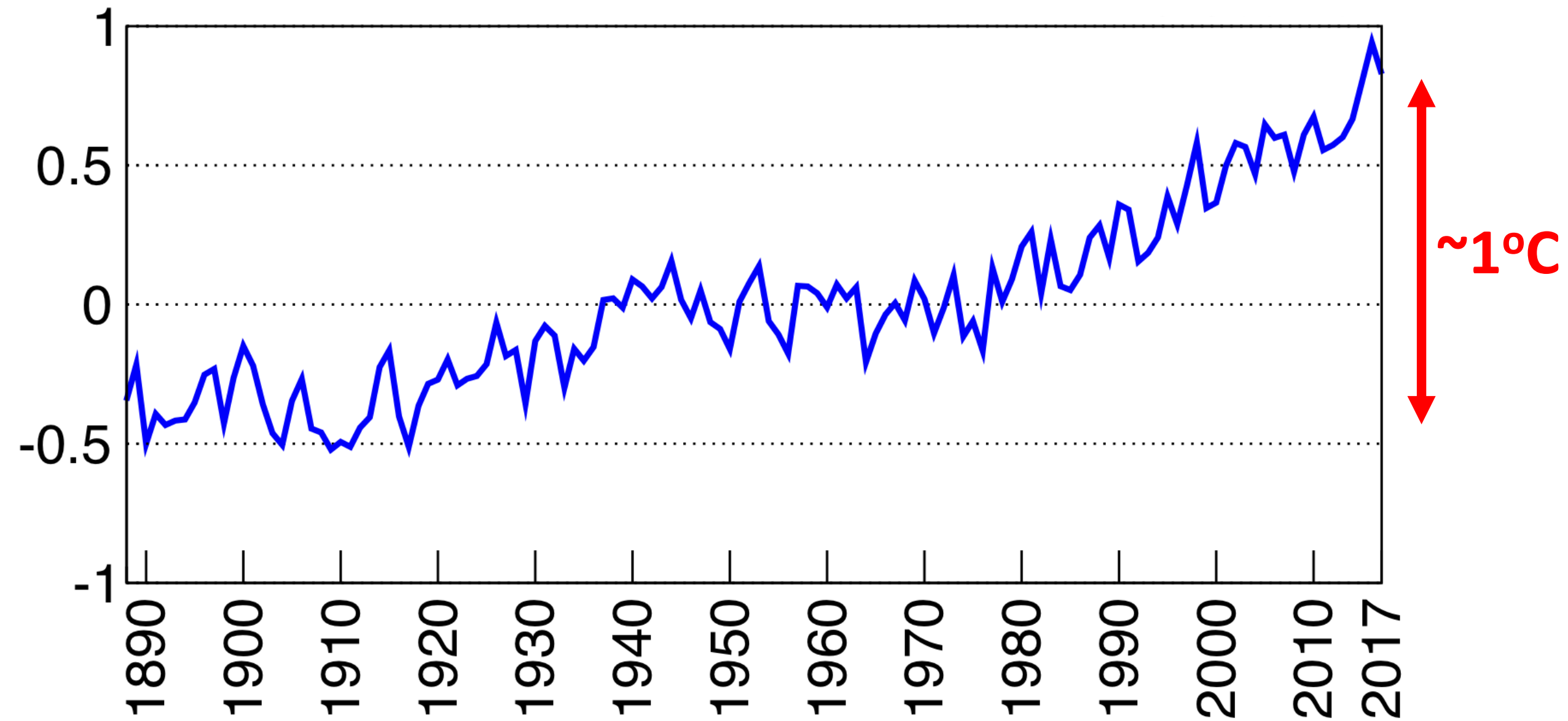


Osmotrene klimatske promene i scenarija promene klime u Srbiji, mogući uticaji i mogućnosti adaptacije

