NATIONAL CENTRE FOR SCIENTIFIC RESEARCH "DEMOKRITOS"

Projection of forest fire danger due to climate change in Greece

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The **National Center for Scientific Research "Demokritos" (NCSR "Demokritos"), inaugurated in 1961, is the largest** multidisciplinary research center in Greece, (800-1000 employees) with high level expertise and advanced infrastructure in the fields of Nanotechnology and Advanced Materials, Energy & Environment, Biosciences, Nuclear and Particle Physics, Informatics & Telecommunications

- Climate change will reduce fuel moisture levels from present values around the Mediterranean region and the region will become drier, increasing the weather-driven danger of forest fires.
  The countries in highest danger are Spain, Portugal, Turkey, Greece, parts of central and southern Italy, Mediterranean France, and the coastal region of the Balkans, according to recent research of JRC [1]

- Recognizing the need to minimize the adverse effects of climate change in such fire-prone areas must drive the efforts of the fire management and prevention community towards detailed assessment of future impacts.

- In view of that, the aim of this work was to provide a study of the Fire Danger evolution and expected changes in the fire regime in Greece in the near future, using FWI system indices, calculated using two available climate model datasets for two RCP scenarios (Representative Concentration Pathway of the Intergovernmental Panel on Climate Change [IPCC] , RCP 4.5, RCP 8.5) .

[1] de Rigo, D.; Libertà, G.; Houston Durrant, T.;Artés Vivancos, T.; San-Miguel-Ayanz, J. Forest fire danger extremes in Europe under climate change: variability and uncertainty. PESETA III project - Climate Impacts and Adaptation in Europe, focusing on Extremes, Adaptation and the 2030s. Task 11 - Forest fires. Final report. JRC Technical Reports. 2017, ISBN 978-92-79-77046-3 ISSN 1831-9424 doi:10.2760/13180

CLIMATE MODELS AND RCP SCENARIOS (CNRM-CERFACS-CNRM-CM5)

- EURO-CORDEX - Coordinated Downscaling Experiment – European Domain , is an internationally coordinated effort to deliver European climate predictions for the 21st century at regional scale at 50 km (EUR-44) and 12 km (EUR-11) horizontal resolution. In EURO-CORDEX, a rather large ensemble of continental scale simulations has been performed for historic and future climates based on CMIP5 (Coupled Model Intercomparison Project) GCM (Global Climate Models) projections.
  - EURO-CORDEX high resolution regional climate simulations (11~ 12 km) were used to investigate the impact of climate change on Fire Danger according to RCP 4.5 and RCP 8.5 scenarios.
    - The RCP 8.5 -business as usual scenario- is the most severe in which emissions are assumed to rise throughout the 21st century and it is regarded as the most credible prediction if no mitigation actions are taken.
      - Emissions according to RCP 4.5 peak around 2040 at around 50% higher than 2000 levels, declining rapidly over 30 years and stabilising at half of 2000 levels thereafter until the end of the century.

METHODOLOGY OF CLIMATIC ANALYSIS AND MAPPING OF FWI SYSTEM PARAMETERS

- The atmospheric climate data sets that were elaborated for the area under consideration were used for the calculation of daily parameter values of FWI system for the **fire seasons (1st of May to 31st of October)**, of **a future time period of ten (10) years (2036-2045)** for the the two RCP scenarios of the climate model. (Two data series)
    - An additional "historical period" data series was considered representing the **reference time period**, based on the RCP 4.5 for the **fire seasons of the years 2006-2015**.

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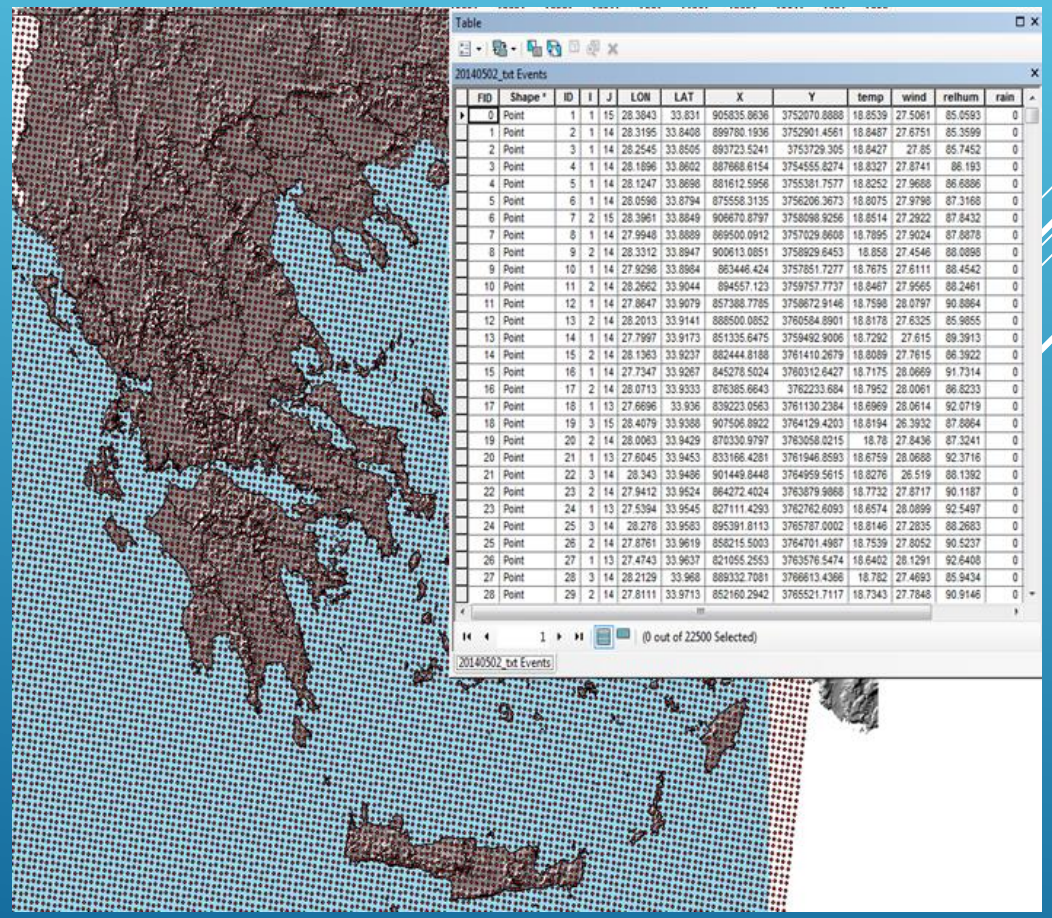
METHODOLOGY OF CLIMATIC ANALYSIS AND MAPPING OF FWI SYSTEM PARAMETERS

