

BONNER METEOROLOGISCHE ABHANDLUNGEN

Heft 86 (2018) (ISSN 0006-7156)

Herausgeber: Andreas Hense

Sebastian Knist

**LAND-ATMOSPHERE INTERACTIONS
IN MULTISCALE REGIONAL
CLIMATE CHANGE SIMULATIONS OVER EUROPE**

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**LAND-ATMOSPHERE INTERACTIONS
IN MULTISCALE REGIONAL
CLIMATE CHANGE SIMULATIONS OVER EUROPE**

Land-atmosphere interactions in multiscale regional climate change simulations over Europe

DISSERTATION
ZUR
ERLANGUNG DES DOKTORGRADES (DR. RER. NAT.)
DER
MATHEMATISCH-NATURWISSENSCHAFTLICHEN FAKULTÄT
DER
RHEINISCHEN FRIEDRICH-WILHELMS-UNIVERSITÄT BONN

vorgelegt von
M.Sc. Sebastian Knist
aus
Düsseldorf

Bonn, März, 2018

Diese Arbeit ist die ungekürzte Fassung einer der Mathematisch-Naturwissenschaftlichen Fakultät der Rheinischen Friedrich-Wilhelms-Universität Bonn im Jahr 2018 vorgelegten Dissertation von Sebastian Knist aus Düsseldorf.

This paper is the unabridged version of a dissertation thesis submitted by Sebastian Knist born in Düsseldorf to the Faculty of Mathematical and Natural Sciences of the Rheinische Friedrich-Wilhelms-Universität Bonn in 2018.

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2. Gutachter: PD Dr. Silke Trömel, Rheinische Friedrich-Wilhelms-Universität Bonn