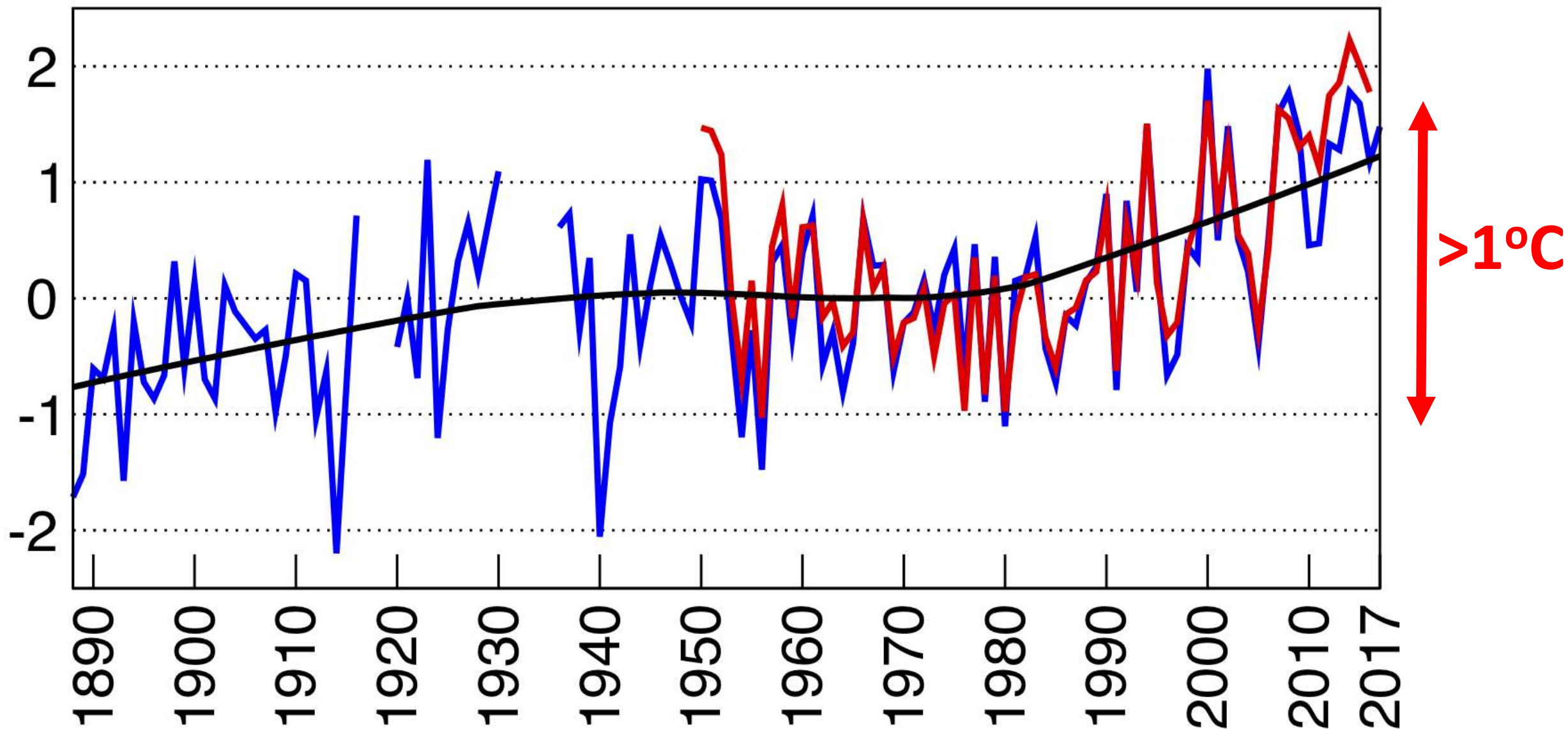
Vladimir Đurđević

Promena globalne srednje godišnje temperature

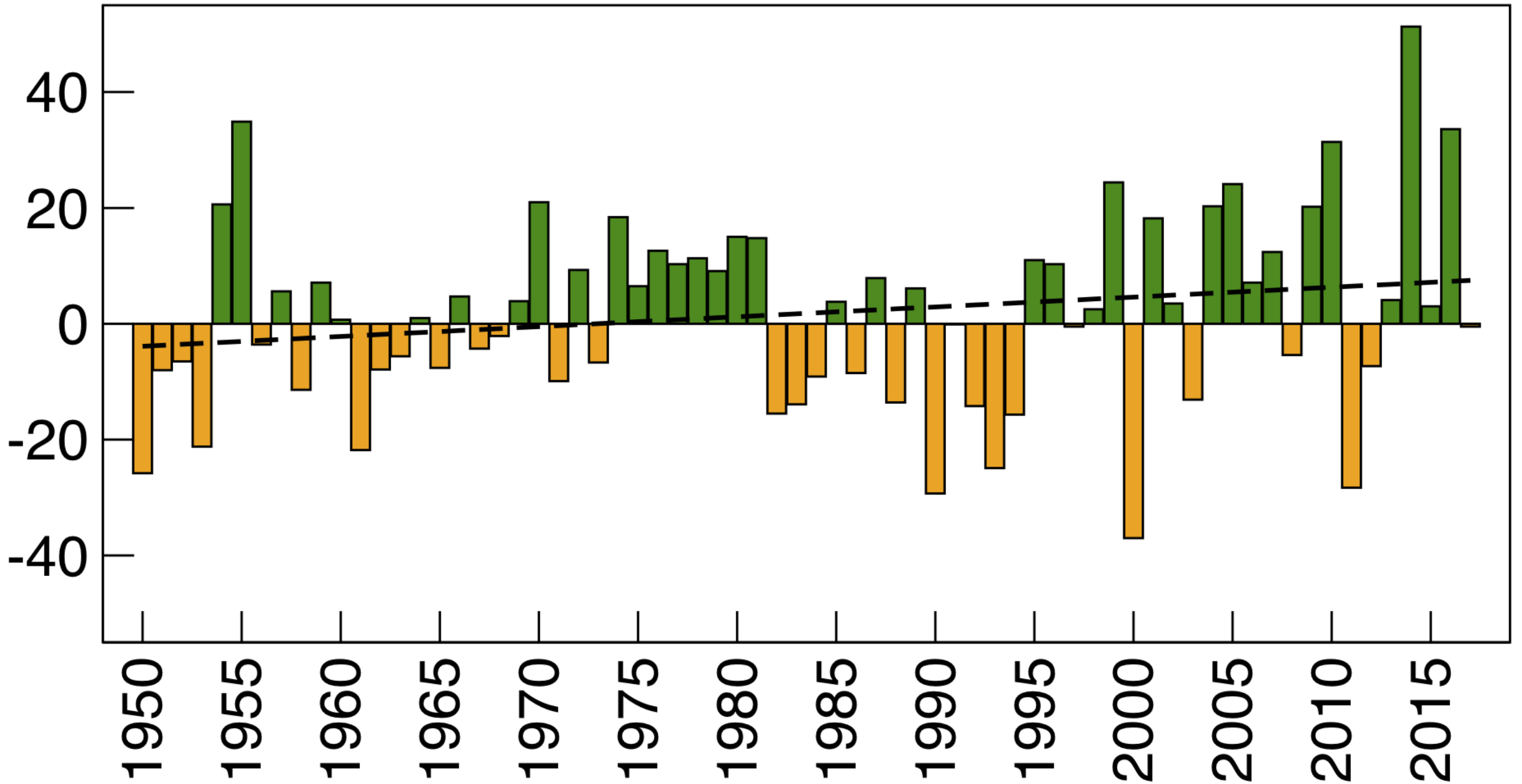


Promena srednje godišnje temperature

- Beograd
- Srbija
- fit



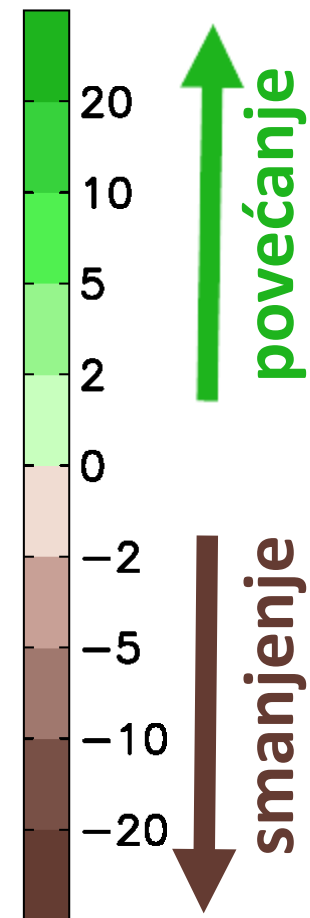
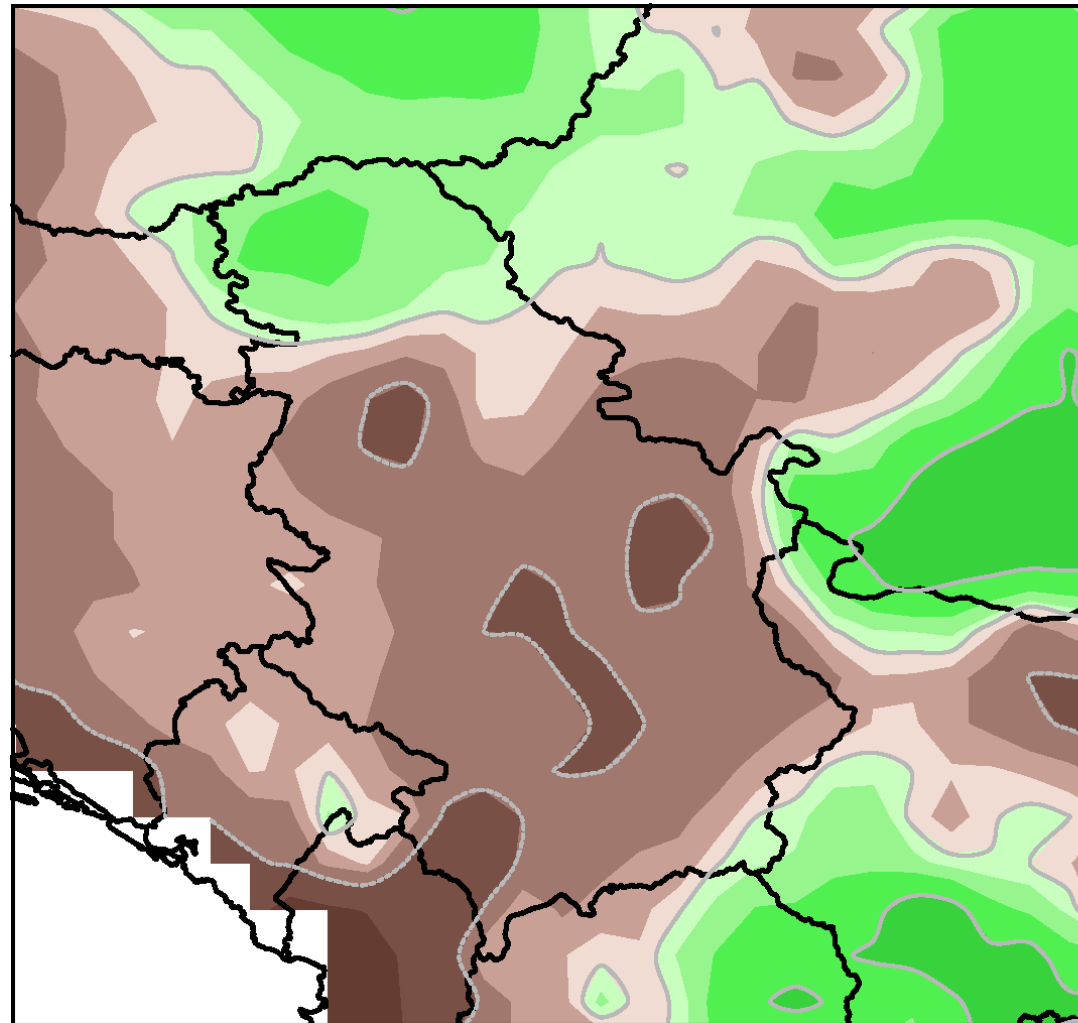
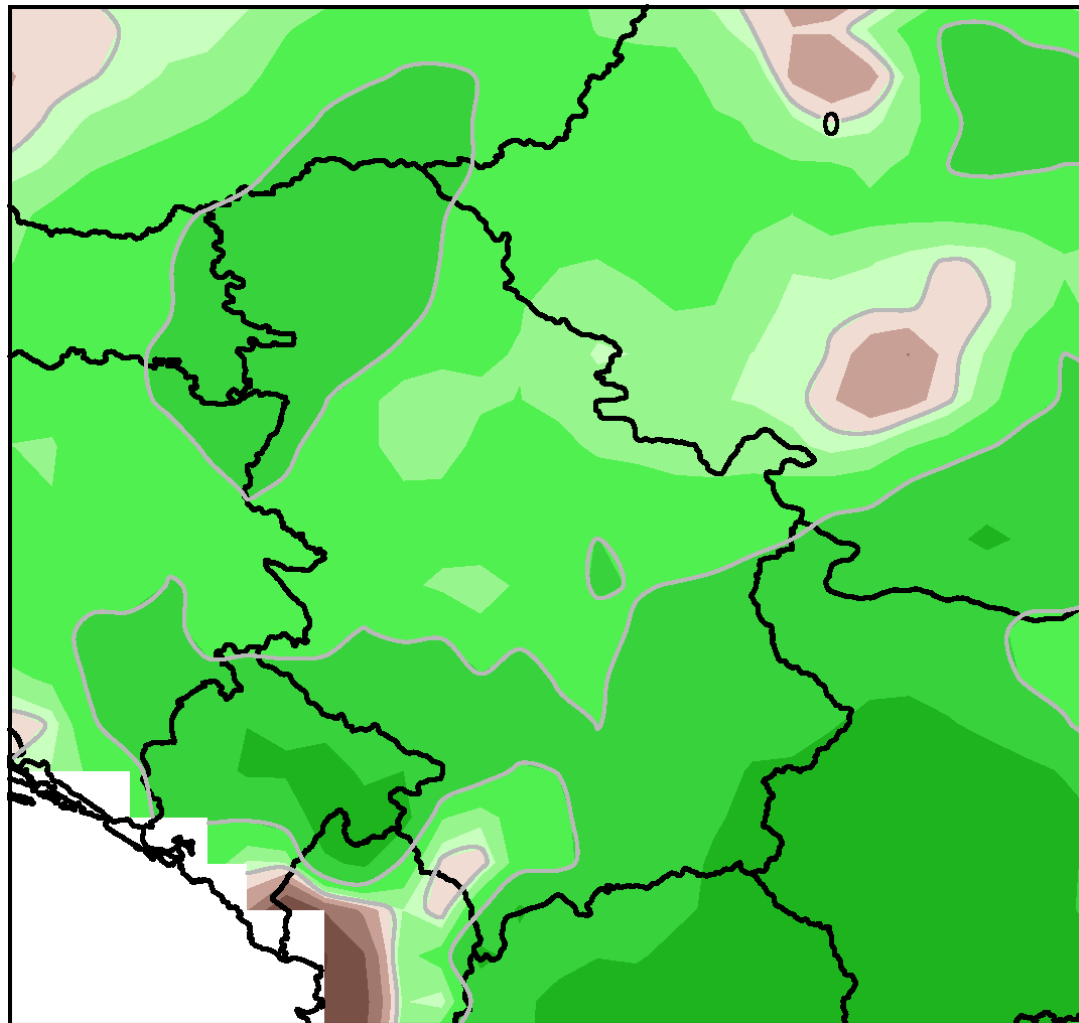
Godišnje padavine za celu Srbiju [odstupanje u %]



