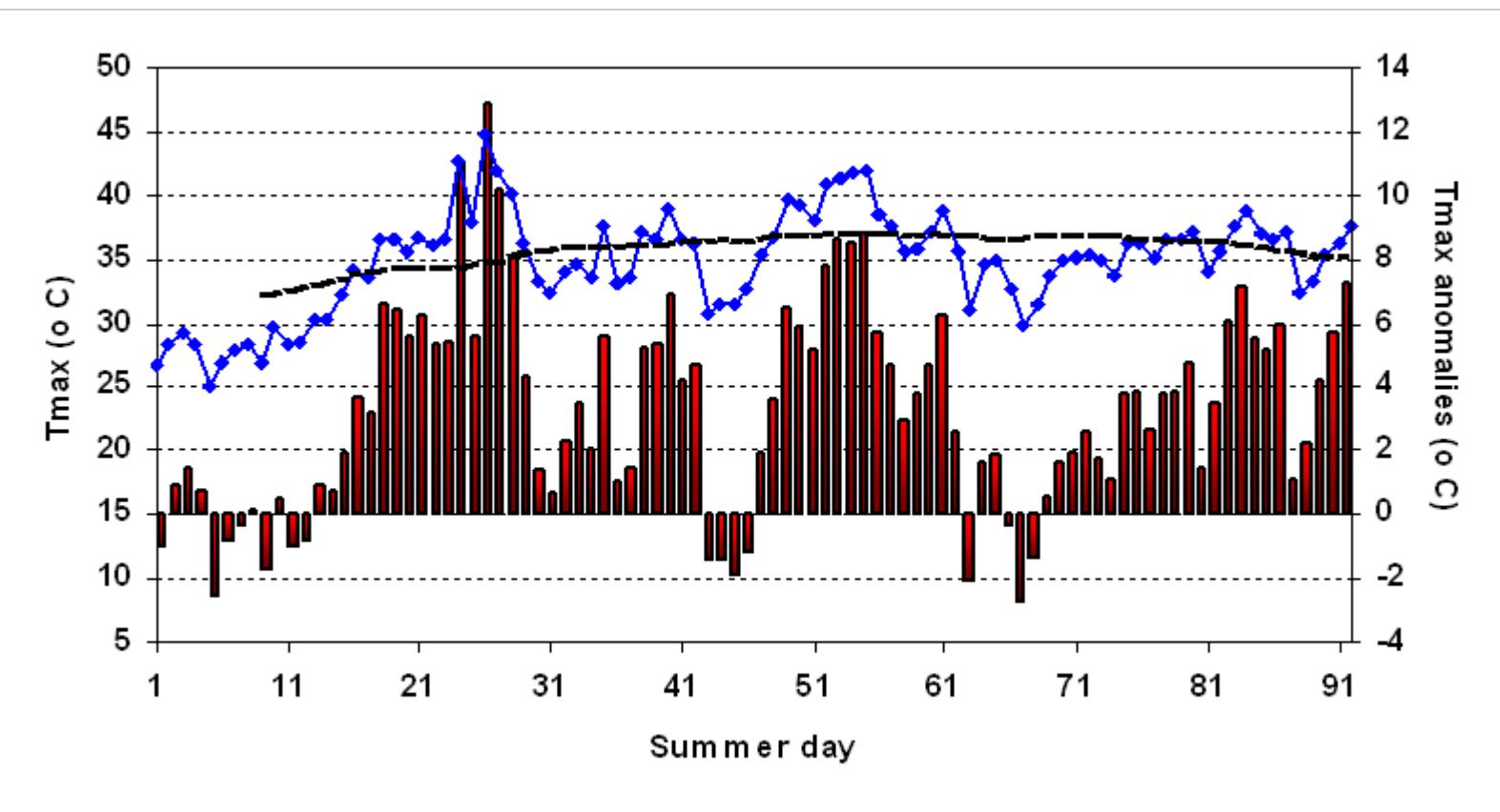


# Case study: 2007 summer in Greece

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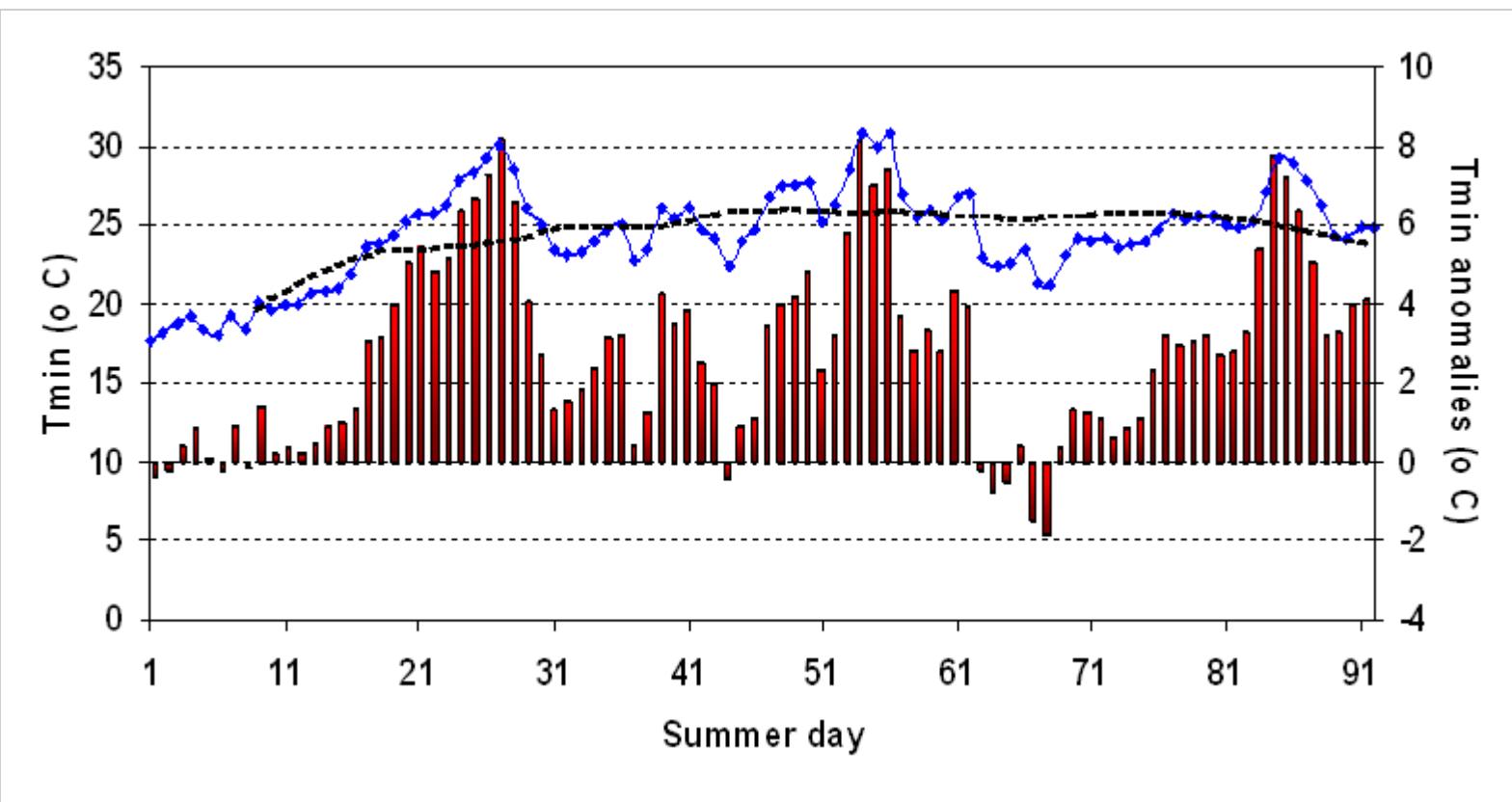
- During 2007, Greece experienced the hottest summer of its instrumental history with respect to absolute and mean temperature values.
- The successive heat waves that affected the area with air temperature exceeding 40°C combined with prolonged rainless conditions