- ✓ FWI system is comprised of six components: three fuel moisture codes and three fire behaviour indices.
- ✓ Calculation of the components is based on daily meteorological measurements made **at noon for air temperature, relative humidity, 10-m open wind speed and 24-hour cumulative precipitation**.
- ✓ The Daily Severity Rating (DSR) and its time-averaged value, the Seasonal Severity Rating (SSR), are extensions of the FWI System. The DSR is a transformation of the daily FWI value, calculated as follows:
- ✓ $$DSR = 0.0272FWI^{1.77}$$
- ✓ Higher FWI values are emphasized through the power relation. **The DSR can be accumulated over time as the cumulative DSR, or it may be averaged over time as the SSR**



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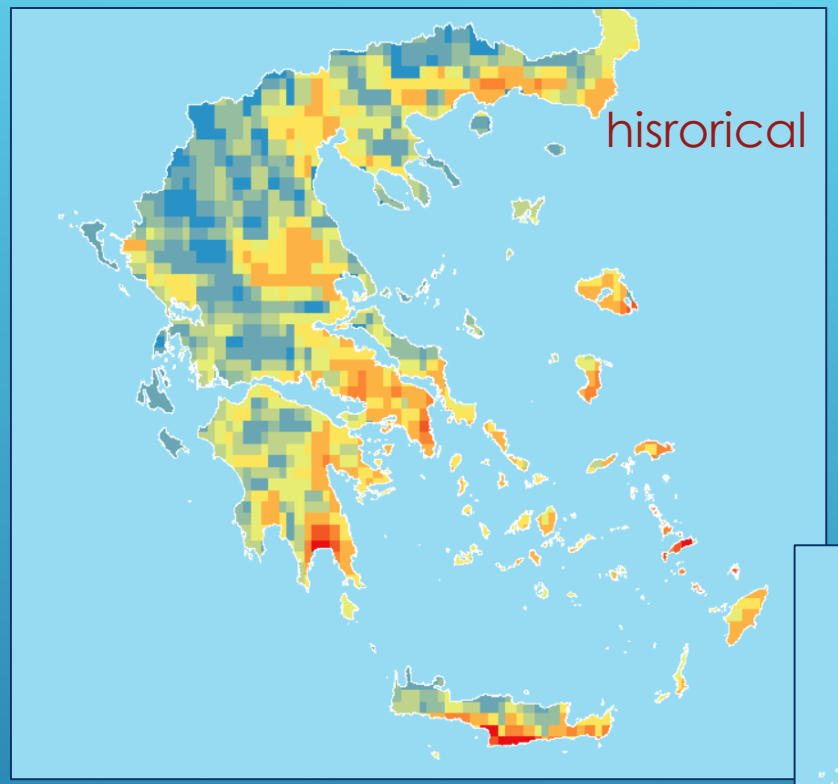
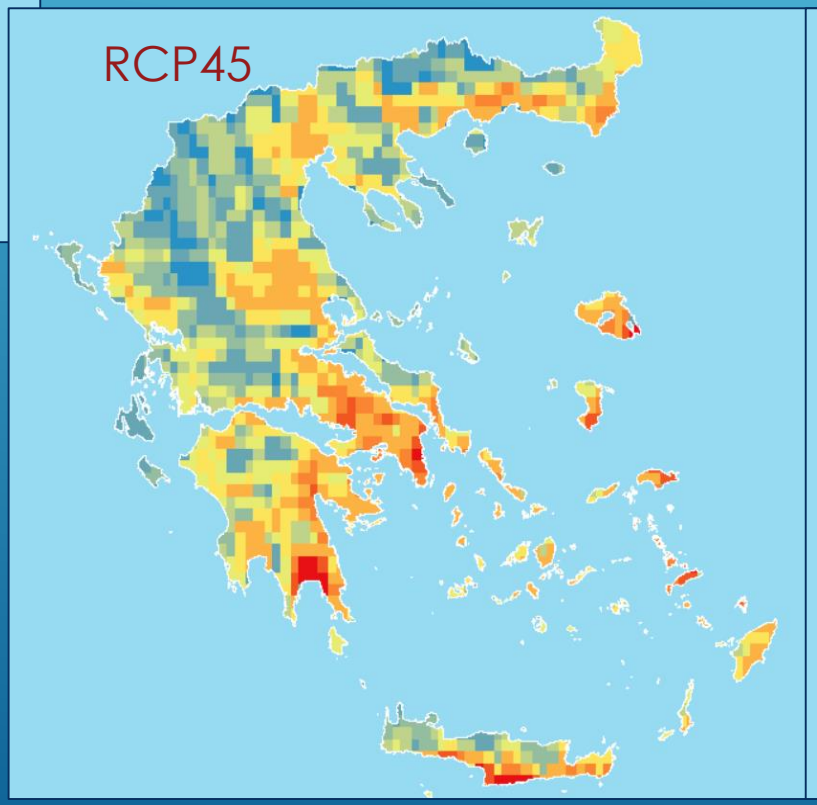
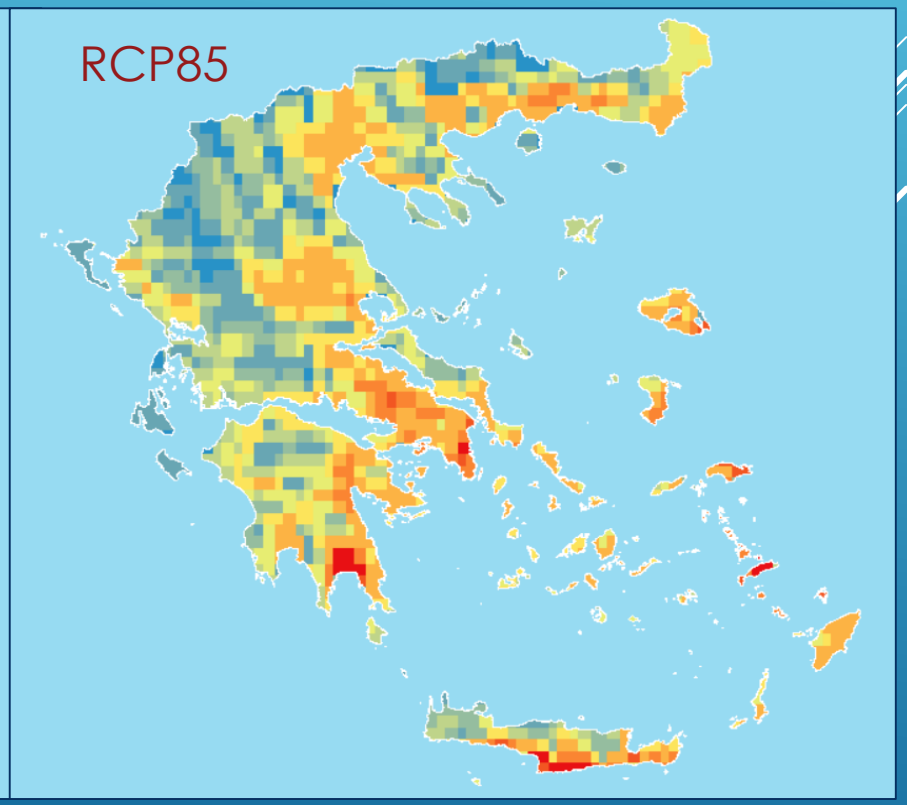
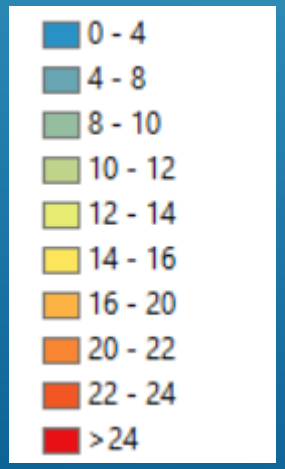
Seasonal Severity Rating