Promena padavina (%) [2001-2017 u odnosu na 1961-1990]

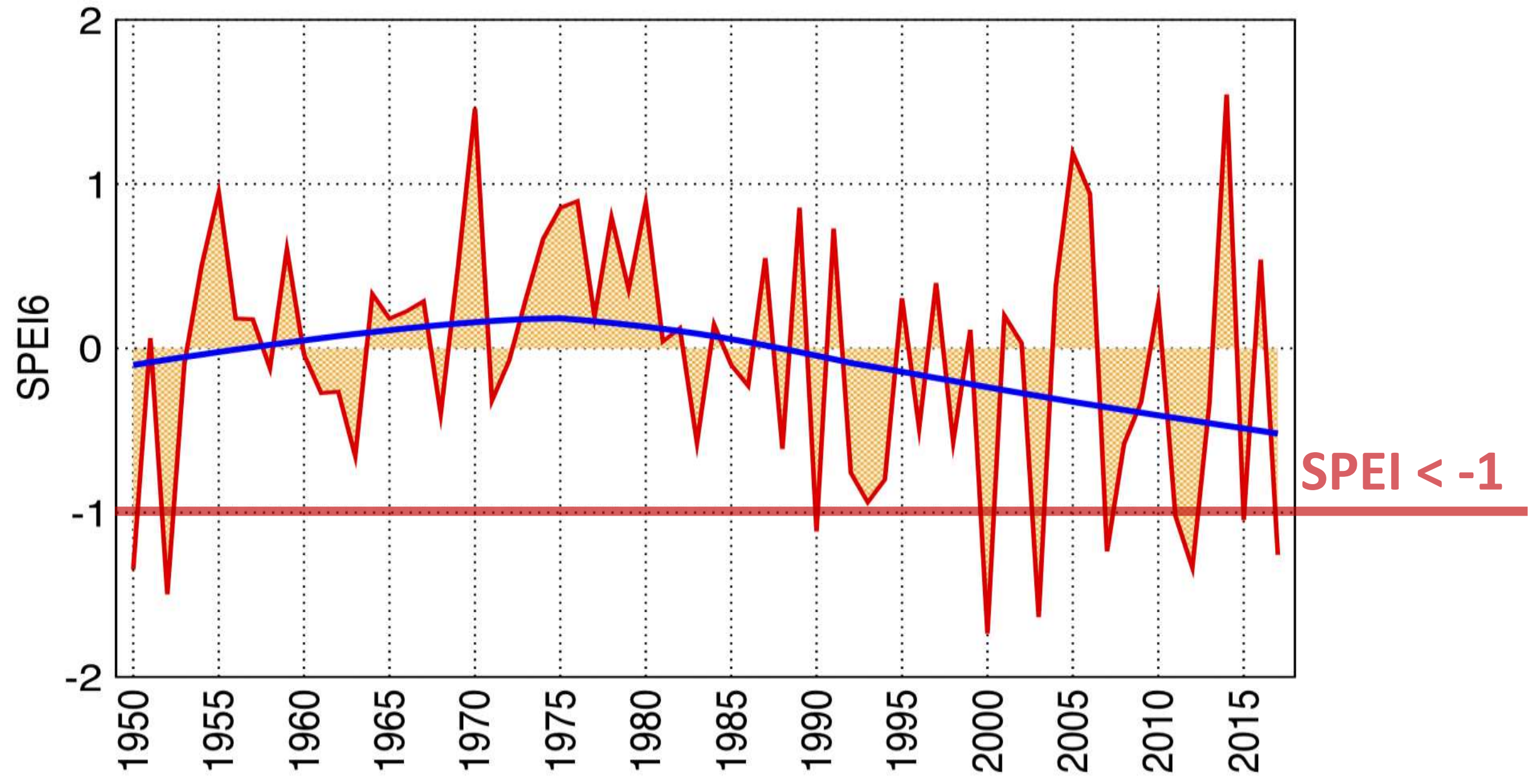
Godišnje

Letnje (JJA)