constituted the ideal conditions for the ignition and spread of fires and resulted to the worst natural hazard in the modern history of the country

# 2007 summer in Greece



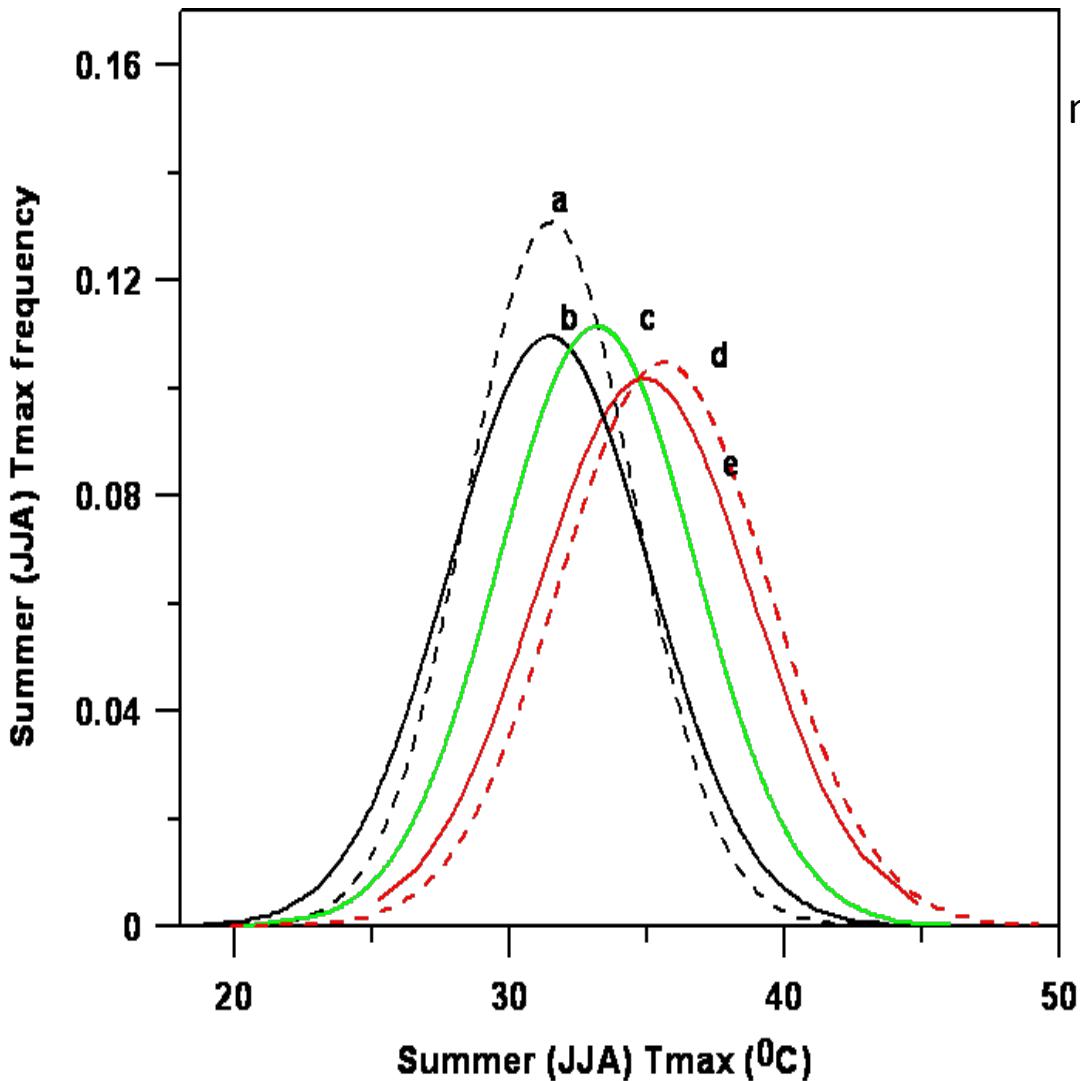
- Daily max temp in Athens in summer 2007 (blue) and departures from the mean 1961-1990 (bars)
  - Record value of  $44.8^{\circ}\text{C}$  on June 26th
  - Daily positive anomalies reached  $13.0^{\circ}\text{C}$