- The Daily Severity Rating (DSR) is a numeric rating of the difficulty of controlling fires. It is based on the Fire Weather Index but more accurately reflects the fire suppression expected efforts. SSR is the mean value of the DSR during a fire season









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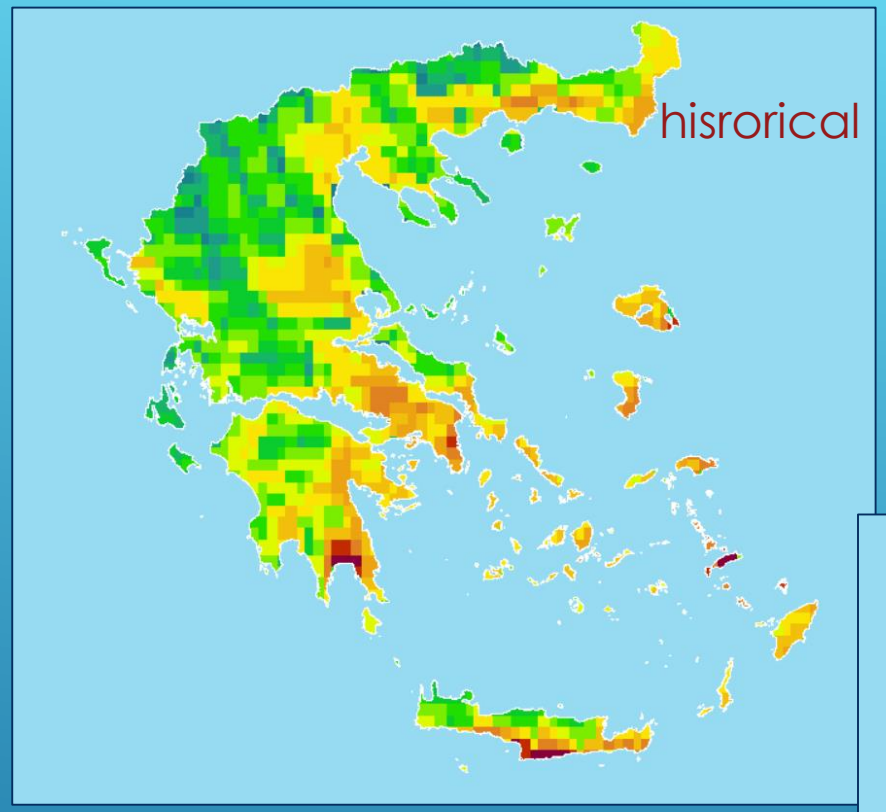
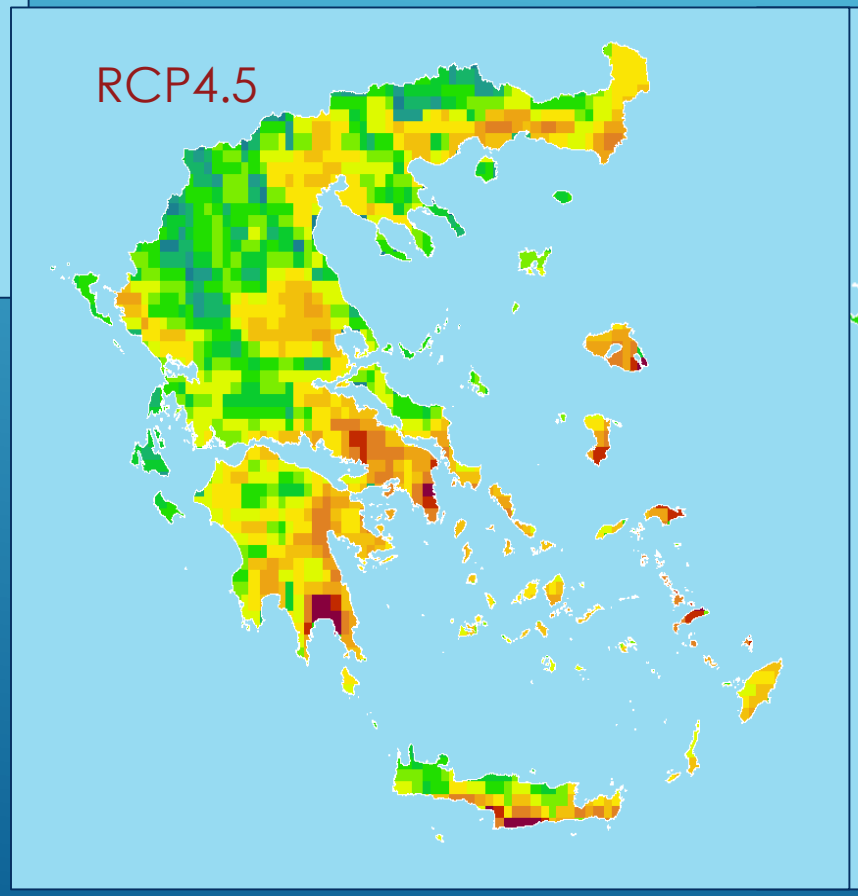
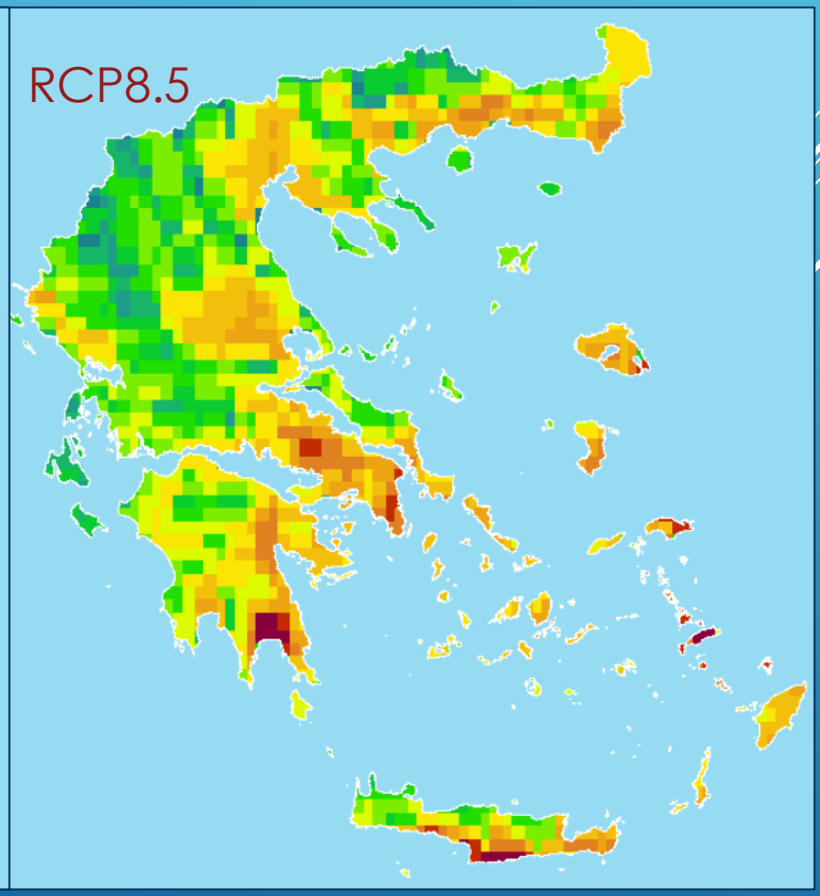
Initial Spread Index (mean)

The Initial Spread Index, ISI, is a numeric rating of the expected rate of fire spread. It combines the effects of wind and the Fine Fuel Moisture Code on rate of spread without the influence of variable quantities of fuel.







