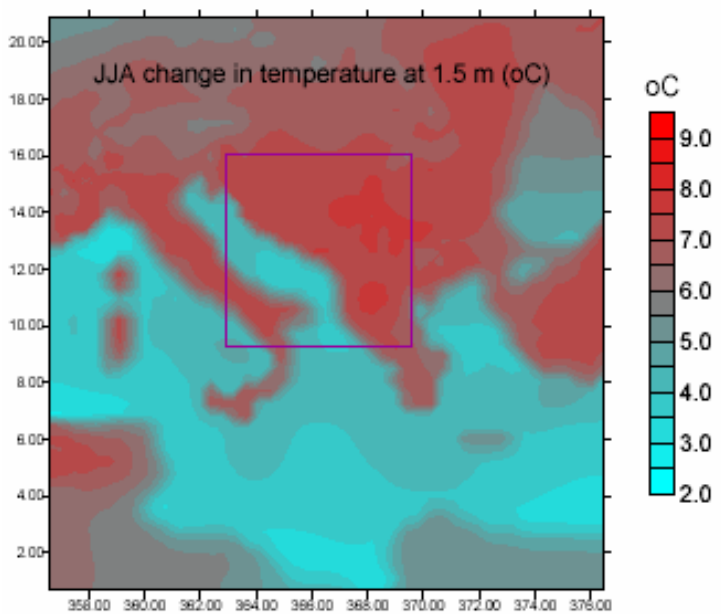


Fig. 14. Projected changes for the 2080s, summer temperature (°C)

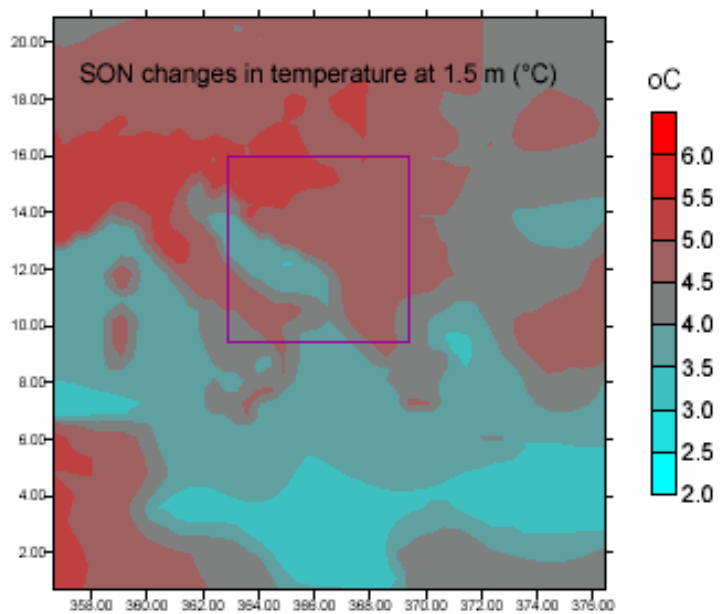


Fig. 15. Projected changes for the 2080s, autumn temperature (°C)

Warming higher than 7.0°C

7.3°C in Croatia and Montenegro to 7.5°C to east Albania

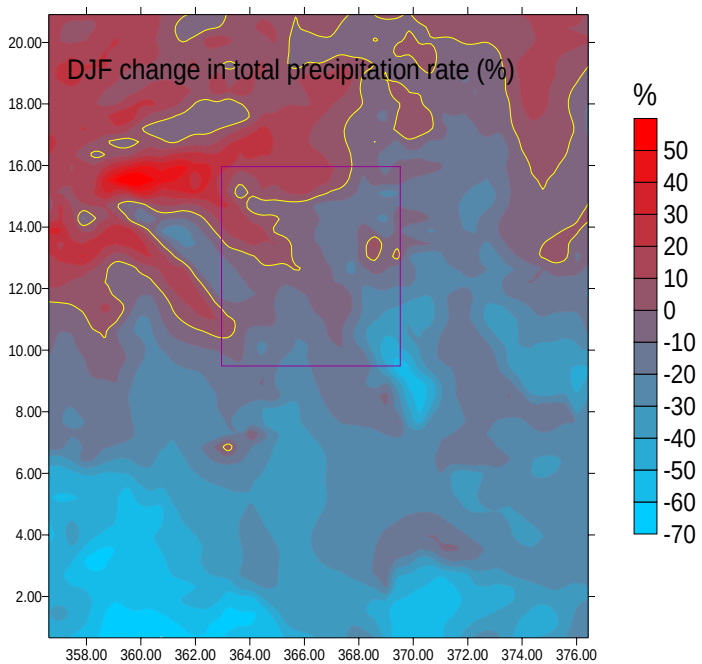
increase in the frequency of extreme events (heat waves!!!!)