# 2007 summer in Greece



- Daily min temp in Athens in summer 2007 (blue) and departures from the mean 1961-1990
- Positive anomalies during almost the whole period which reached up to 8.0°C

# 2007 summer resembles future summers?



**PDF of Gaussian distribution** fitted to max temperature for : (a) model output for 1961-1990,  
(b) observations for 1961-1990,  
(c) the 2021-2050 model simulations,  
(d) the 2071-2100 model simulations  
and  
(e) the summer 2007

## 2007 summer resembles future summers?

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- ❑ It comes out that the PDF of summer 2007 lies entirely within the range of the future model projection of the period 2071-2100, indicating that 2007 resembles a summer that is likely to occur in 2071-2100 and what is ‘exceptional’ now, is likely to be ‘normal’ by the end of the century.

# Summer 2007 forest fires

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- 280,000 hectares (corresponding to almost of the entire Greek land surface) of forests, bush and agricultural areas (including olive groves which provide one of the main Greek exportable products) were destroyed.
- 64 human deaths occurred and thousands of people were left homeless as a direct consequence of the fires. This was an unprecedented ecological disaster not only for Greece but for the whole Mediterranean area.

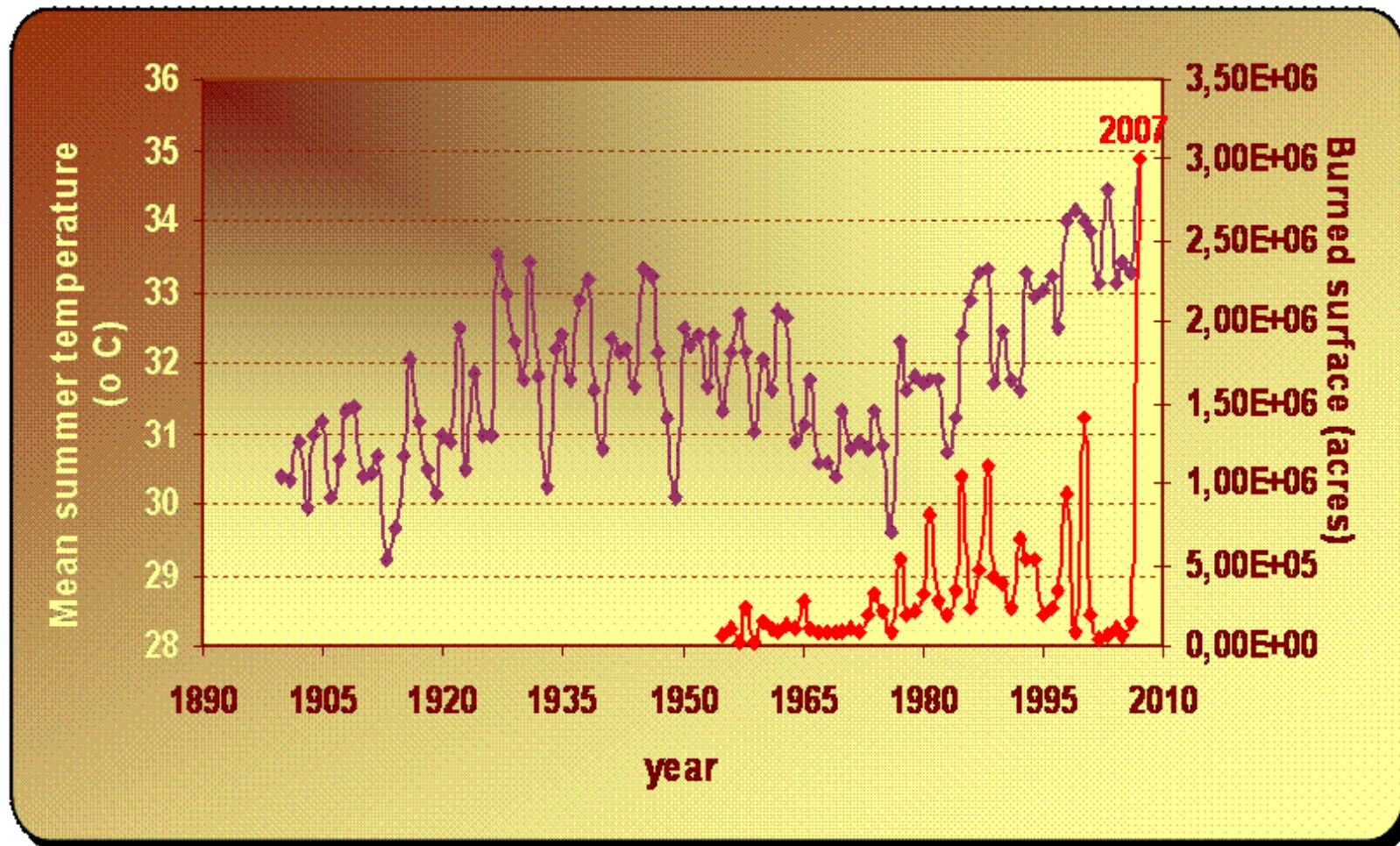
# Summer 2007 forest fires

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We estimate whether summer 2007 was indeed an exceptional meteorological summer in terms of fire risk occurrence.