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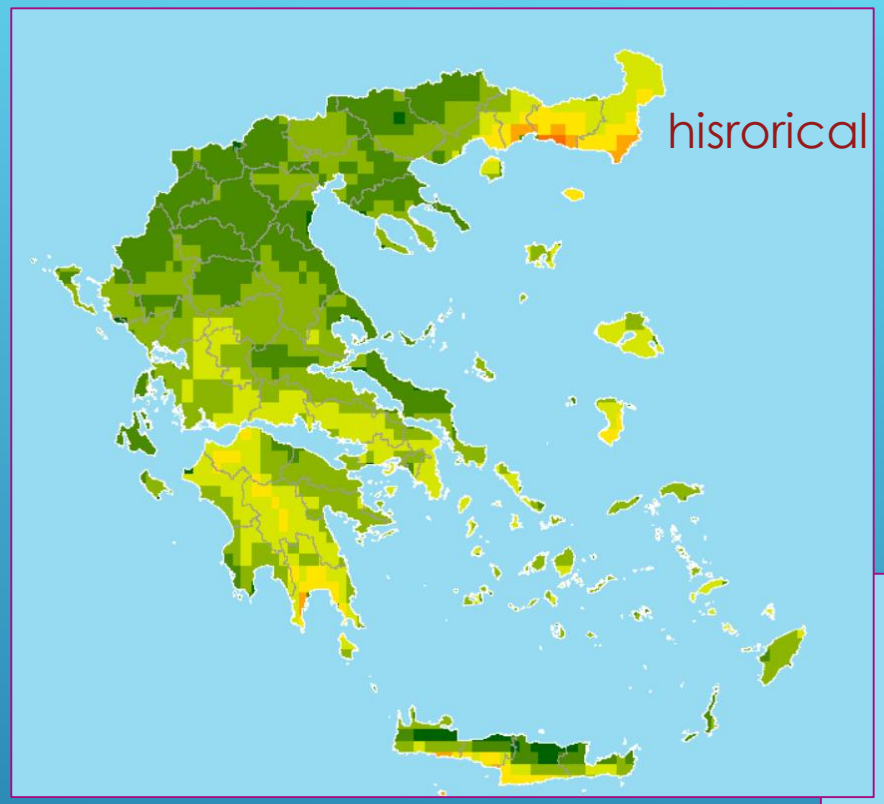
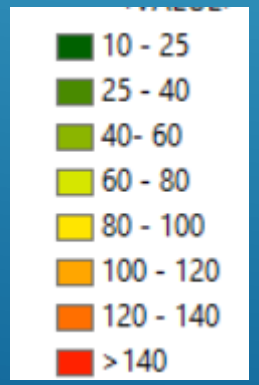
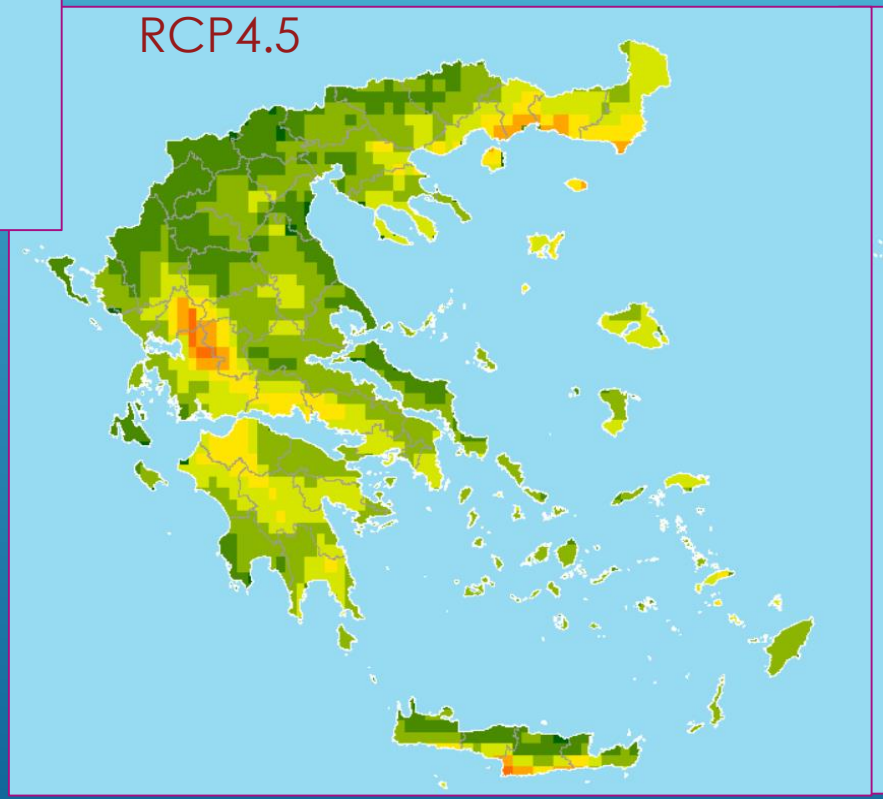
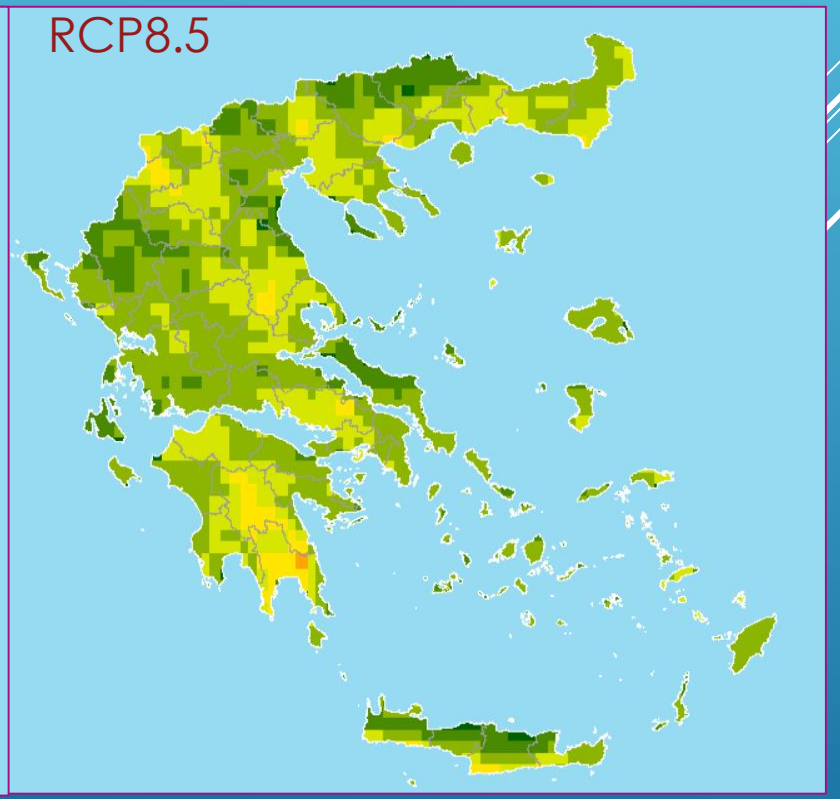
Initial Spread Index (max)