Tag der Promotion: 31. Juli 2018

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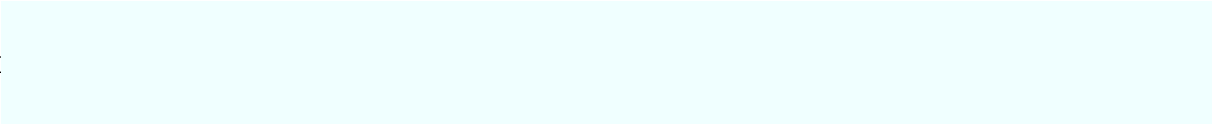
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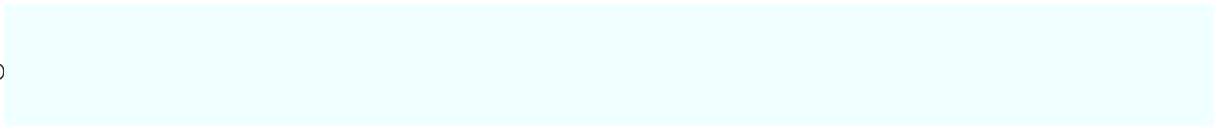
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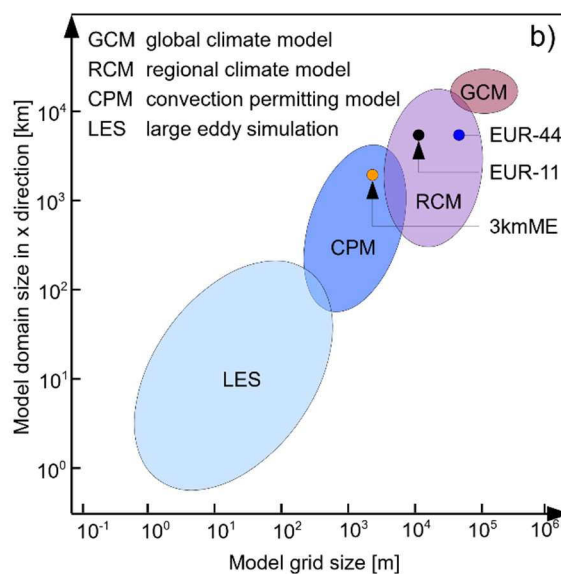
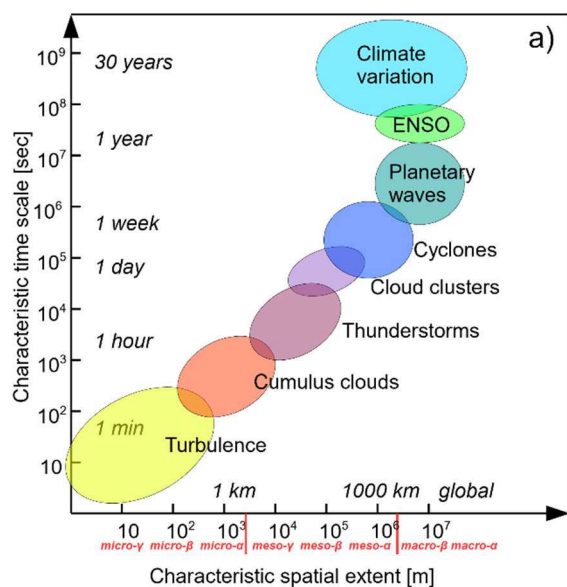
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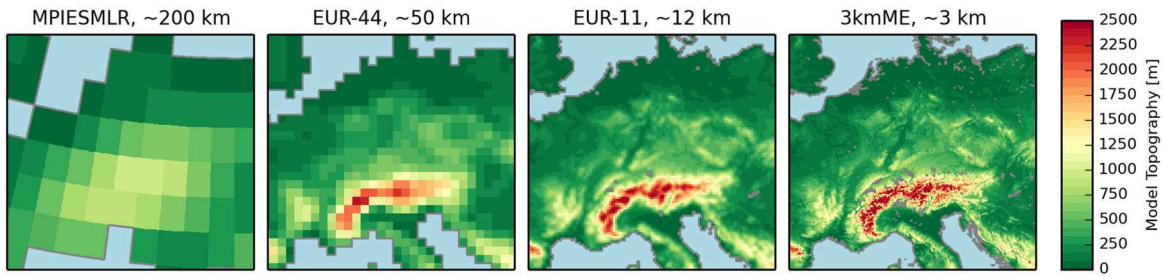