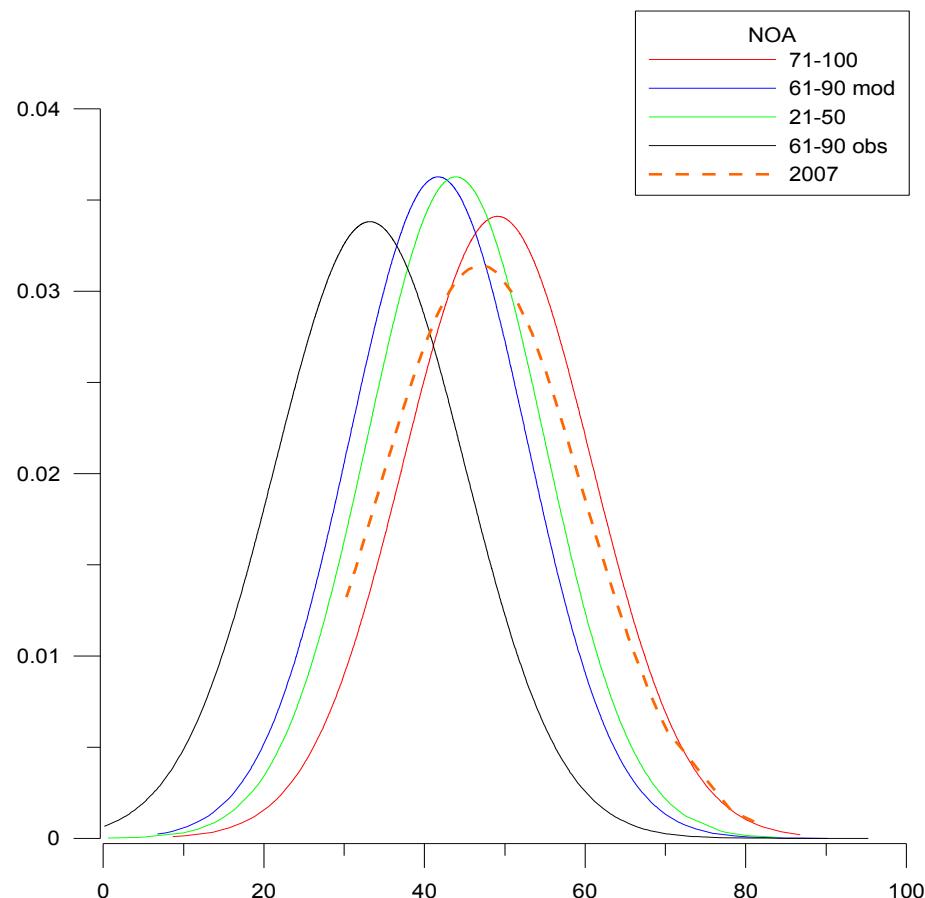
Using available regional climate model output we compare future fire risk with present and with 2007 fire risk to determine the severity of summer 2007 in fire danger.

# Relation with forest fires



Mean area burnt from 1955 onwards and mean summer temperature from 1890 in Athens

# Summer 2007 fire risk (Athens)



Obs (1961-1990)

$\text{prob(FWI}>30)=60\%$ ,  $\text{prob(FWI}>60)=2\%$

RCMs 2071-2100

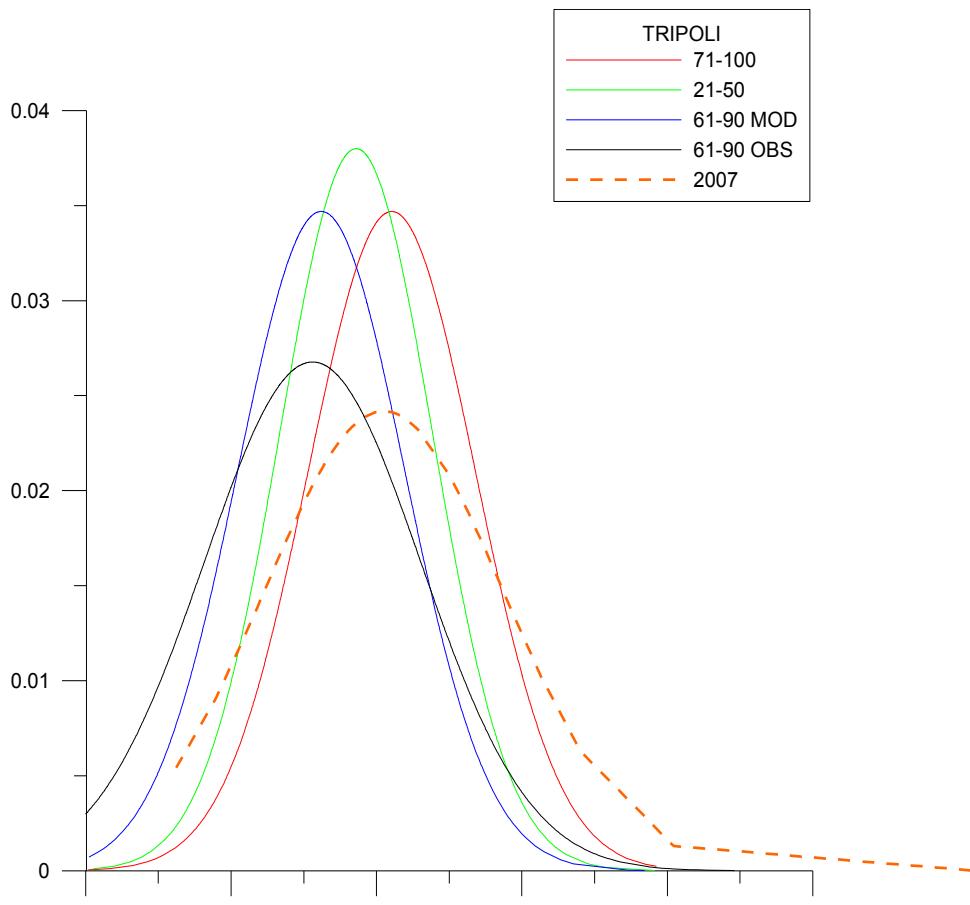
$\text{prob(FWI}>30)=95\%$ ,  $\text{prob(FWI}>60)=17\%$