increase in temperature, around 5.0°C

Total precipitation rate

annual

less total precipitation rate is likely for the 2080s;
changes' pattern - quite irregular

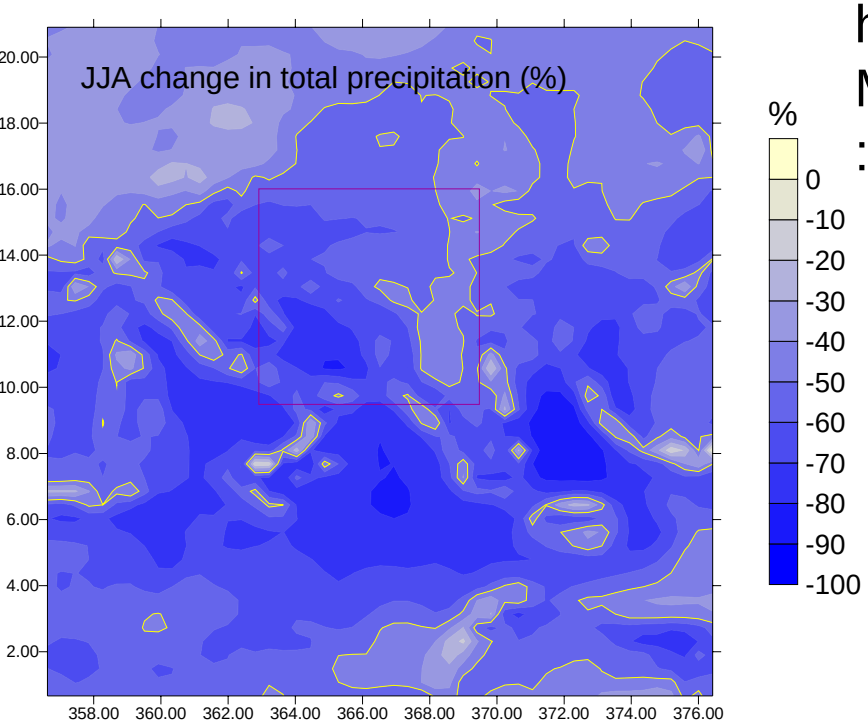


winter

•increase : in the northern part of Croatia varying from 4% to 16%
•higher rates: about 4% and 12% Northern and northwestern part of Serbia
•similar pattern of changes in B&H
•reduction in the rest of study area
•Montenegro around -12%, Albania -20%

•more precipitation is likely to fall in the form of rain rather than snow, which will increase both soil moisture and runoff.

Total precipitation rate



Summer:

high decrease in Croatia, B&H : around 60%
Montenegro, Albania, Macedonia
: around 50%

Autumn

- **very slight increase is likely in NW Croatia, otherwise decrease**
- Serbia: SW increase, **otherwise** decrease up to 20%
- Montenegro, Albania decrease
- Macedonia: slight increase in central part (up to 5%)

Specific humidity

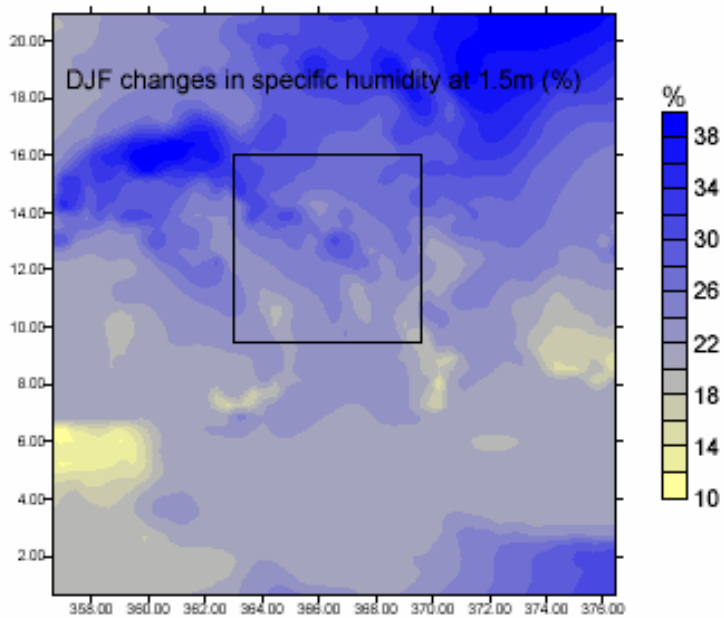


Fig. 18. Projected changes for the 2080s, winter specific humidity (%)