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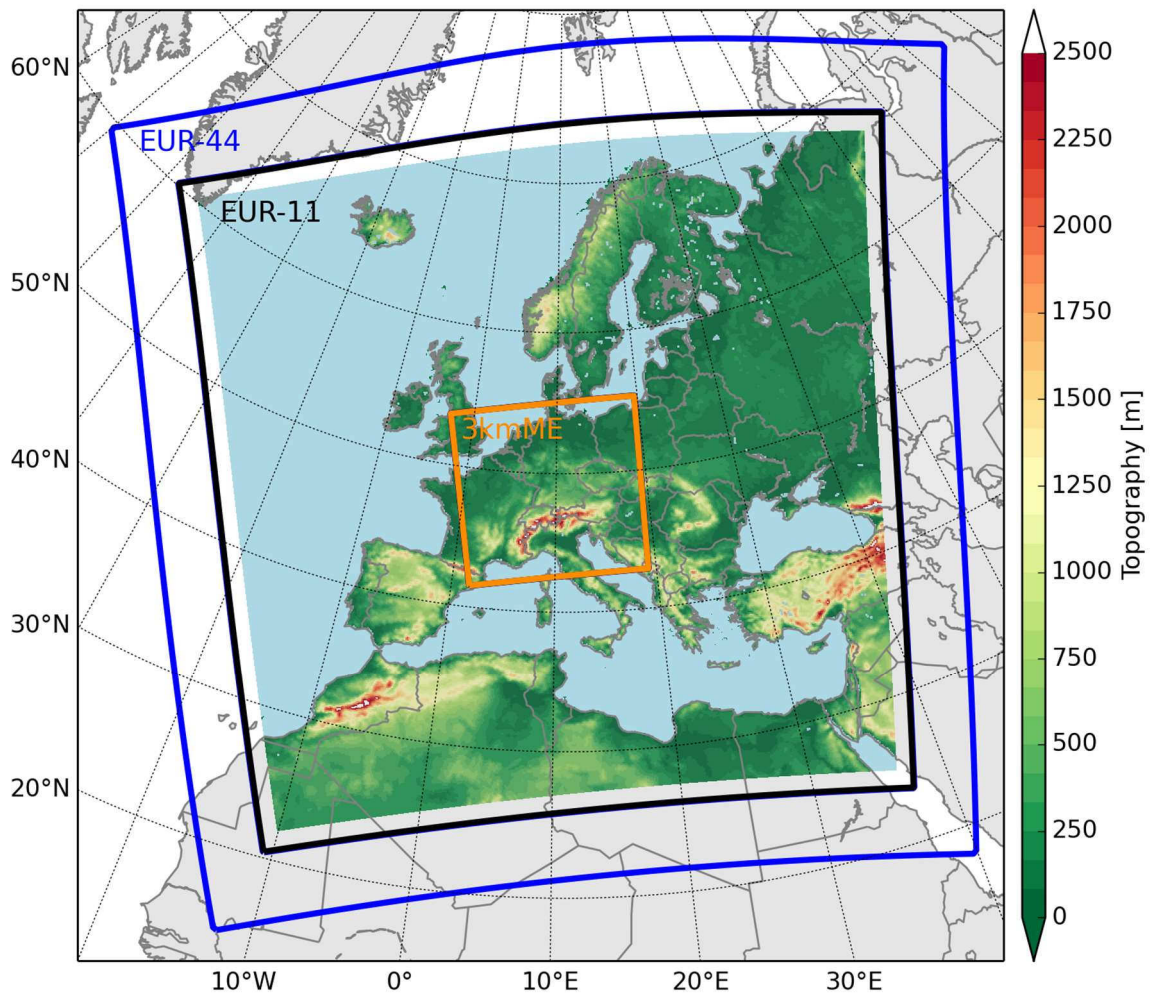
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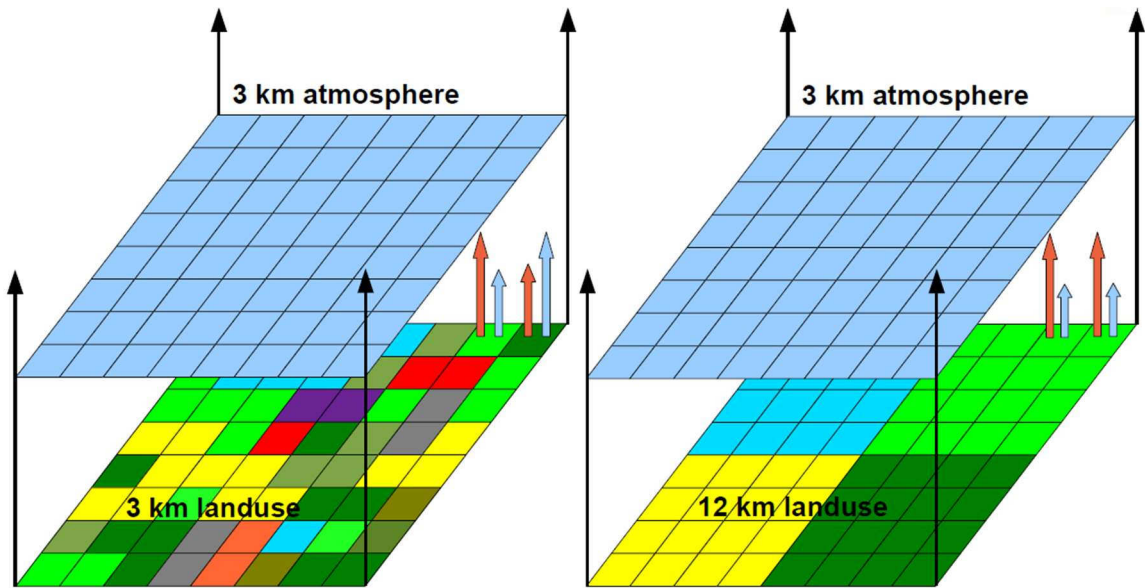
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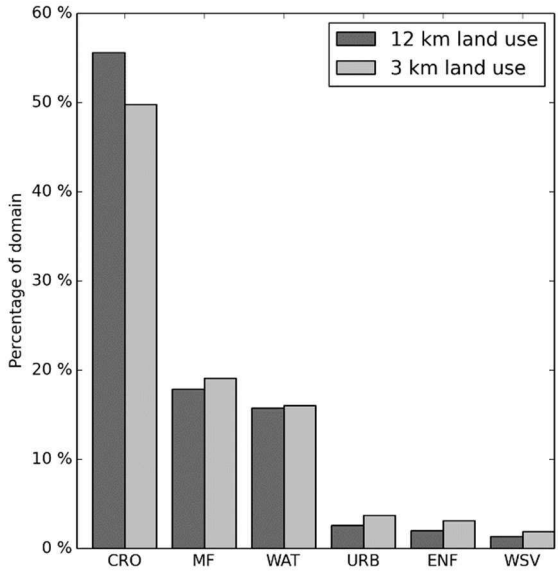
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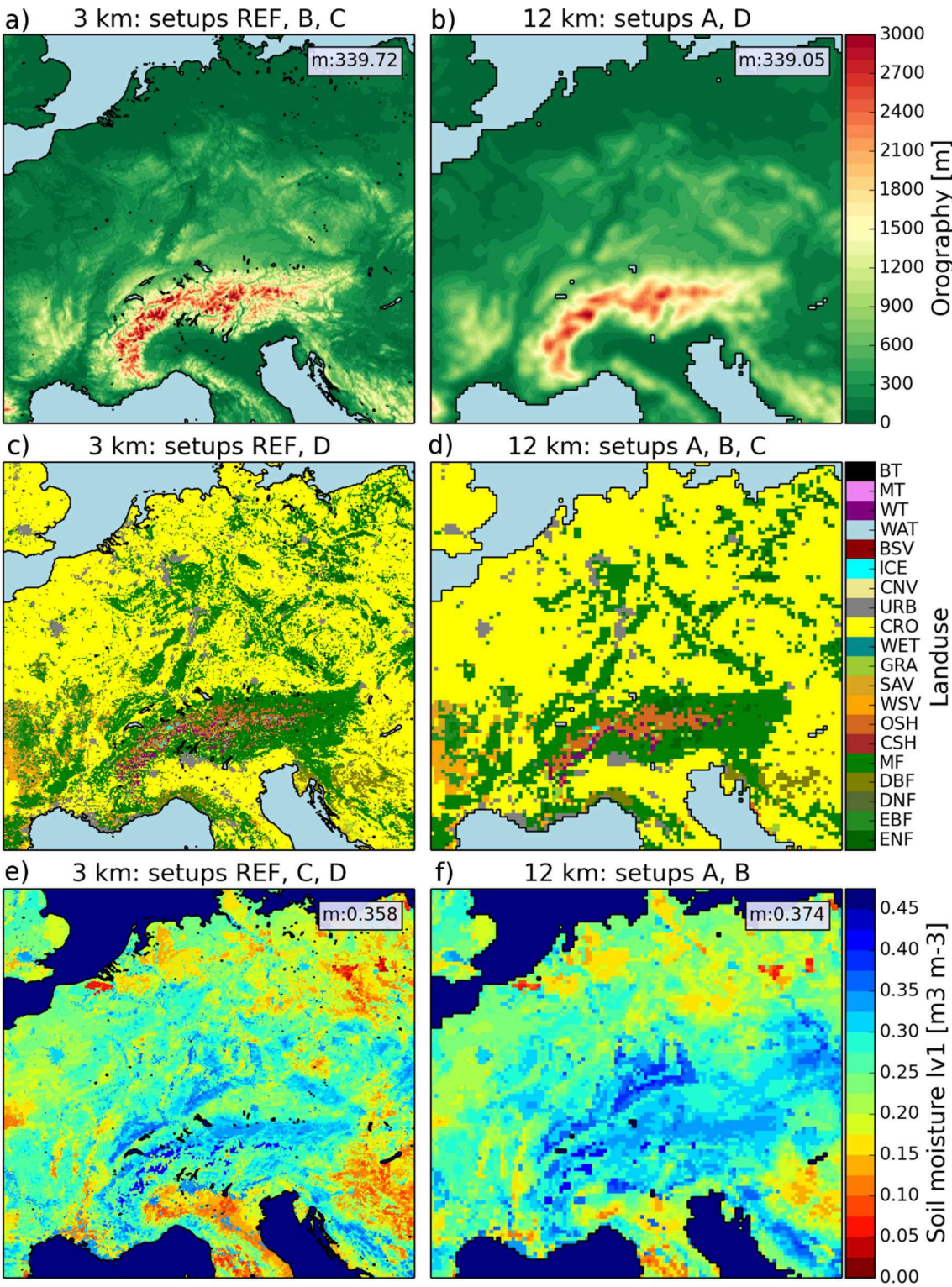