summer 2007

$\text{prob(FWI}>30)=99\%$ ,  $\text{prob(FWI}>60)=15\%$

summer 2007 fire risk close to 2071-2100

# Summer 2007 fire risk (Tripoli)



Obs (1961-1990)  
prob(FWI>30)=53%, prob(FWI>60)=3%

RCMs 2071-2100  
prob(FWI>30)=87%, prob(FWI>60)=6%

summer 2007  
prob(FWI>30)=75%, prob(FWI>60)=13%

summer 2007 fire risk close to 2071-2100

# Conclusions

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- Future fire risk can be estimated from RCM output
- Vulnerable areas to forest fire in the present climate will experience the greatest increases in fire risk in the future climate (20 more days of extreme risk)
- 2007 stands out as an exceptionally extreme year in respect to fire risk with FWI values well exceeding those for the future period 2021-2050 and reaching the values of the period 2071-2100

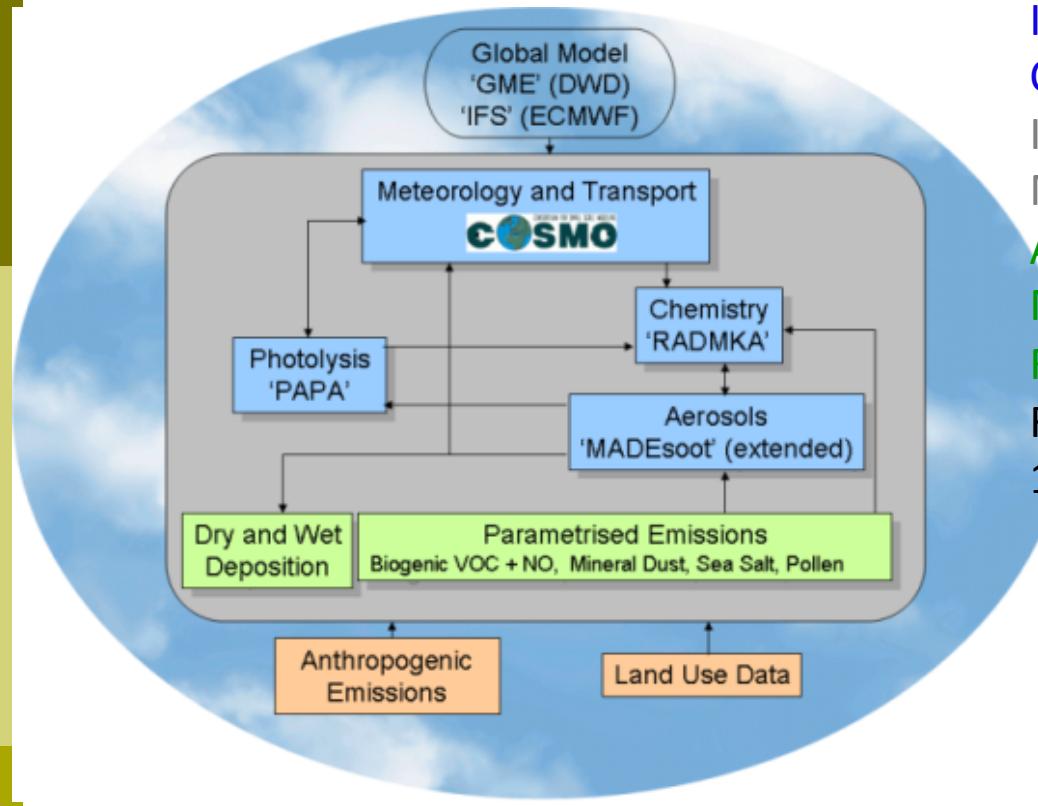
# The wildfire events of 2007

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Fire risk and air  
pollution  
assessment  
using the  
COSMO-ART  
atmospheric  
model



# COSMO-ART<sup>1</sup> application over the Greater Greek area: 15 August – 13 September 2007



Horizontal spacing: 2.8 km  
Vertical extent: ~20km,  
1st layer height: ~20m

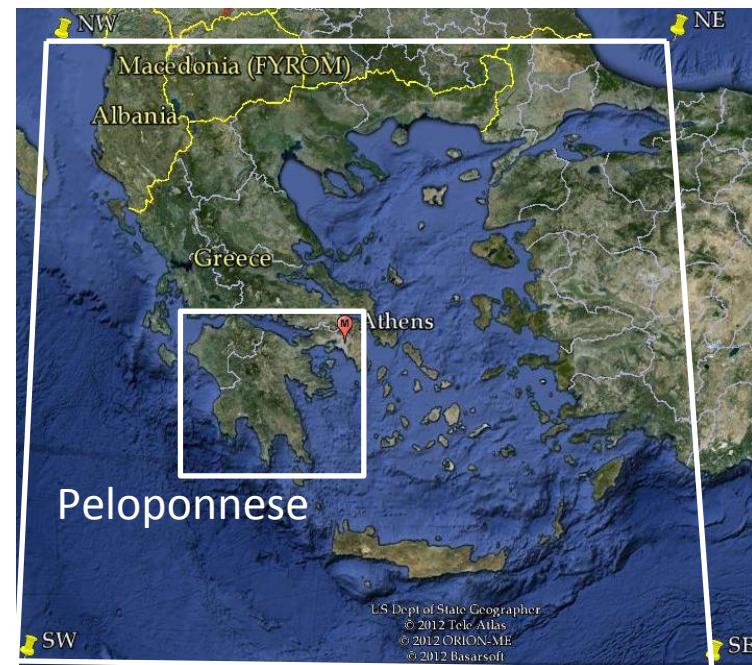
Initial and Boundary Meteorological input:  
Coarser COSMO model results by DWD