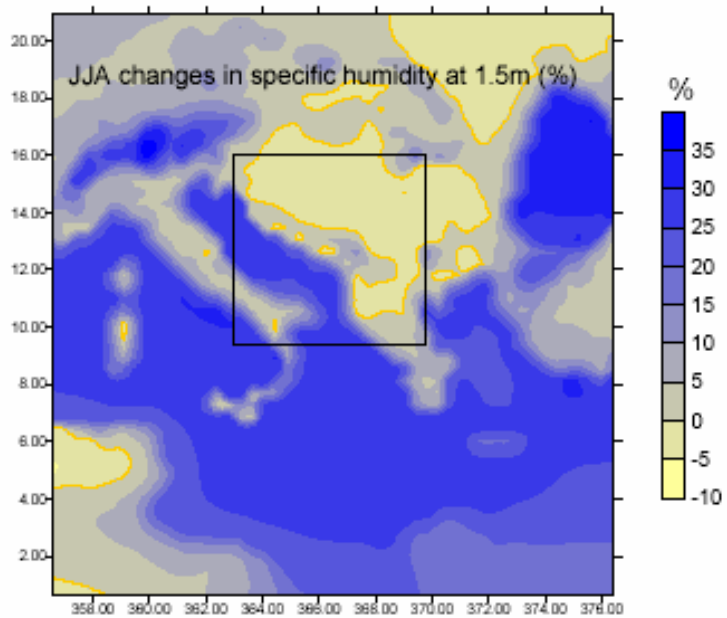


Fig. 19. Projected changes for the 2080s, summer specific humidity (%)

Annual increase up to 10 % is likely over the study area.

increase - more distinct during winter time

specific humid. +total precip. rate = heavier precip. during winter ……flooding

Summer: decreasing in the most of study area, with a slight increase along coastal part of Croatia, Montenegro, South Serbia, North and South Albania.

combined with the high increase in temperature and high decrease in precipitation rate might favor the prolonged summer droughts over the

Potential evaporation

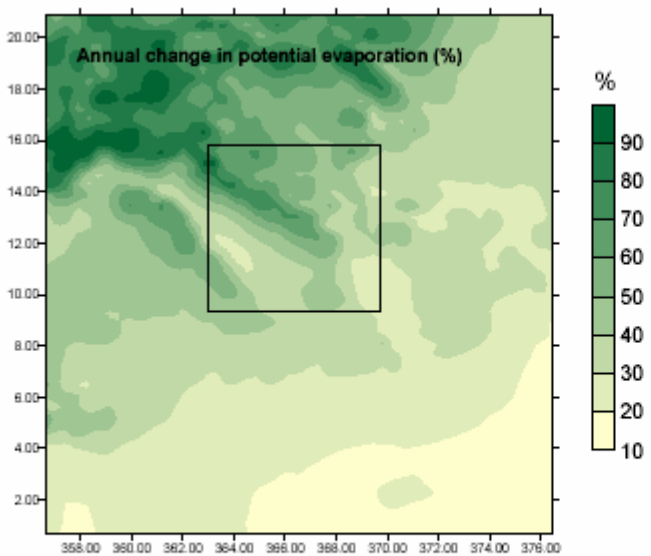


Fig. 22. Projected changes for the 2080s, winter potential evaporation (%)

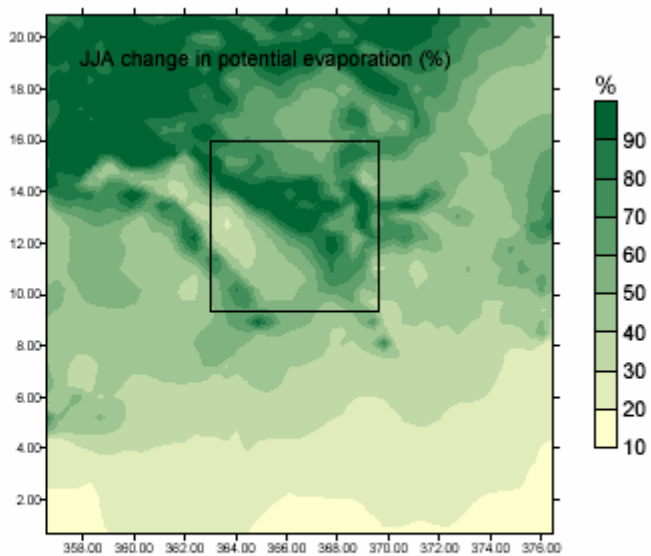


Fig. 23. Projected changes for the 2080s, summer potential evaporation (%)