The Initial Spread Index, ISI, is a numeric rating of the expected rate of fire spread. It combines the effects of wind and the Fine Fuel Moisture Code on rate of spread without the influence of variable quantities of fuel.









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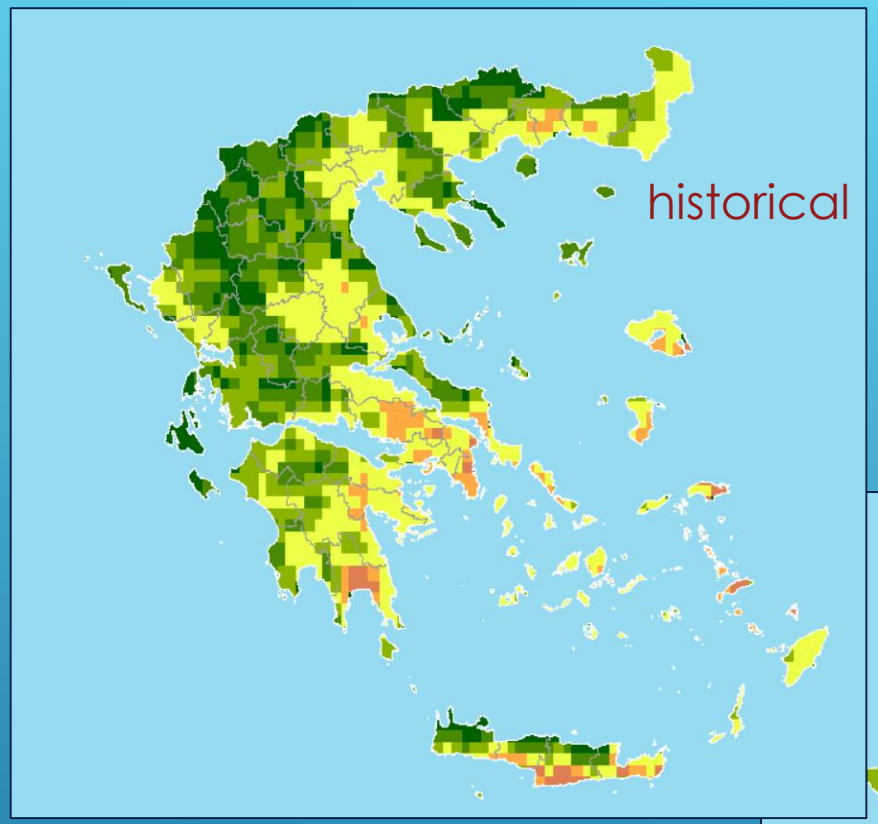
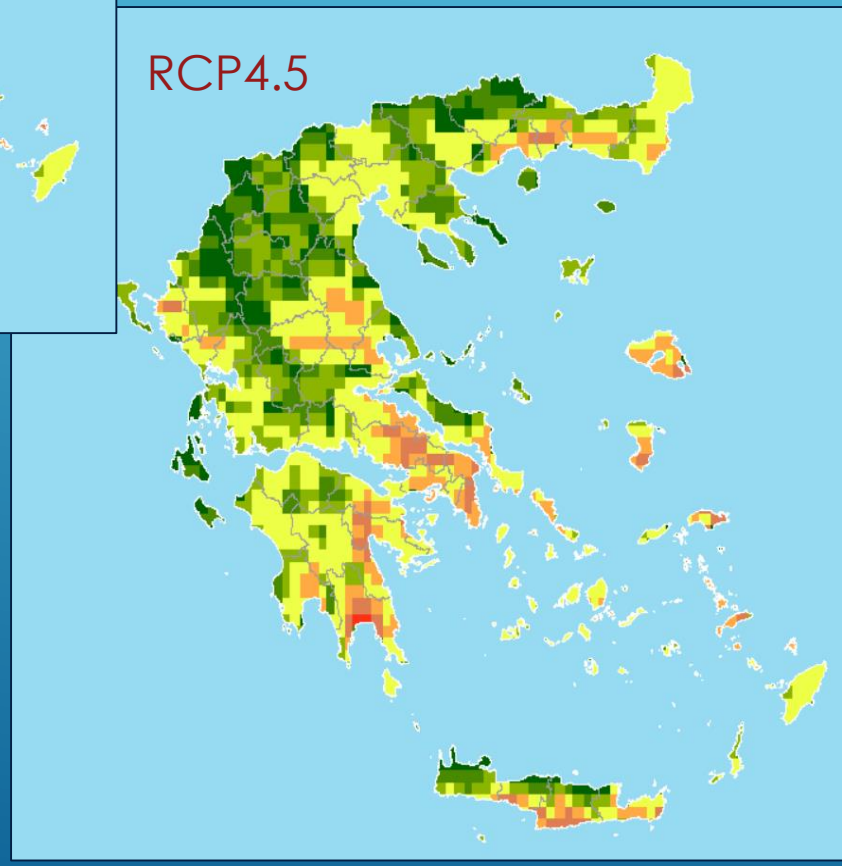
No of days per fire period with FWI > 50