Initial and Boundary Gaseous pollution:  
MOZART-NCEP model results

Anthropogenic Emission database: TNO/  
MACC

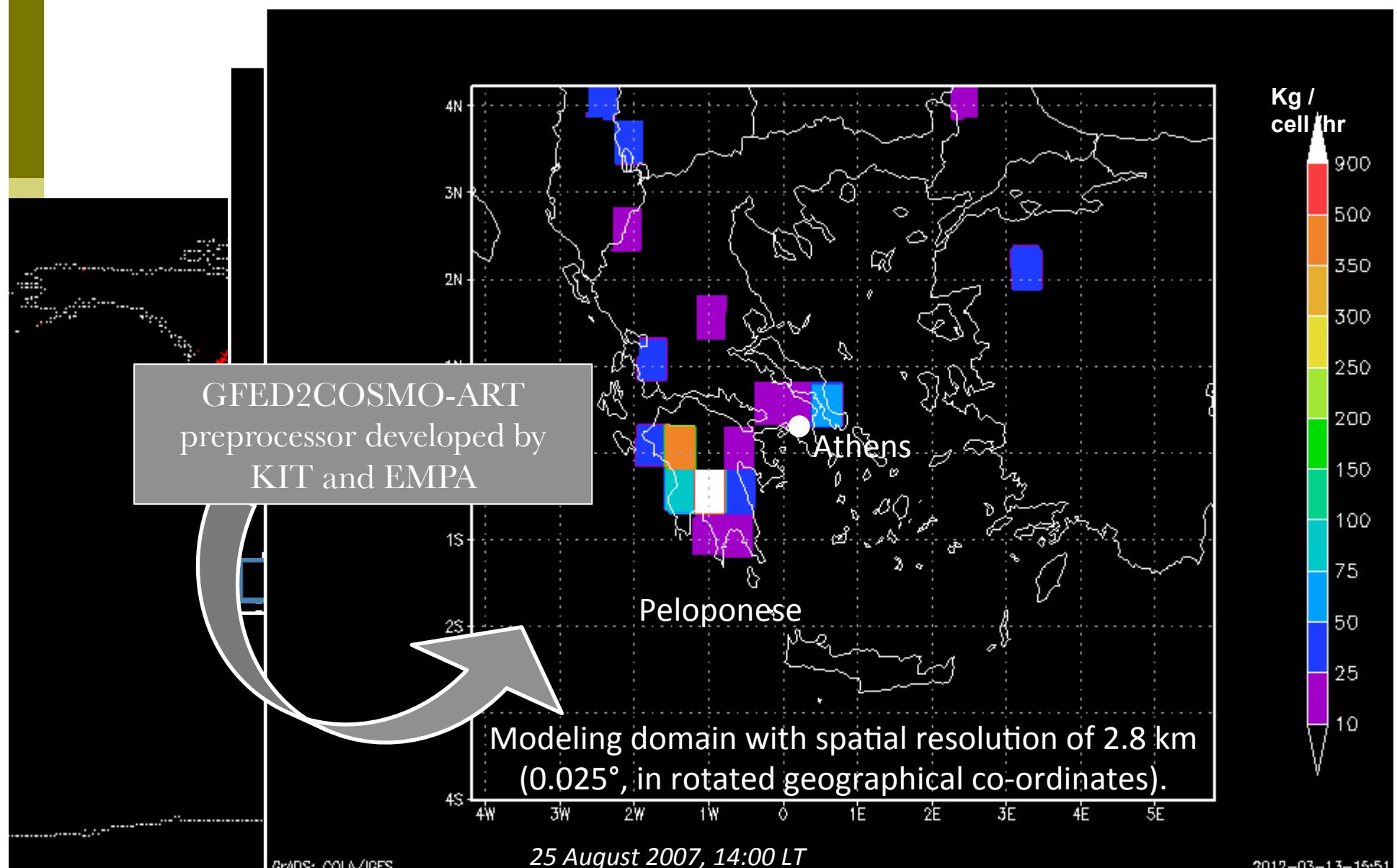
Fire Emission database: GFED (version 3)