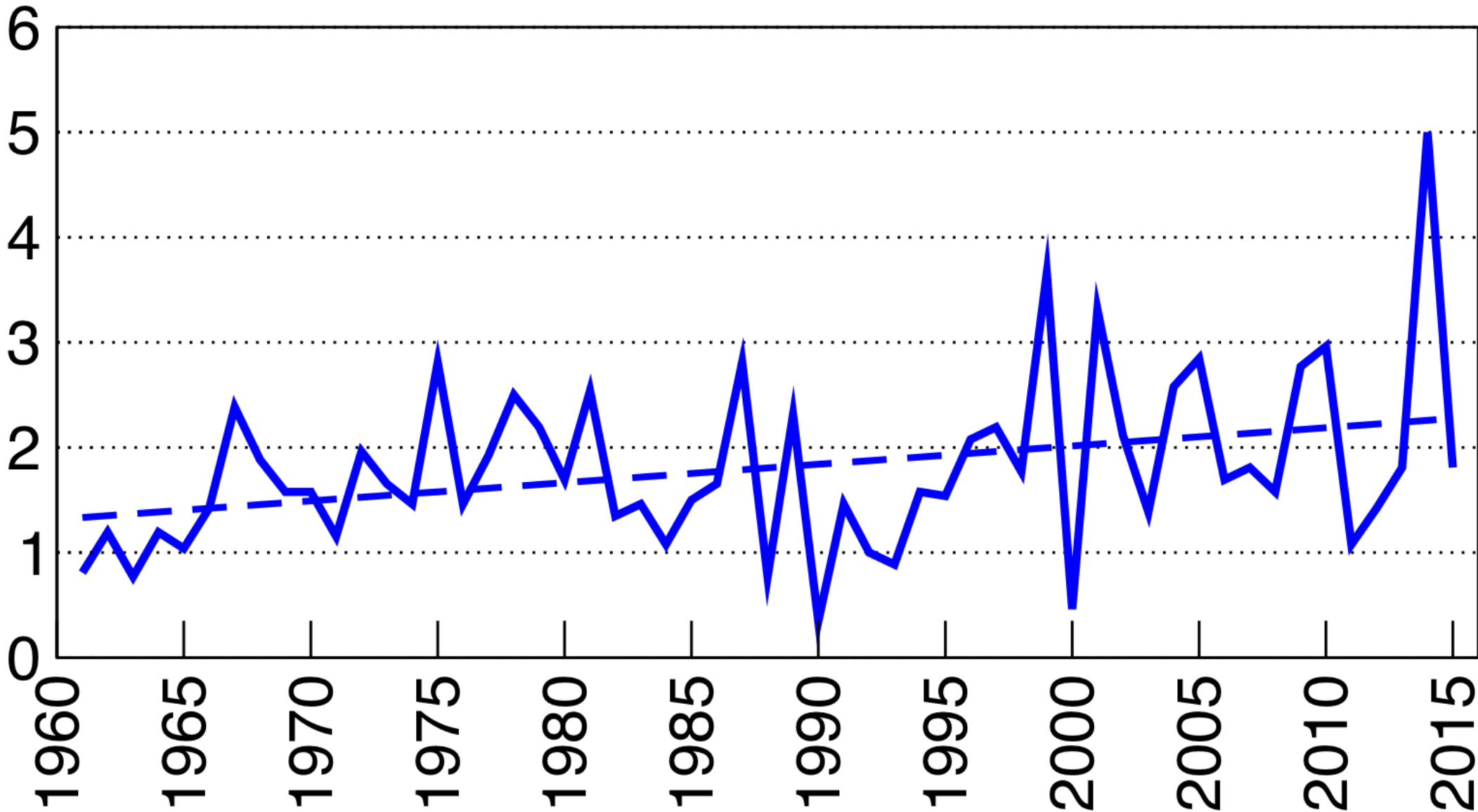


SPEI Indeks suše

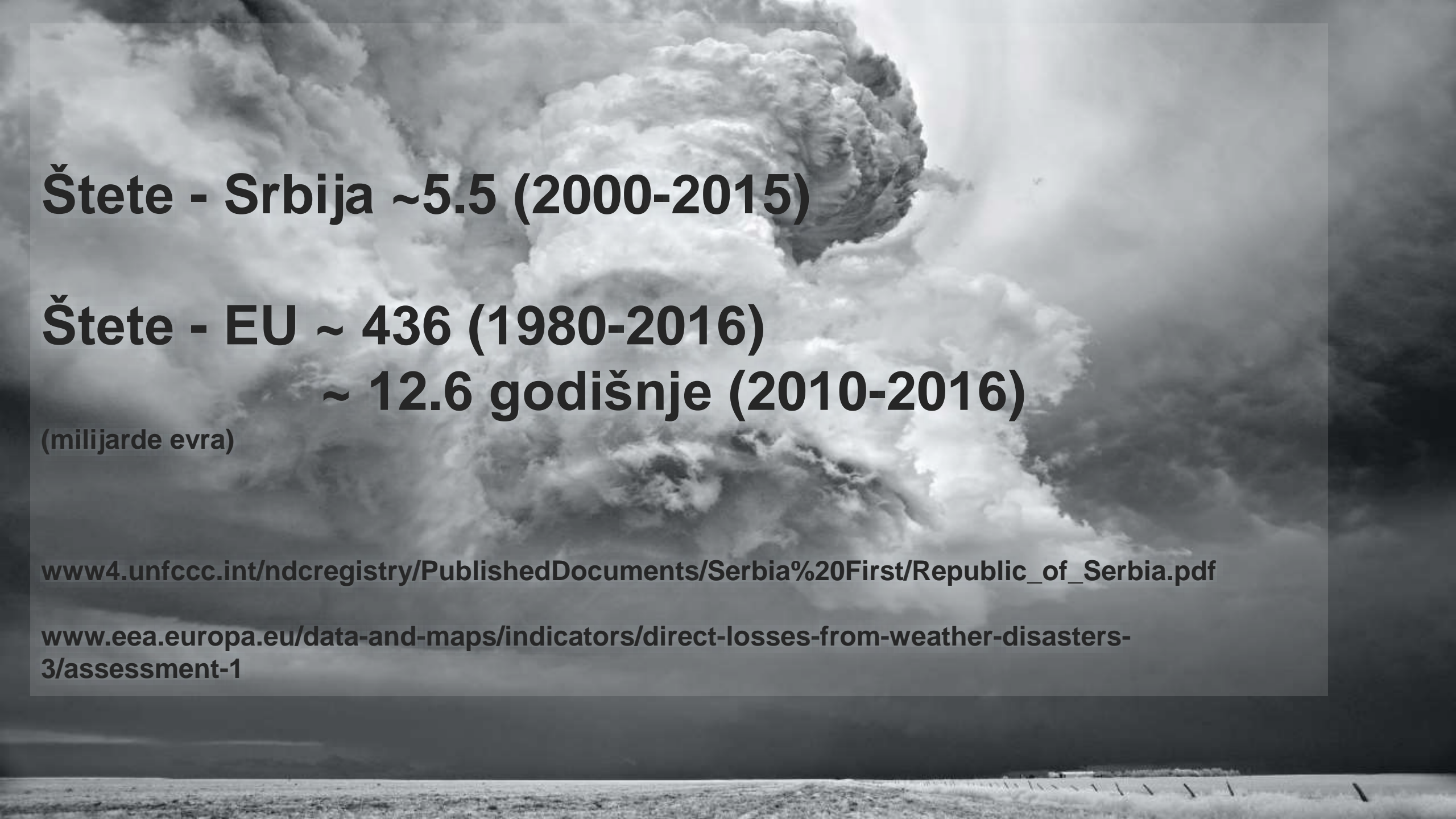
— SPEI6 (Avgust)
— fit



Broj dana sa padavinama većim od 30 mm



(podaci: RHMZS)



Štete - Srbija ~5.5 (2000-2015)

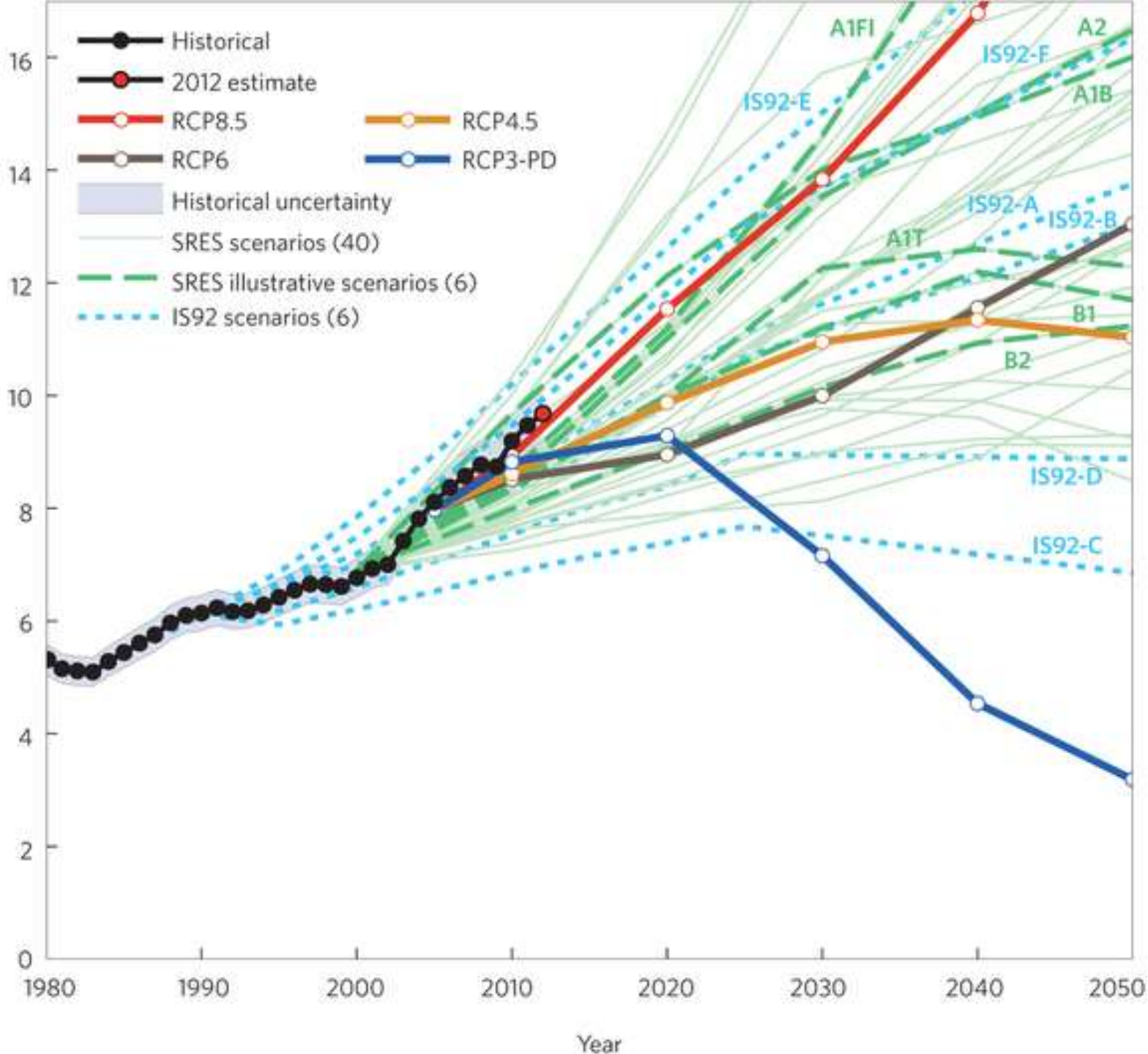
Štete - EU ~ 436 (1980-2016)
~ 12.6 godišnje (2010-2016)

(milijarde evra)

www4.unfccc.int/ndcregistry/PublishedDocuments/Serbia%20First/Republic_of_Serbia.pdf

www.eea.europa.eu/data-and-maps/indicators/direct-losses-from-weather-disasters-3/assessment-1