Figure 1

Figure 1

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[illegible]

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h'p' \$

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$$\Delta\Omega_X = \Omega_X(R) - \Omega_X(W)$$

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$$\Omega_{X,G} = \frac{N\sigma_X^2 - \sigma_X^2}{(N-1)\sigma_X^2}$$

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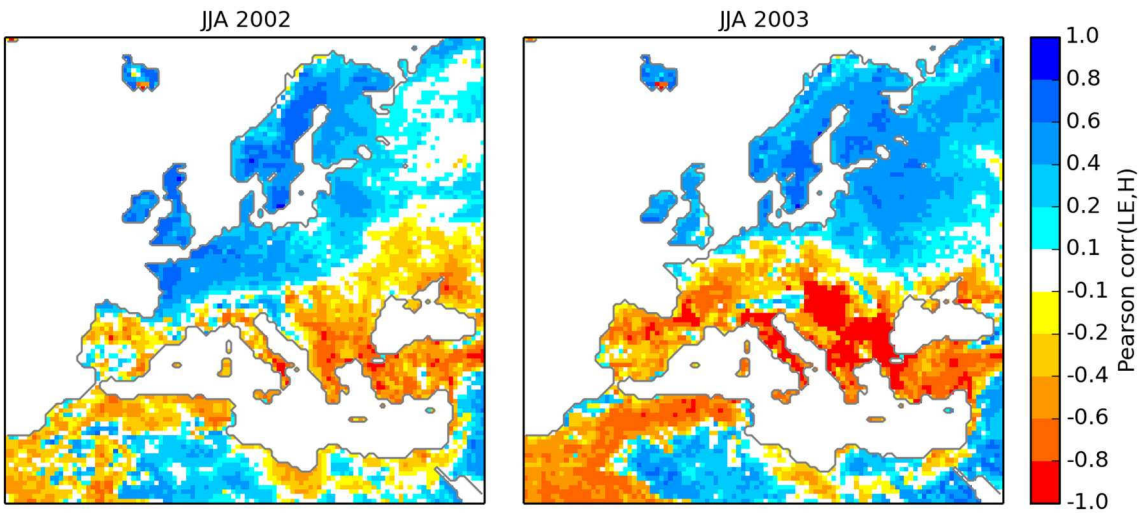
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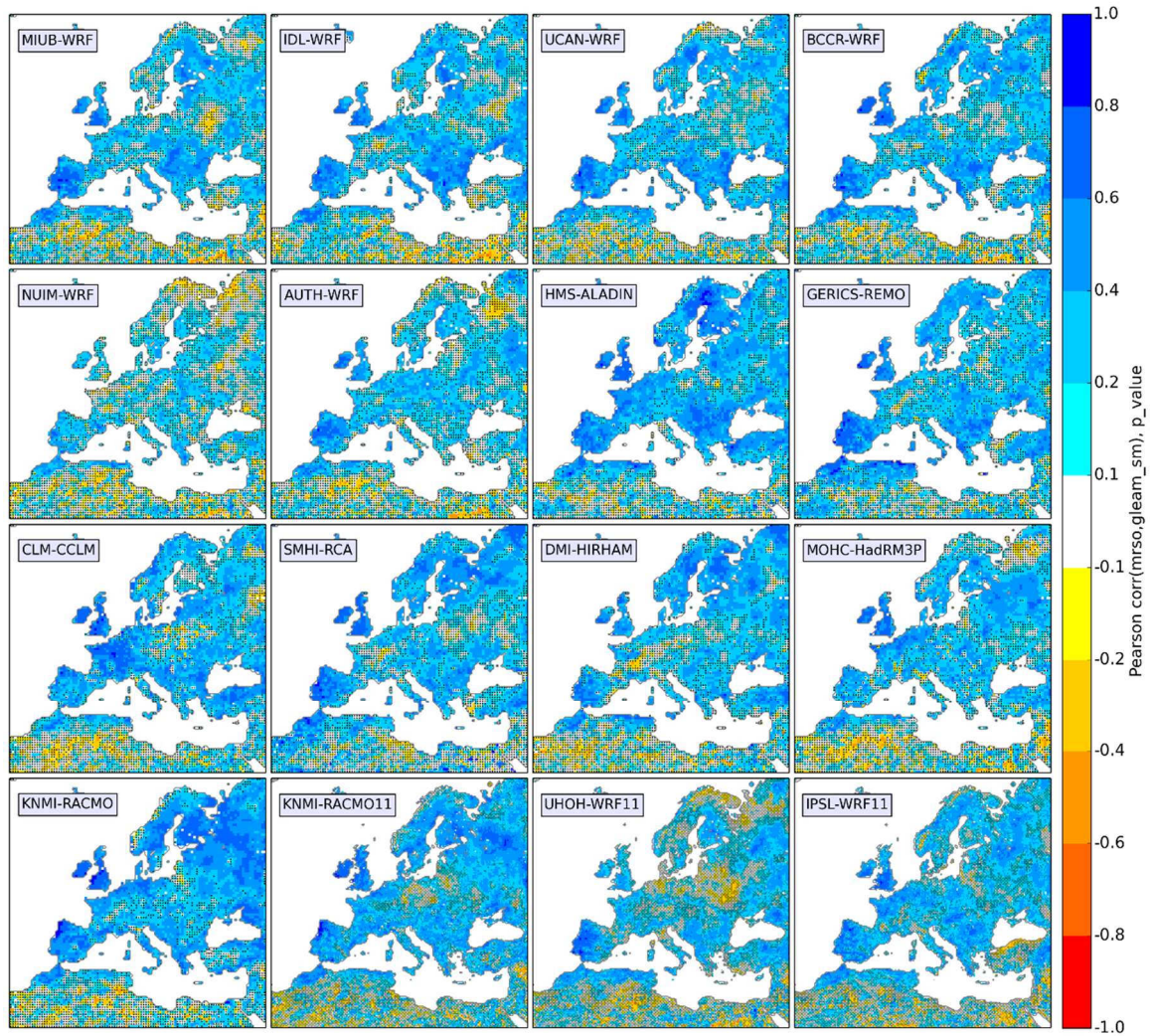
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Կլիմայի փոփոխությունները
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Պատկեր 4. Եվրոպայի միջին
) համայնական