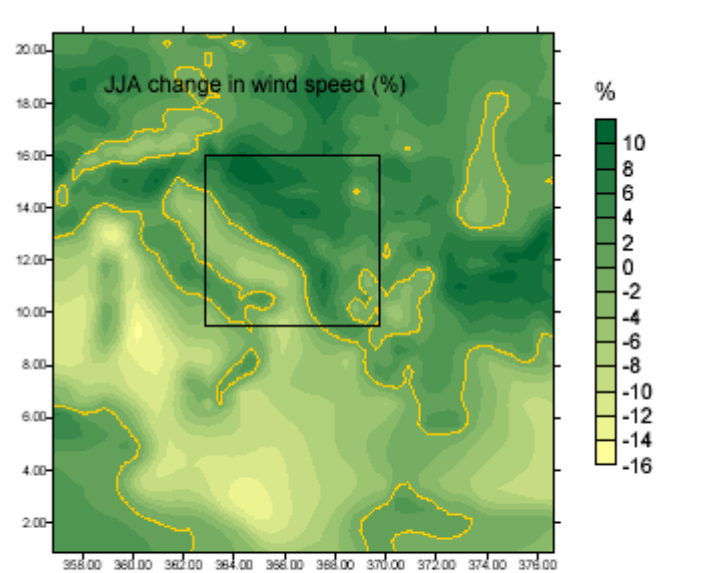
increase in annual and seasonal values of potential evaporation overall the study area

absolute rate of increase in potential evaporation increases exponentially with the temperature if other factors (wind, stability and relative humidity) are unchanged (IPCC, 1998). This increase, together with precipitation reduction will lead to drier conditions and reductions in water availability over the study area.

wind speed

A slight reduction in annual wind speed
(at 10m.a.s.l) up to 2% over the coast, south Serbia, Montenegro, north and South Albania and Macedonia.

Otherwise an increase up to 6% in north Croatia and B&H is likely.



25. Projected changes for the 2080s, l speed (%), summer

Likely impacts

- a general drying over the study area during summer. (combination of the increased temperature and potential evaporation that is not balanced by the increases of precipitation).

- increases in the heat index (because of changes in surface air temperature and humidity).

- More hot days and heat waves are very likely over nearly all study area. These increases are projected to be largest mainly in areas where soil moisture decreases occur.

- More frequent and severe droughts with greater fire risk are likely.
- Increases more in daily minimum than maximum temperatures are likely to occur over nearly all land areas.

- Frost days and cold waves are very likely to become fewer.

Likely impacts cont.

- higher temperatures lead to higher potential evaporation and decreased discharge.
- snow and ice and their potential changes in warmer global climate will have profound impacts on streams and rivers. Higher temperatures will shift the snowline upwards; the seasonal patterns of snowfall are likely to change with the snow season beginning later and ending earlier.
- Decrease in total precipitation rates combined with higher evaporative demand would probably result in less river flow (run-off).
- Hydropower industry must take into consideration that winter runoff is likely to increase and spring runoff probably will decrease in generating electricity especially in the countries that are dependent on hydropower (Albania).

Likely impacts cont.

- Water resources are likely to be further stressed due to projected growth in demand and climate-driven changes in supply for irrigation, cities, industry and environmental flows.
- Warmer average and extreme temperatures will enhance the demand for freshwater and water for irrigation purposes, especially for soils with low water-storage capacities. If precipitation decline, countries such as Albania would face substantially increased risks of summer water shortages.

Water supply

- Numerous public supplies depend on groundwater (e.g. in Albania); any decrease in winter recharge could have serious implications. Reduced runoff also would negatively affect cooling of electric-power and industrial plants.
- Anticipated climatic changes in Albania are likely to dramat-ically increase the risk of summer water shortages. Significant increases in storage capacity would be needed to maintain existing water and energy supplies.


Jan BRUCI, 2006