Globalne emisije CO₂



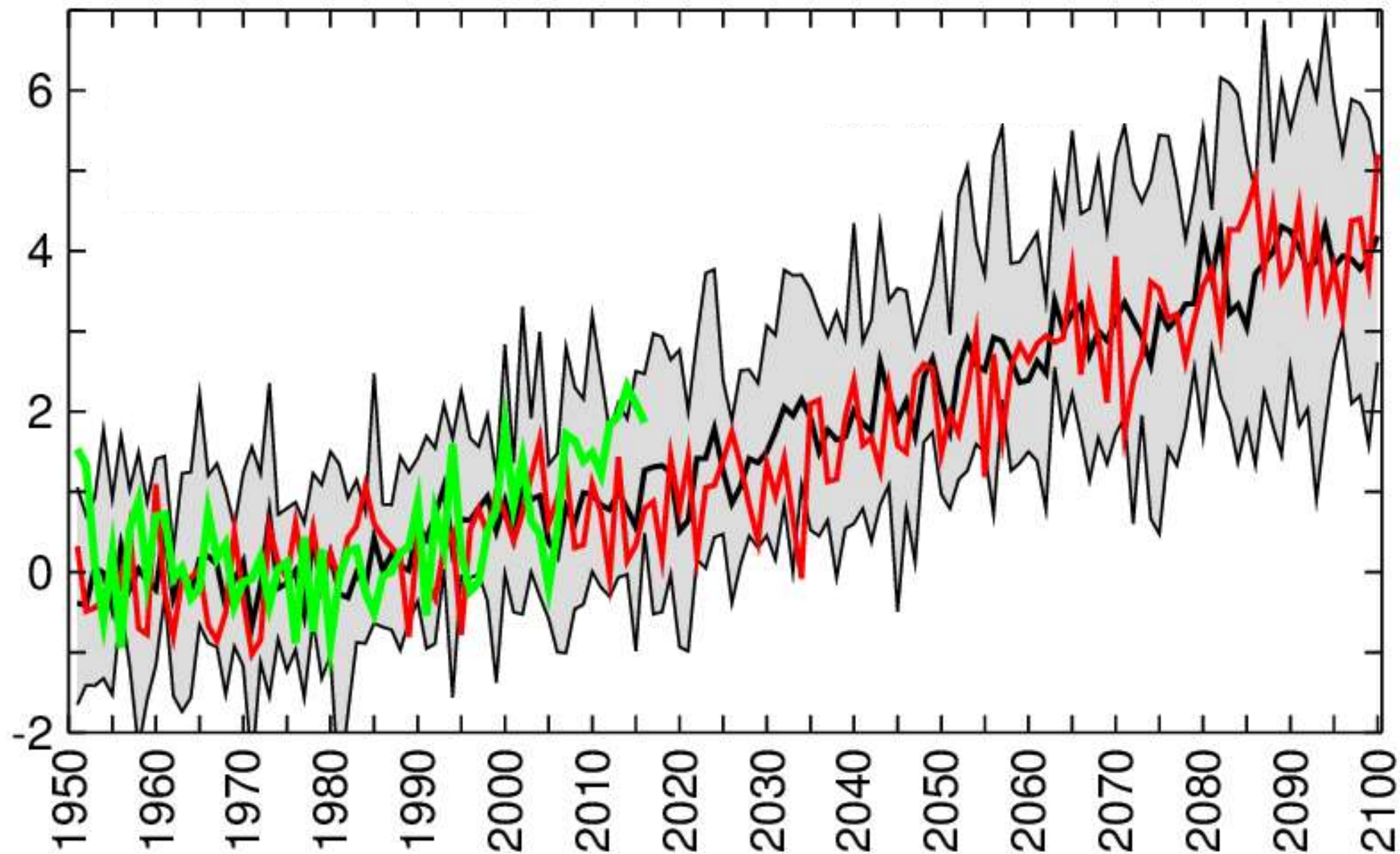
Projekcije za budućnost

Scenarija emisija:

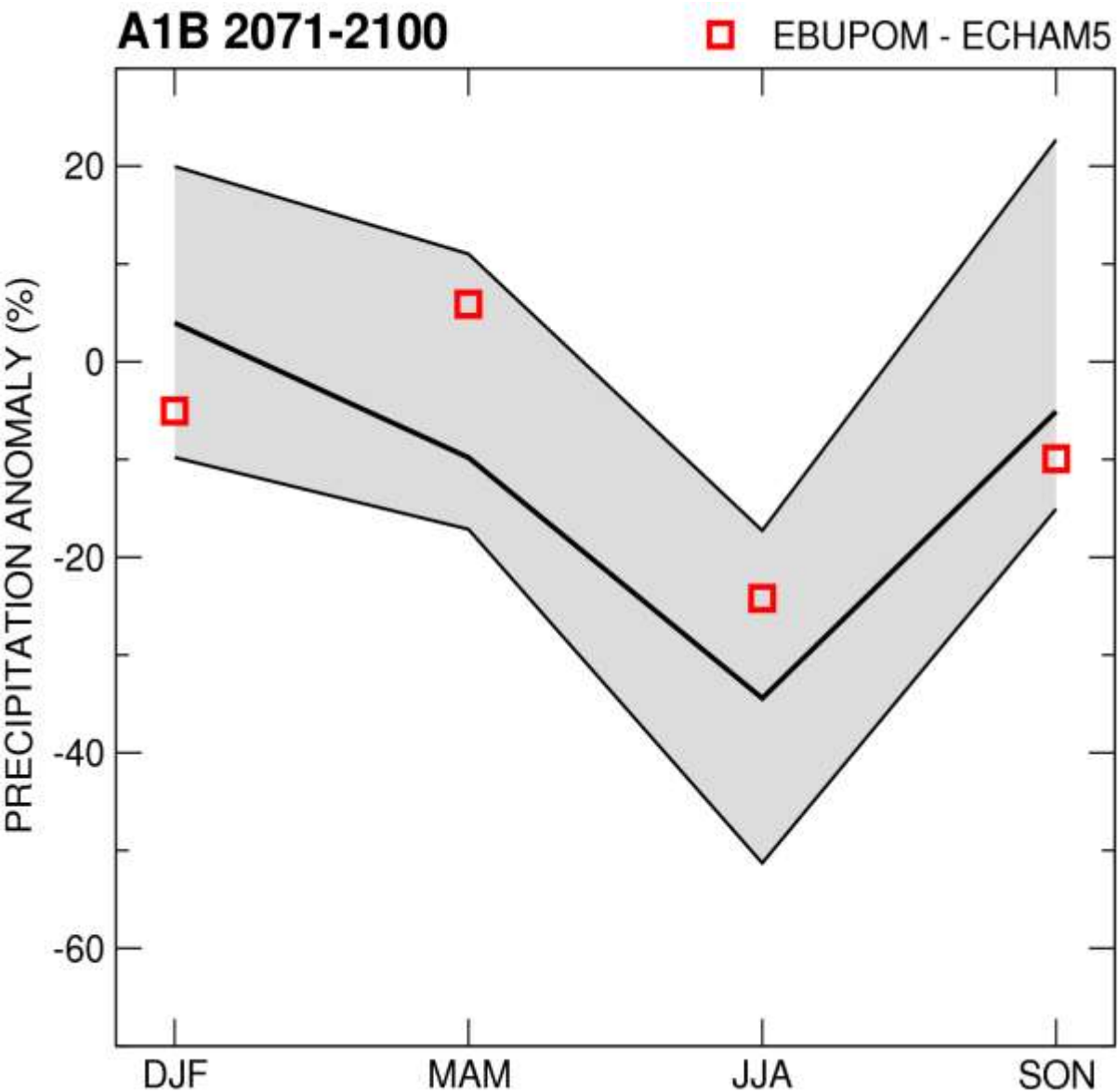
- “nepovoljan” scenario (red line)
- “Pariski sporazum” (blue line)