Runge-Kutta time integration scheme,  $dt = 15''$

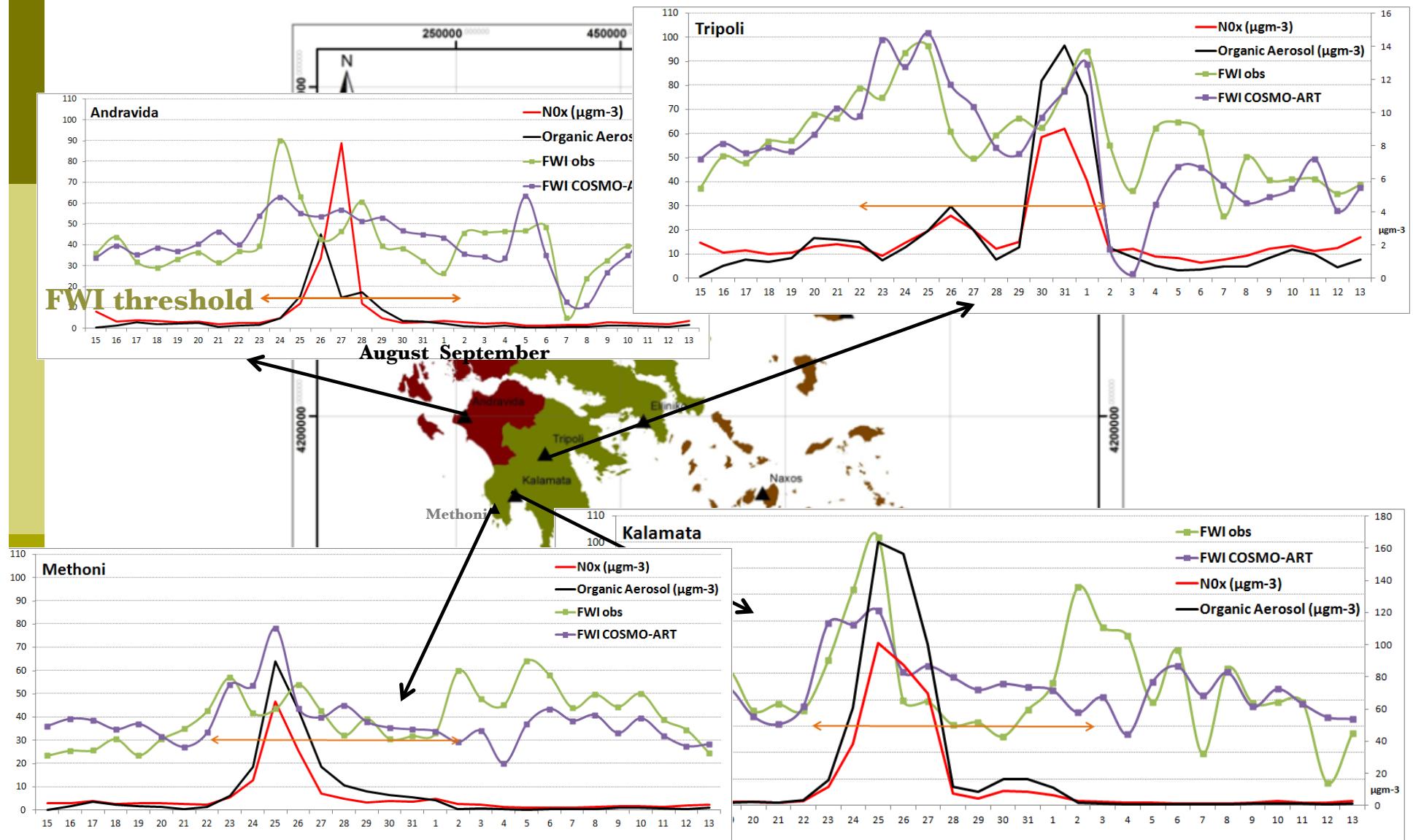


<sup>1</sup> Developed at the Karlsruhe Institute for Technology, Germany (Vogel et al., 2009)

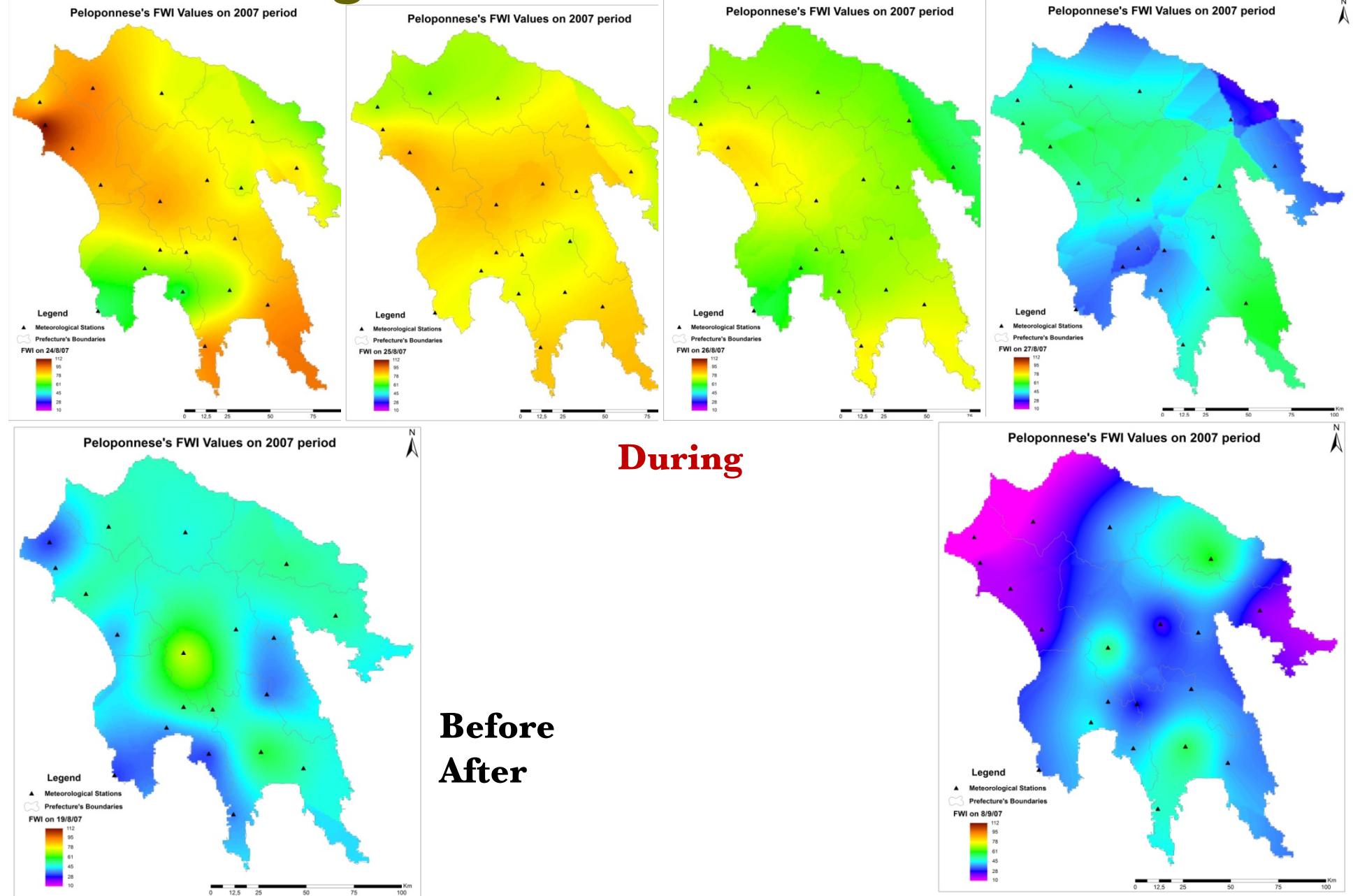
# The Global Fire Emissions Database, Version 3 (van der Werf et al., 2010; Mu et al., 2011)