Պատկեր 4. Եվրոպայի միջին

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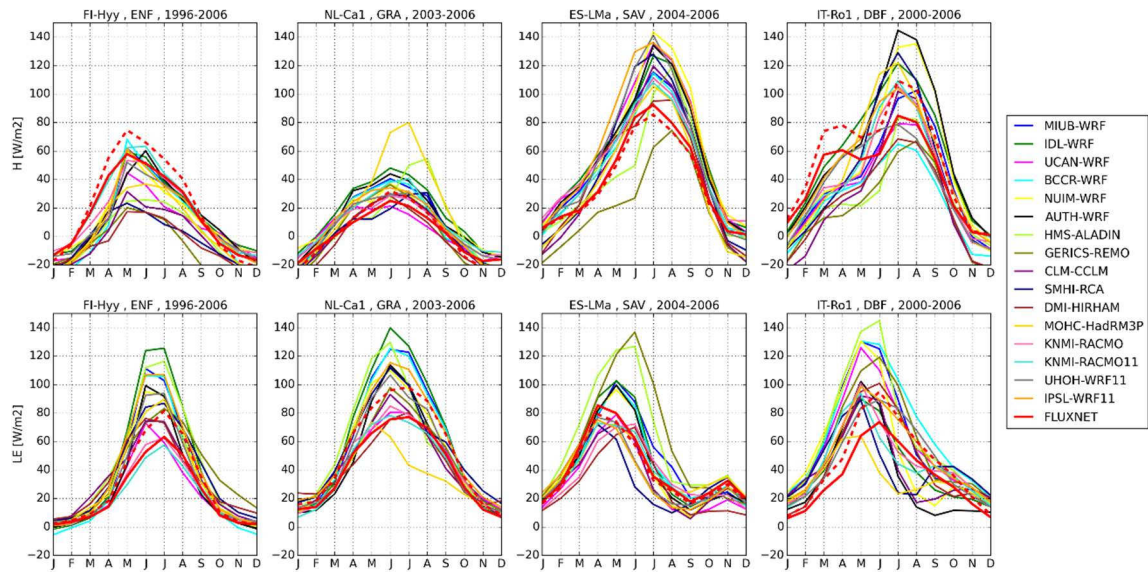
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Կլիմայի փոփոխությունները

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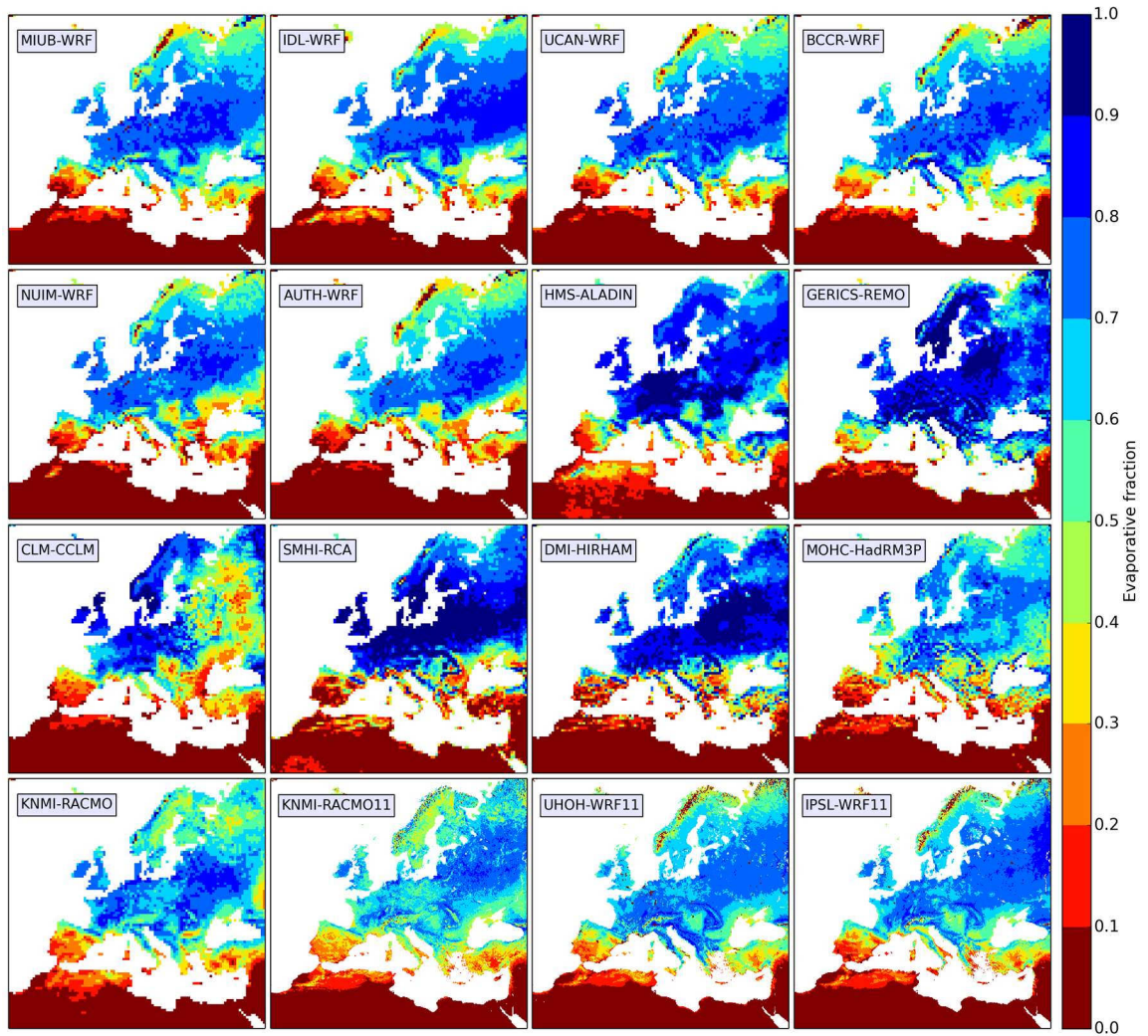
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Վերջին օրերի ընթացքում