KLIMATSKI MODELI

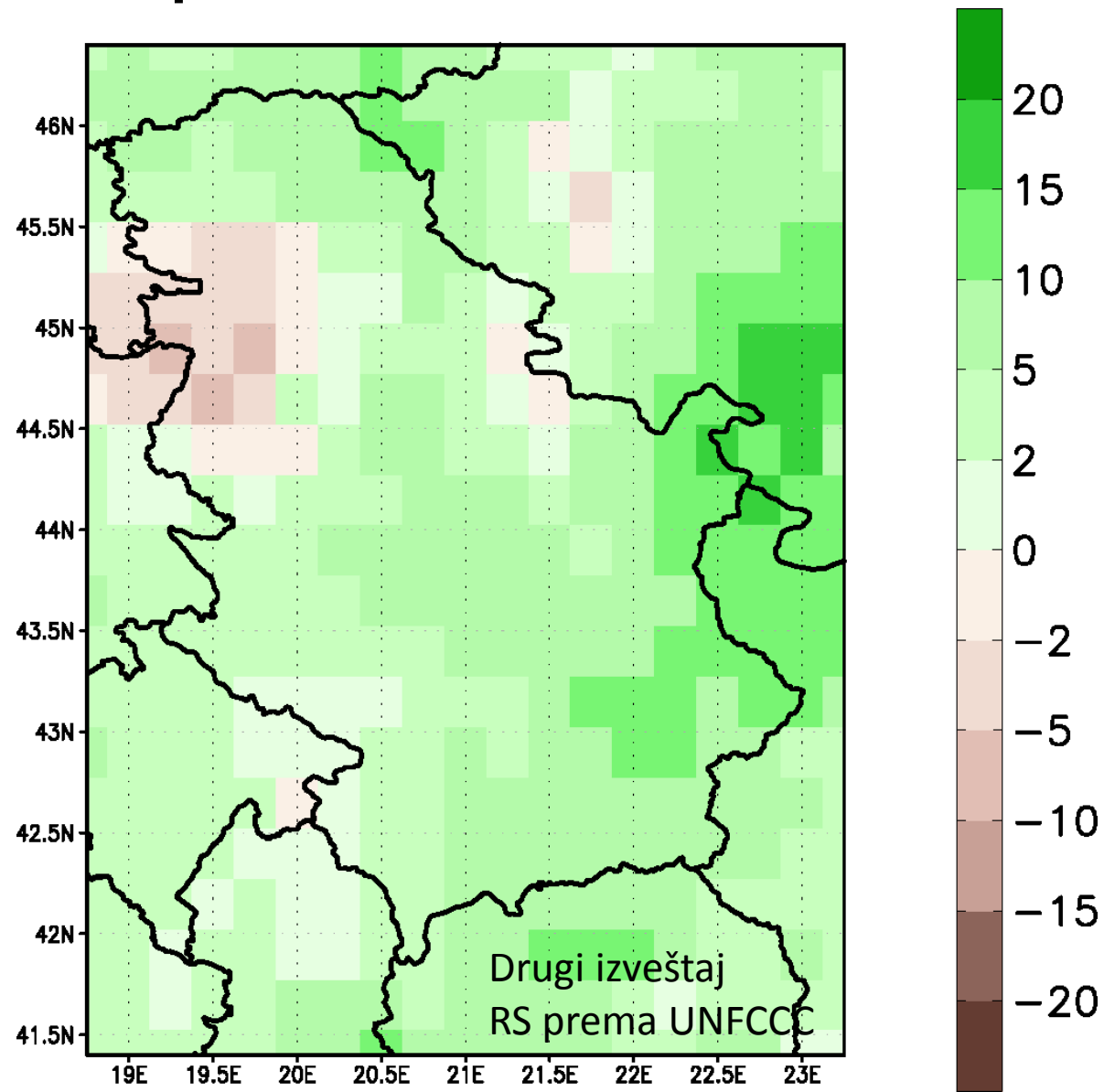
EBU-POM MODEL
OSMATRANJA



Odstupanje sezonskih padavina (%) za period 2071-2100.



Anomalija akumuliranih padavina (%) u danima sa >20mm za period 2071-2100



Uticaj klimatskih promena

(Prvi i Drugi izveštaj)

Visoke
temperature

Suša

Ekstremne
padavine

Poljoprivreda

Vodni resursi

Šumarstvo

Zdravlje

Biodiverzitet

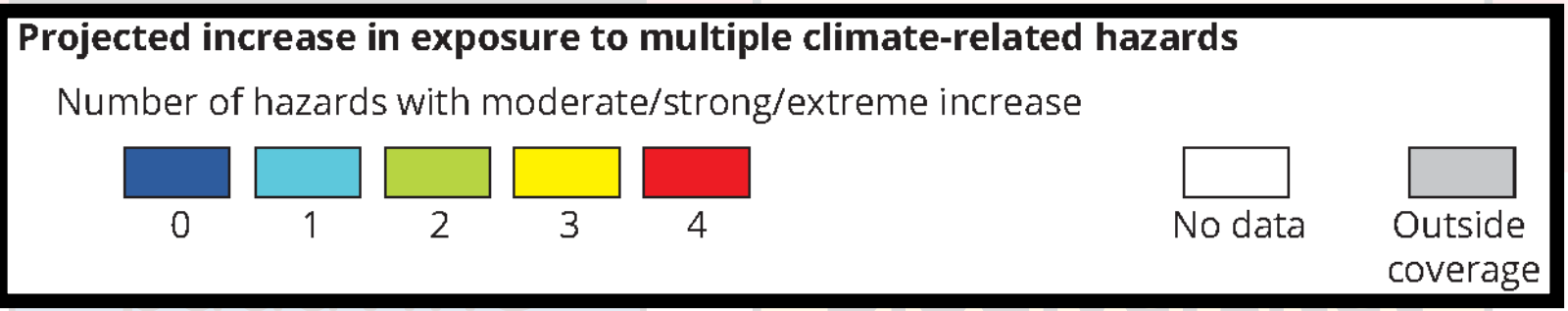
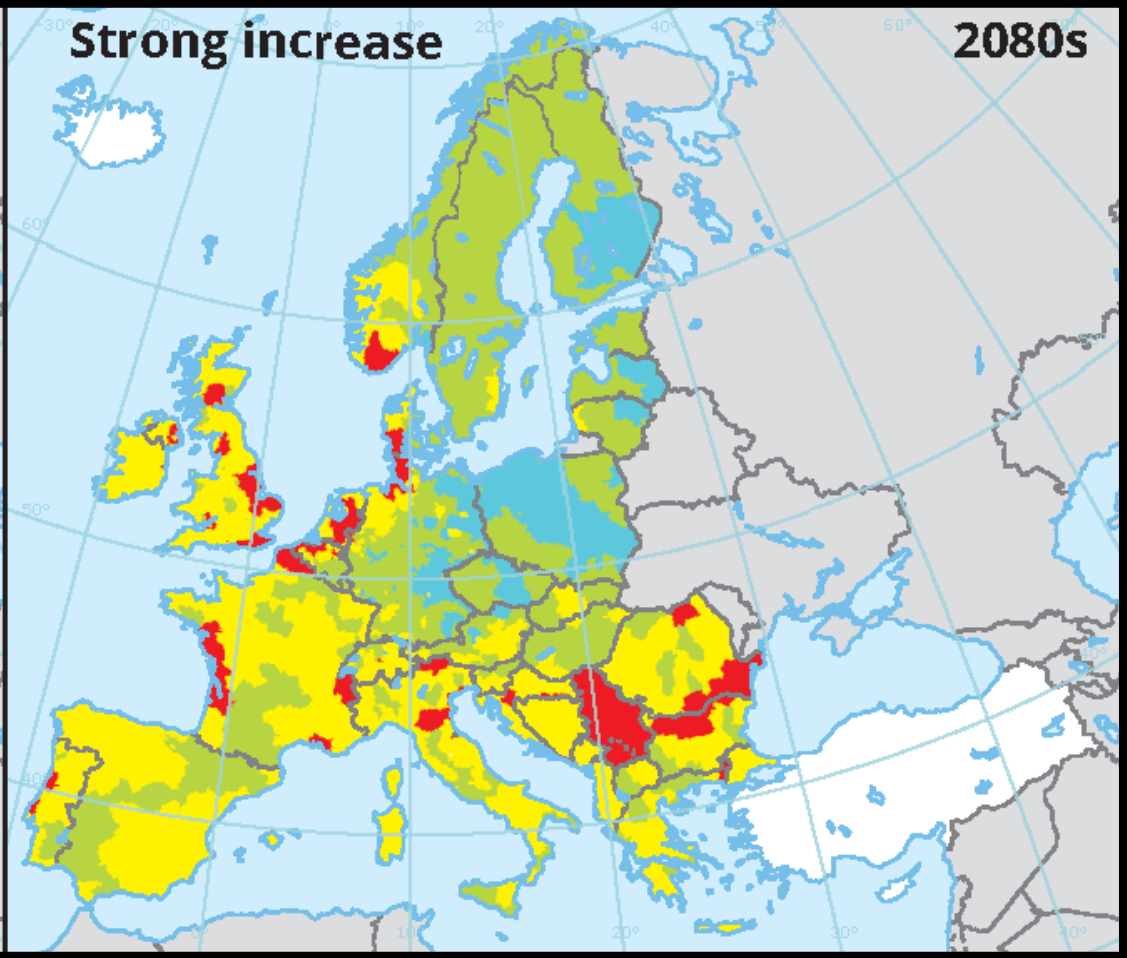
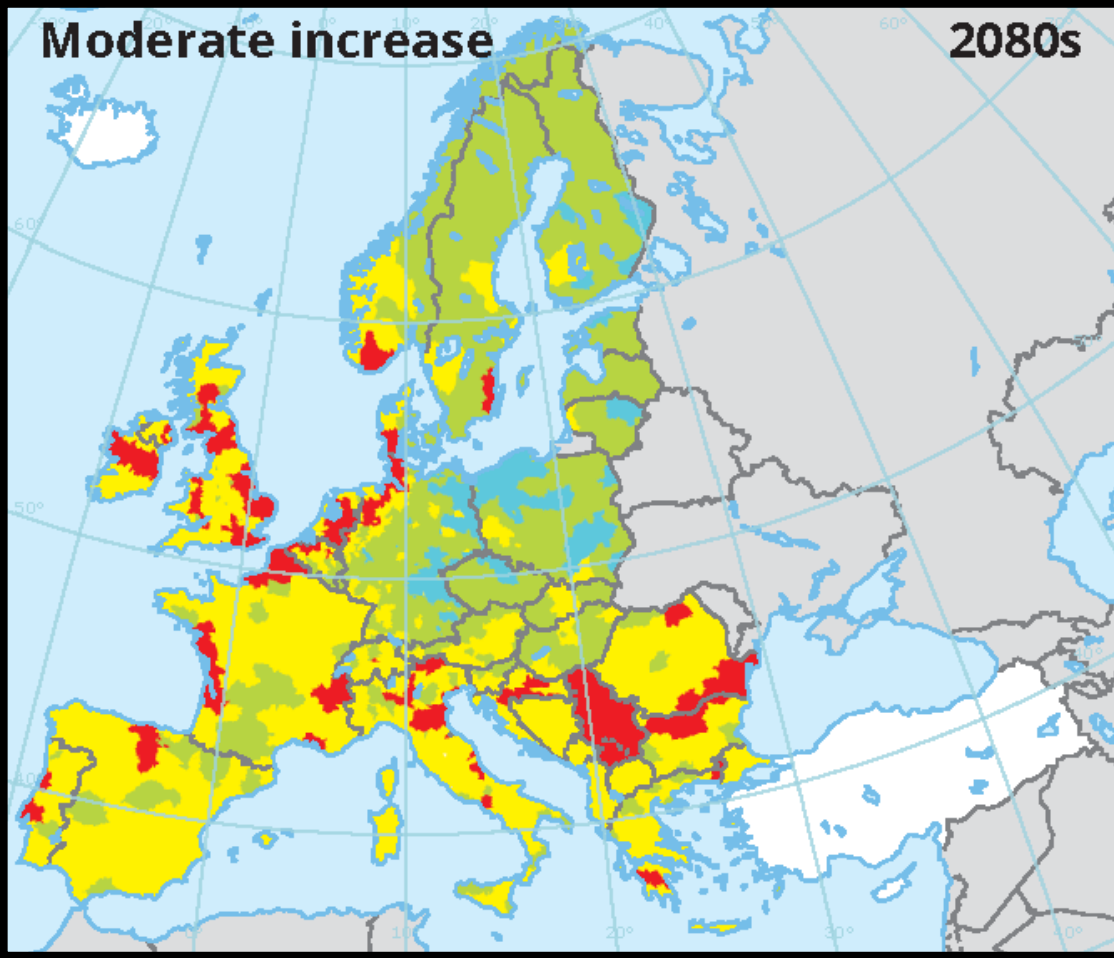
Mnaji kvanitet i kvalitet prinosa
(kuk. >50%), nove bolesti i štetočine...