FWI represents the potential fireline intensity and it is a good indicator of general fire danger

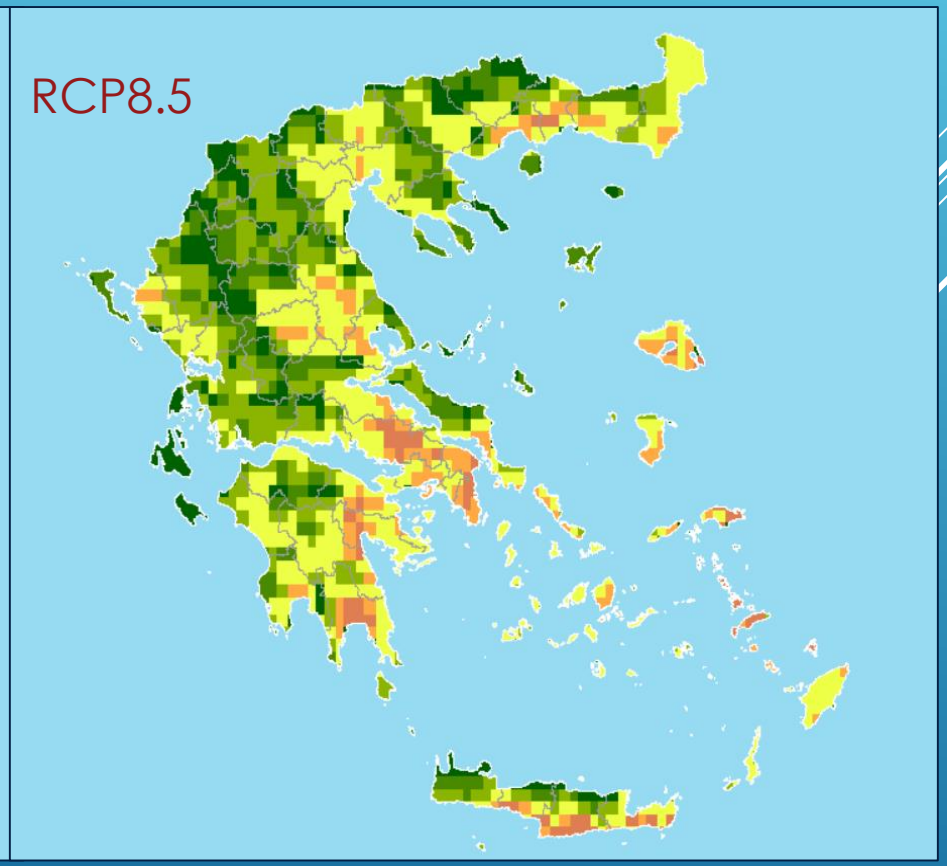
historical

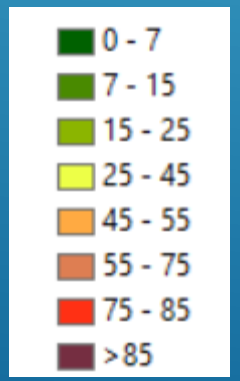


RCP4.5



RCP8.5





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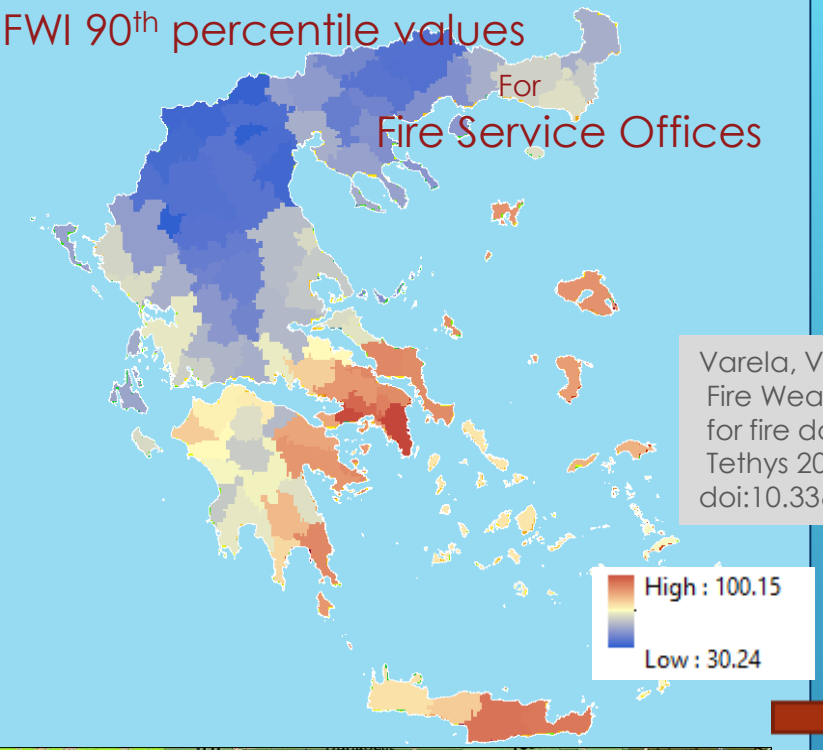
Difference in the number of days above FWI 90th percentile