# FWI during the 2007 wildfire events



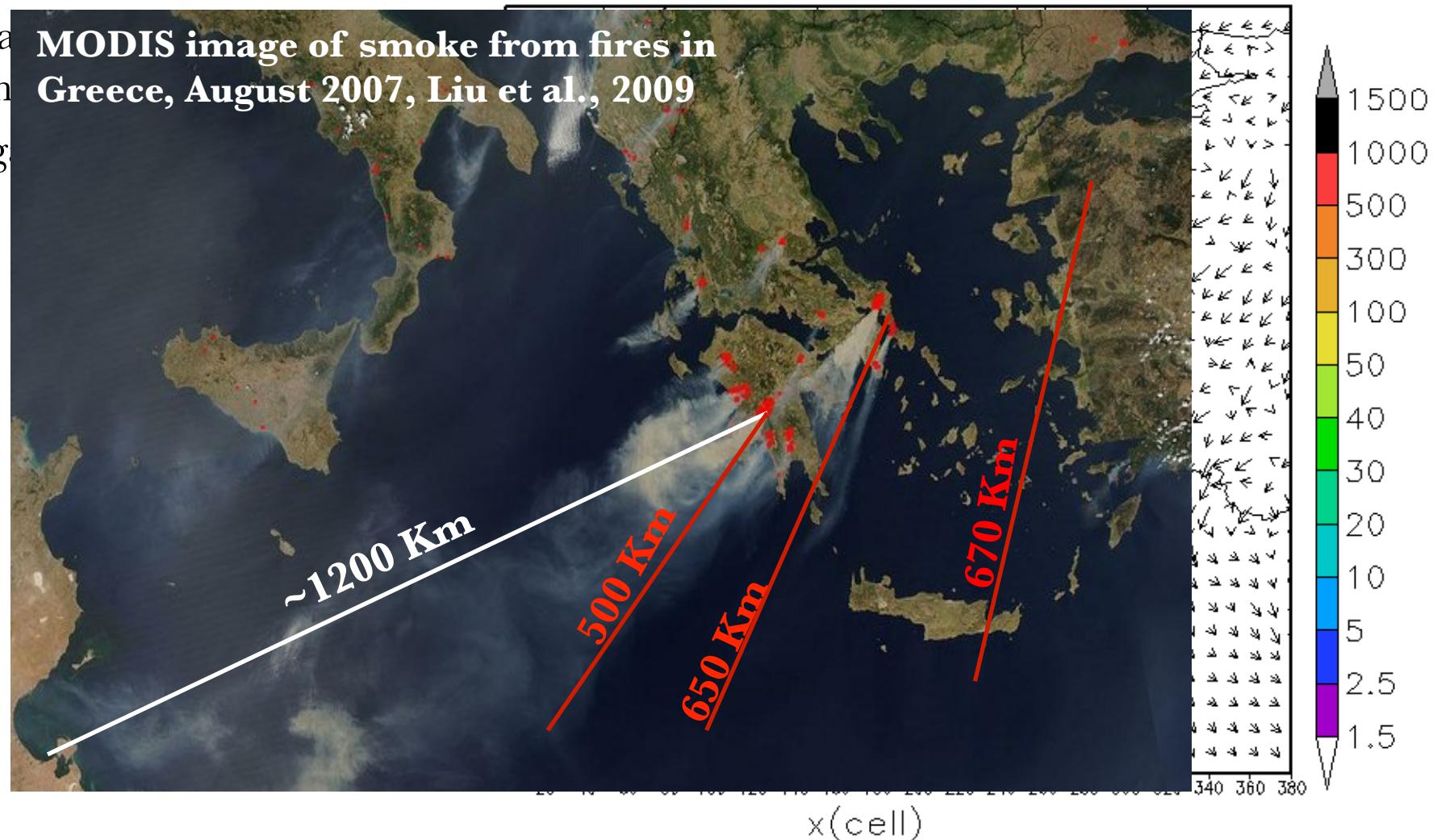
# FWI during the 2007 wildfire events



# First pollution episode 24–29 August 2007

## Horizontal extent of fire plumes

03Z24AUG2007



# Second pollution episode 30 August – 3 September 2007

## Temporal extent of fire plumes

Spatial distribution of hourly concentrations ( $\mu \text{ gm}^{-3}$ ) of organic aerosol