Gubitak resursa, nepovoljne promene
u h. ciklucu, poplave, snabdevanje ...

Gubitak klim. uslova za pojedine vrste
(bukva), požari, bolesti/štetočine ...

Dugotrajni toploni talasi, pojava
vektorskih bolesti, indirektni uticaji ...

Gubitak staništa i vrsta, pojava
invazivnih vrsta, ...



valitet (kuk.
ćine

e promene
devanje ...

edine vrste
toćine ...

Dugotrajni toploni talasi, pojava vektorskih bolesti, indirektni uticaji ...

Gubitak staništa i vrsta, pojava invazivnih vrsta, ...

Hazardni: toplotni talasi, hladni talasi, suše, požari, poplave, priobalno plavljenje i olujni vetrovi

<https://www.eea.europa.eu/data-and-maps/figures/projected-multi-hazard-exposure-for>

Adaptacija – predložene mere

Reducing risk	<ul style="list-style-type: none"> - Assess vulnerability to climate change - Develop vulnerability map and map of flood risk - Determine need for widening and deepening of riverbed - Additional clearing - Estimate ability of dams and other constructions, in w channel systems, flood control - Improve flood warning systems - Create flood insurance systems - Create flood risk management systems - Adapt agriculture to climate change - Adapt agriculture to climate change
	<ul style="list-style-type: none"> - Adapt agriculture to climate change - Adapt agriculture to climate change - Adapt agriculture to climate change - Adapt agriculture to climate change - Adapt agriculture to climate change - Adapt agriculture to climate change - Adapt agriculture to climate change - Adapt agriculture to climate change - Adapt agriculture to climate change - Adapt agriculture to climate change

Strategic area	Adaptation measures	Challenges and obstacles
Policy	<ul style="list-style-type: none"> - Detailed forest mapping - Detailed vulnerability assessment to climate change - Improve fire protection systems - Improve forest management - Use regulations and directives in forest management 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Monitoring and research	<ul style="list-style-type: none"> - Improve integral monitoring of the effects of air, water and soil pollution and climate change on forest ecosystems - Intensify multidisciplinary research of climate change impacts on forests - Develop and apply strategy evaluation methods and adaptation measures, including measures for strengthening the resilience of forests to climate change 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Capacity building and public awareness	<ul style="list-style-type: none"> - Capacity building in institutions responsible for forest management - Educate rangers - Strengthen the role of local communities in sustainable forest management - Raise awareness of the scientific community and forest owners - Raise the public awareness level and improve information on climate change impacts and possible adaptation measures 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness

Table 4.6. Strategic areas and measures of adaptation to climate change

Monitoring and research	<ul style="list-style-type: none"> - Additional research and monitoring vulnerability and adaptation (LT) - Continued inventory of private forests
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Capacity building and public awareness	<ul style="list-style-type: none"> - Capacity building of public enterprises of appropriate legal, organizational and financial nature - Awareness raising on the importance of forests for adapting of the society as a whole to climate change (LT) - Awareness raising on multiple forest ecosystem services and their multi-functionality (LT) - Training on the impacts of climate change on forests and adaptability of forests to changing climate conditions
--	--

Monitoring and research	<ul style="list-style-type: none"> - Improvement of monitoring and other non-structural (LR, CLT) - Hydrological monitoring network improvement - Improvement of the early warning systems for events (NR, CLT) - Establishment of database on extreme meteorological disasters (NR, ST) - Research improvement in the field of numerical climate change modeling (LR, CLT) - Advancement of research of climate change impacts on forests (NR, CLT) - Advancement of multidisciplinary research of climate change impacts on forests (NR, CLT) - Monitoring of the specific ecosystem and species indicators of the state of the river basin and catchment (CLT)
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Capacity building and public awareness	<ul style="list-style-type: none"> - Improvement of coordination/harmonized activities in charge at local, regional and national levels (NR, CLT) - Capacity building of government institutions (NR, CLT) - Building of local community capacities (LR, CLT) - Capacity building of research and educational institutions - Improved inter-sectoral cooperation and ongoing communication - Public awareness raising and better information on climate change impacts and possible adaptation measures (LR, CLT) - Capacity building and active participation of civil society organizations (LR, CLT)
--	--

Strategic area	Adaptation measures	Challenges and obstacles
Policy	<ul style="list-style-type: none"> - Include climate change impact problems into forest sector strategy and Action Plan - Adopt an adaptation plan within the sector, including its financial needs 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Monitoring and research	<ul style="list-style-type: none"> - Improve integral monitoring of the effects of air, water and soil pollution and climate change on forest ecosystems - Intensify multidisciplinary research of climate change impacts on forests - Develop and apply strategy evaluation methods and adaptation measures, including measures for strengthening the resilience of forests to climate change 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Capacity building and public awareness	<ul style="list-style-type: none"> - Capacity building in institutions responsible for forest management - Educate rangers - Strengthen the role of local communities in sustainable forest management - Raise awareness of the scientific community and forest owners - Raise the public awareness level and improve information on climate change impacts and possible adaptation measures 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness

Strategic area	Adaptation measures	Challenges and obstacles
Policy	<ul style="list-style-type: none"> - Detailed vulnerability assessment to climate change - Improve fire protection systems - Improve forest management - Use regulations and directives in forest management 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Monitoring and research	<ul style="list-style-type: none"> - Improve integral monitoring of the effects of air, water and soil pollution and climate change on forest ecosystems - Intensify multidisciplinary research of climate change impacts on forests - Develop and apply strategy evaluation methods and adaptation measures, including measures for strengthening the resilience of forests to climate change 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Capacity building and public awareness	<ul style="list-style-type: none"> - Capacity building in institutions responsible for forest management - Educate rangers - Strengthen the role of local communities in sustainable forest management - Raise awareness of the scientific community and forest owners - Raise the public awareness level and improve information on climate change impacts and possible adaptation measures 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness

Table 4.8. Strategic areas and measures of adaptation to climate changes in agriculture

Strategic area	Adaptation measures	Challenges and obstacles
Policy	<ul style="list-style-type: none"> - Develop a biodiversity indicator system - Detailed vulnerability assessment to climate change - Increase protected areas - Create an adaptation plan within the sector - Improve inter-sector planning and integral management of water resources in catchment areas of importance to agriculture - Introduce new insurance mechanisms 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Monitoring and research	<ul style="list-style-type: none"> - Improve integral monitoring of the effects of air, water and soil pollution and climate change on forest ecosystems - Intensify multidisciplinary research of climate change impacts on forests - Develop and apply strategy evaluation methods and adaptation measures, including measures for strengthening the resilience of forests to climate change 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Capacity building and public awareness	<ul style="list-style-type: none"> - Capacity building in institutions responsible for forest management - Educate rangers - Strengthen the role of local communities in sustainable forest management - Raise awareness of the scientific community and forest owners - Raise the public awareness level and improve information on climate change impacts and possible adaptation measures 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness

Strategic area	Adaptation measures	Challenges and obstacles
Policy	<ul style="list-style-type: none"> - Detailed vulnerability assessment to climate change - Improve fire protection systems - Improve forest management - Use regulations and directives in forest management 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Monitoring and research	<ul style="list-style-type: none"> - Improve integral monitoring of the effects of air, water and soil pollution and climate change on forest ecosystems - Intensify multidisciplinary research of climate change impacts on forests - Develop and apply strategy evaluation methods and adaptation measures, including measures for strengthening the resilience of forests to climate change 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Capacity building and public awareness	<ul style="list-style-type: none"> - Capacity building in institutions responsible for forest management - Educate rangers - Strengthen the role of local communities in sustainable forest management - Raise awareness of the scientific community and forest owners - Raise the public awareness level and improve information on climate change impacts and possible adaptation measures 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness

Table 4.10. Strategic areas and measures of adaptation to climate change in forestry sector