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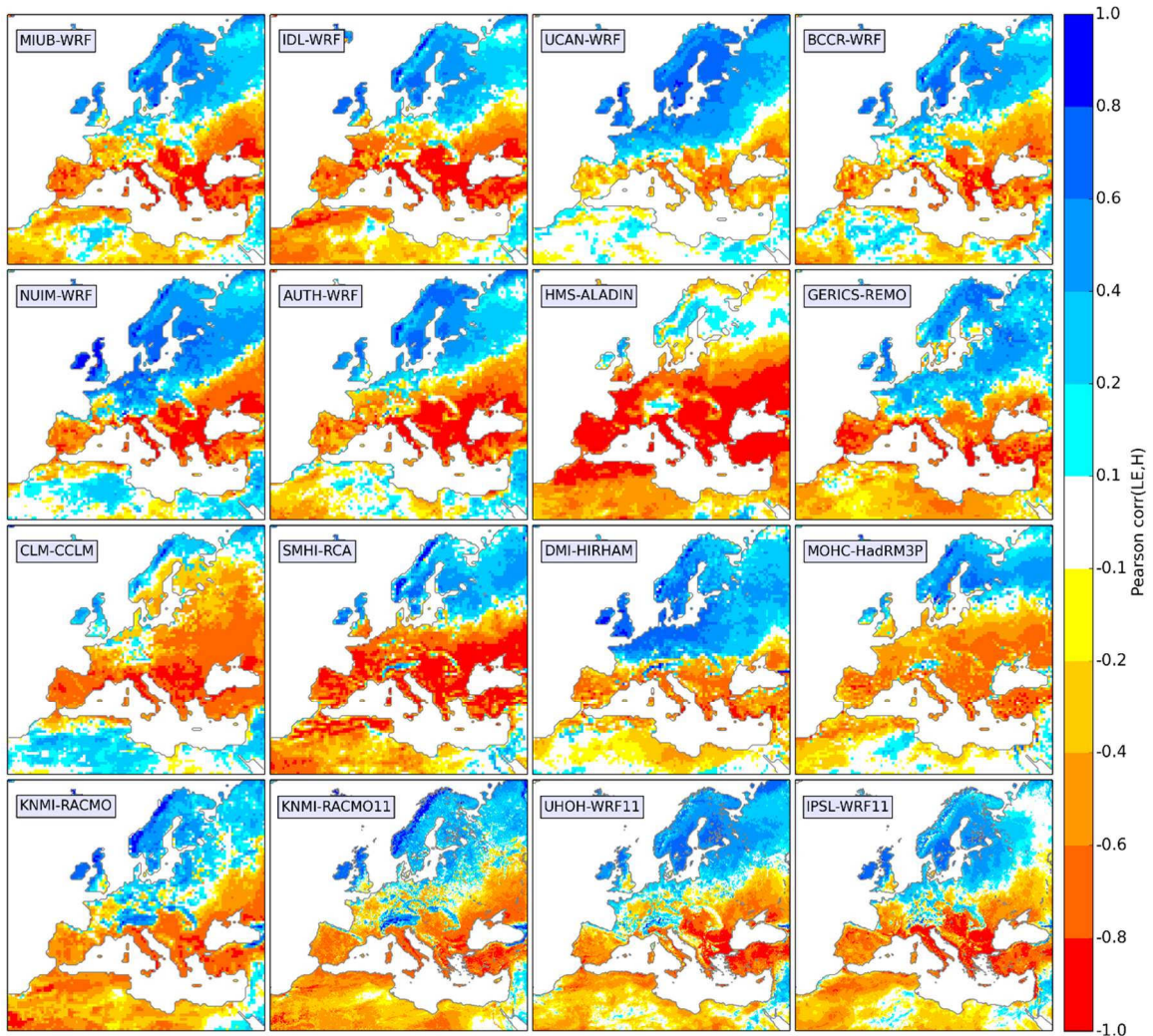
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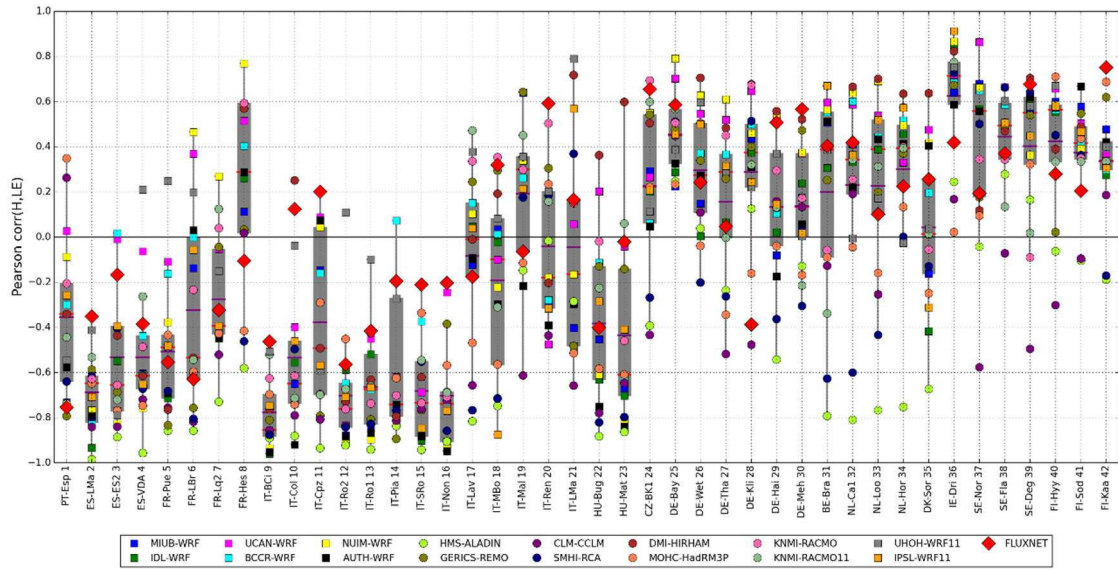