FWI 90th percentile values
For
Fire Service Offices



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Fire Weather Index (FWI) classification
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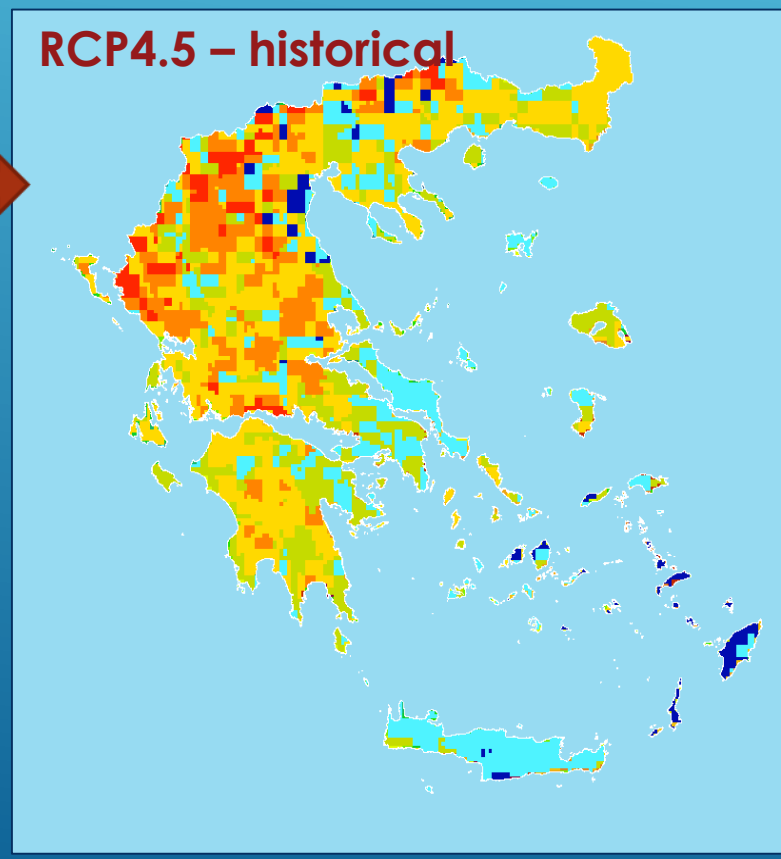
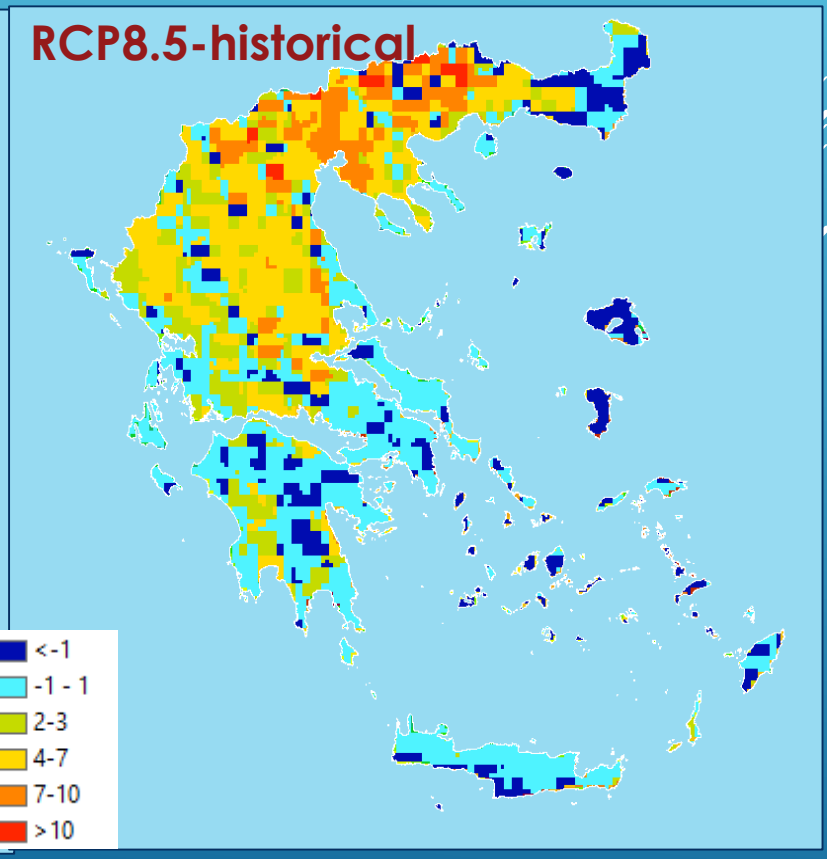
Tethys 2018 no. 15 pp.: 31 – 40,
doi:10.3369/tethys.2018.15.03

http://www.globalbioclimatics.org/form/bi_map/MS30W060.htm

RCP4.5 – historical



RCP8.5-historical



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thank you!

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