Strategic area	Adaptation measures	Challenges and obstacles
Risk reduction	<ul style="list-style-type: none"> - Reduction of risks and abiotic disturbances through building adaptive capacity of forests - Redesigning protection forest walls in fire-prone regions (MT) - Early treatment of pests (ST) - Management of thinning of cooler plantations (MT) - Prevention of insect pests (ST) - Prevention of canopy gaps (ST) - Choice of adequate tree species, provenances, populations and genotypes, which show higher resilience to altered climate conditions or are specially adapted to potential climate conditions in the future (ST) - Introducing the practice of adaptive management of forests and forest measures in order to adapt to climate change - Change of forest management goals and generation of 'close to nature' forest management (through ST) - More intensive monitoring of degraded forests by afforestation, after-ripping and related activities - Prevention of erosion and land slide of forests 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Policy	<ul style="list-style-type: none"> - Develop a biodiversity indicator system - Detailed vulnerability assessment to climate change - Increase protected areas - Create an adaptation plan within the sector - Improve inter-sector planning and integral management of water resources in catchment areas of importance to agriculture - Introduce new insurance mechanisms 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Monitoring and research	<ul style="list-style-type: none"> - Improve integral monitoring of the effects of air, water and soil pollution and climate change on forest ecosystems - Intensify multidisciplinary research of climate change impacts on forests - Develop and apply strategy evaluation methods and adaptation measures, including measures for strengthening the resilience of forests to climate change 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Capacity building and public awareness	<ul style="list-style-type: none"> - Capacity building in institutions responsible for forest management - Educate rangers - Strengthen the role of local communities in sustainable forest management - Raise awareness of the scientific community and forest owners - Raise the public awareness level and improve information on climate change impacts and possible adaptation measures 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness

Adaptacija

Implementacija?

Rana implementacija omogućava evaluaciju (i ispravljanje "grešaka") kao i izbegavanje nefunkcionalne adaptacije (+ izbegavanje brzopletih rešenja + izbegvanje greenwahsing-a)

The background image is a large, multi-column table with a grid-like structure. The columns are headed by 'Strategic area', 'Adaptation measures', 'Challenges and obstacles', 'Strategic area', 'Adaptation measures', 'Challenges and obstacles', 'Strategic area', 'Adaptation measures', 'Challenges and obstacles', 'Strategic area', 'Adaptation measures', 'Challenges and obstacles'. The rows are headed by 'Reducing risks', 'Policy', 'Monitoring and research', 'Capacity building and public awareness', 'Monitoring and research', 'Capacity building and public awareness', 'Monitoring and research', 'Capacity building and public awareness', 'Monitoring and research', 'Capacity building and public awareness'. The table contains various text entries, some of which are partially obscured by the large red text overlay. The text is in a light grey color, making it difficult to read in detail. The table appears to be a comprehensive overview of climate change adaptation strategies and their implementation challenges.

Adaptacija na klimatske promene

u sinergiji (možda?) sa:

Ciljevima održivog razvoja

Smanjenje rizika od elementarnih nepogoda

Dugoročne sektorske strategije

Velika infrastrukturna ulaganja ...

Osmotrena klima i/ili trenutni trendovi

Adaptacija na klimatske promene

u sinergiji (~~možda?~~) sa:

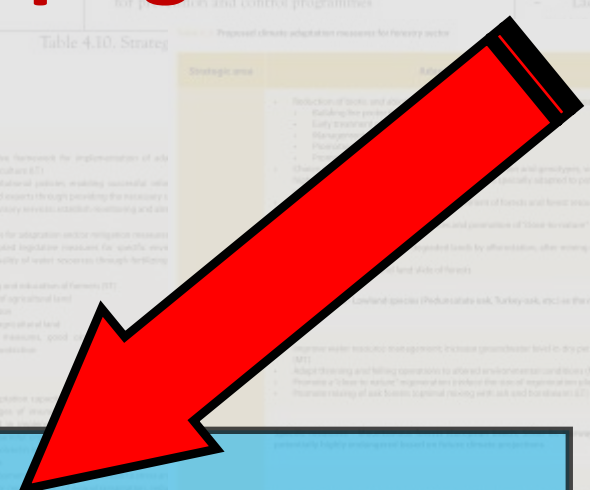
Ciljevima održivog razvoja

Smanjenje rizika od elementarnih nepogoda

Dugoročne sektorske strategije

Velika infrastrukturna ulaganja ...

Osmotrena + trend + projekcije buduće klime



Adaptacija

Prioriteti?

Troškovi/dobit; Troškovi/efikasnost;
Višekriterijumski analiza; Ekspertska procena

Ciljanje vremenskog horizonta

Strategic area	Adaptation measures	Challenges and obstacles
Reducing risks	<ul style="list-style-type: none"> - Develop a biodiversity indicator system - Detailed vulnerability assessment to climate change - Increase protected areas - Ensure corridors for the migration of species - Decrease pressure of other anthropogenic factors to biodiversity 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical and technological capacities
Policy	<ul style="list-style-type: none"> - Include climate change impact problems into forest sector strategy and Action Plan - Integrate adaptation plan within the sector, including the needs of different user groups - Integrate the integral monitoring of the effects of air, water and soil pollution and climate change on forest ecosystems - Intensity multidisciplinary research of climate change impacts on forests - Develop and apply strategy evaluation methods and adaptation measures, including measures for strengthening the resilience of forests to climate change - Capacity building in institutions responsible for forest management - Educate citizens 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Monitoring and research	<ul style="list-style-type: none"> - Intensity multidisciplinary research of climate change impacts on forests - Develop and apply strategy evaluation methods and adaptation measures, including measures for strengthening the resilience of forests to climate change - Improve climate monitoring systems - Develop and apply specific measures to green climate change, including information on change in the agriculture and other sectors 	<ul style="list-style-type: none"> - Insufficient funds - Lack of awareness
Capacity building and public awareness	<ul style="list-style-type: none"> - Capacity building in institutions responsible for forest management - Educate citizens - Increase the level of local community awareness - Increase the public awareness level and improve information on climate change impacts and possible adaptation measures 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness

Strategic area	Adaptation measure	Challenges and obstacles
Policy	<ul style="list-style-type: none"> - Detailed assessment of related risks to climate change - Improve irrigation and drainage - Invest in new irrigation systems and related infrastructure - Advise farmers down and the field work schedule to the new climate conditions - Reduce the share of summer crops and increase the share of winter crops in the farmer's rotation - Change sowing practices - Improve soil moisture with adaptive treatment in order to increase its water storage capacity - Introduce measures to protect food from rotting - Change practices concerning the use of herbicides and herbicides - Include climate change impacts in sector strategies and Action Plans - Create an adaptation plan within the sector - Improve inter-sector planning and integral management of water resources in order to meet the requirements of agriculture - Introduce new insurance mechanism - Improve climate monitoring systems - Develop action plan concerning information on extreme weather occurrence and changes connected with climate change, including information on change in the agriculture and other sectors 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
Monitoring and research	<ul style="list-style-type: none"> - Intensity multidisciplinary research of climate change impacts on forests - Develop and apply strategy evaluation methods and adaptation measures, including measures for strengthening the resilience of forests to climate change - Improve climate monitoring systems - Develop and apply specific measures to green climate change, including information on change in the agriculture and other sectors 	<ul style="list-style-type: none"> - Insufficient funds - Lack of awareness
Capacity building and public awareness	<ul style="list-style-type: none"> - Capacity building in institutions responsible for forest management - Educate citizens - Increase the level of local community awareness - Increase the public awareness level and improve information on climate change impacts and possible adaptation measures 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness

Strategic area	Adaptation measure	Challenges and obstacles
Policy	<ul style="list-style-type: none"> - Detailed assessment of related risks to climate change - Improve irrigation and drainage - Invest in new irrigation systems and related infrastructure - Advise farmers down and the field work schedule to the new climate conditions - Reduce the share of summer crops and increase the share of winter crops in the farmer's rotation - Change sowing practices - Improve soil moisture with adaptive treatment in order to increase its water storage capacity - Introduce measures to protect food from rotting - Change practices concerning the use of herbicides and herbicides - Include climate change impacts in sector strategies and Action Plans - Create an adaptation plan within the sector - Improve inter-sector planning and integral management of water resources in order to meet the requirements of agriculture - Introduce new insurance mechanism - Improve climate monitoring systems - Develop action plan concerning information on extreme weather occurrence and changes connected with climate change, including information on change in the agriculture and other sectors 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness
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Capacity building and public awareness	<ul style="list-style-type: none"> - Capacity building in institutions responsible for forest management - Educate citizens - Increase the level of local community awareness - Increase the public awareness level and improve information on climate change impacts and possible adaptation measures 	<ul style="list-style-type: none"> - Insufficient funds - Insufficient technical capacity - Lack of awareness

Planovi za treći izveštaj


Revizija projekcija buduće klime (scenarija iz RCP familije, sa horizontalnim razlaganjem od 11km, CORDEX/Copernicus baza podataka).

Revizija uticaja i ranjivosti sektora (u zavisnosti od dostupnosti podataka; fokus na sub-nacionalnom nivou).

Prioriteti u implementaciji.

Sinergija sa drugim planovima/strategijama.

Među-sektorske analize.



Osmotrene klimatske promene i scenarija promene klime u Srbiji, mogući uticaji i mogućnosti adaptacije

H V A L A