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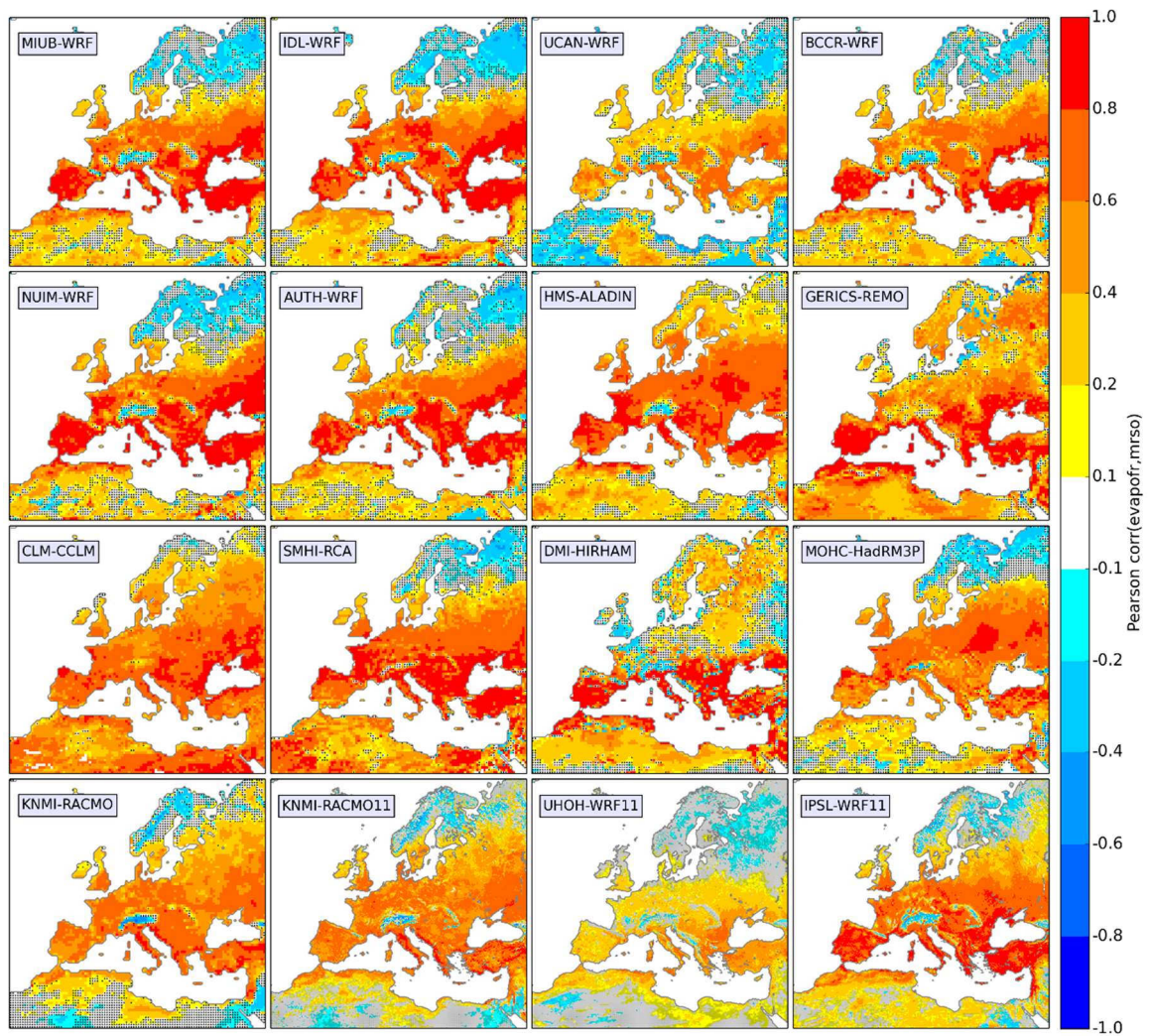
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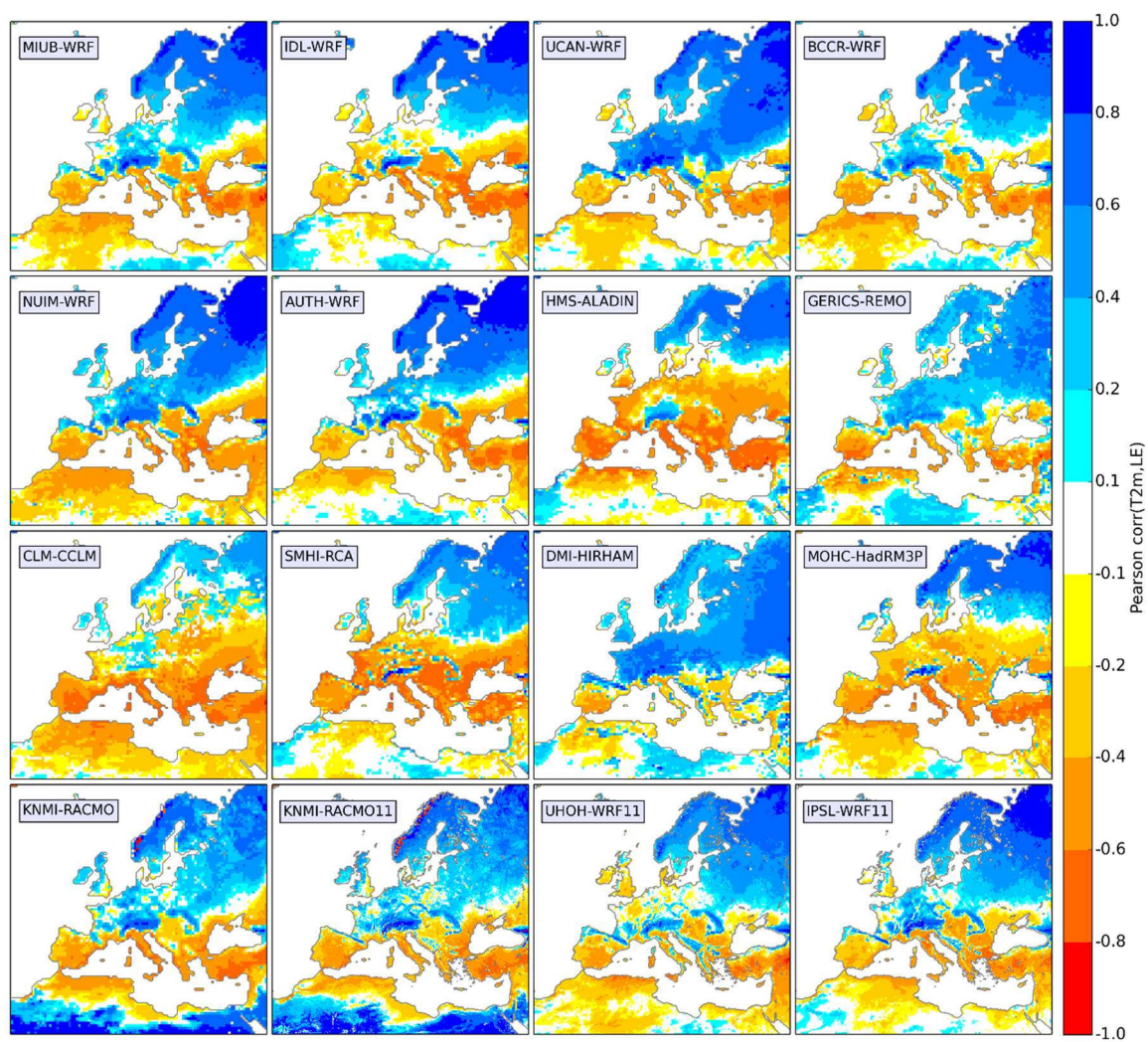
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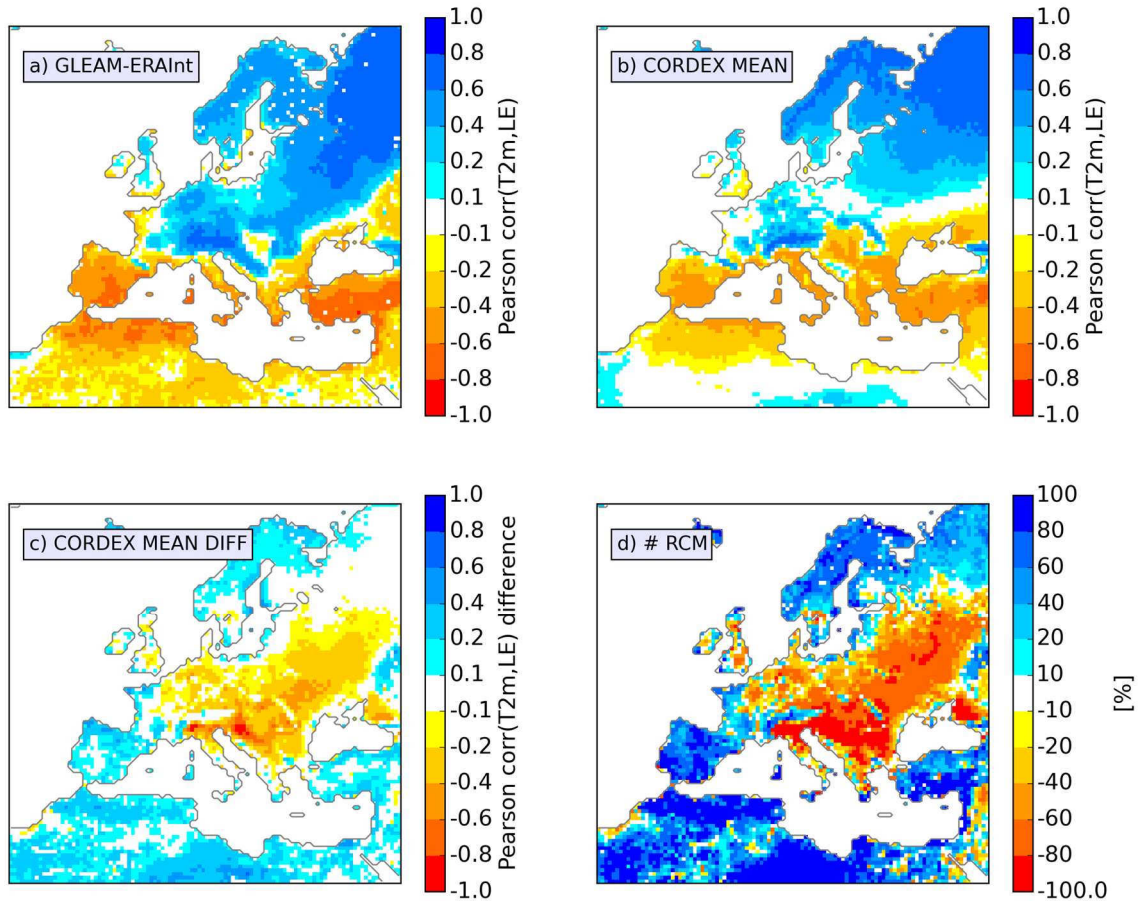
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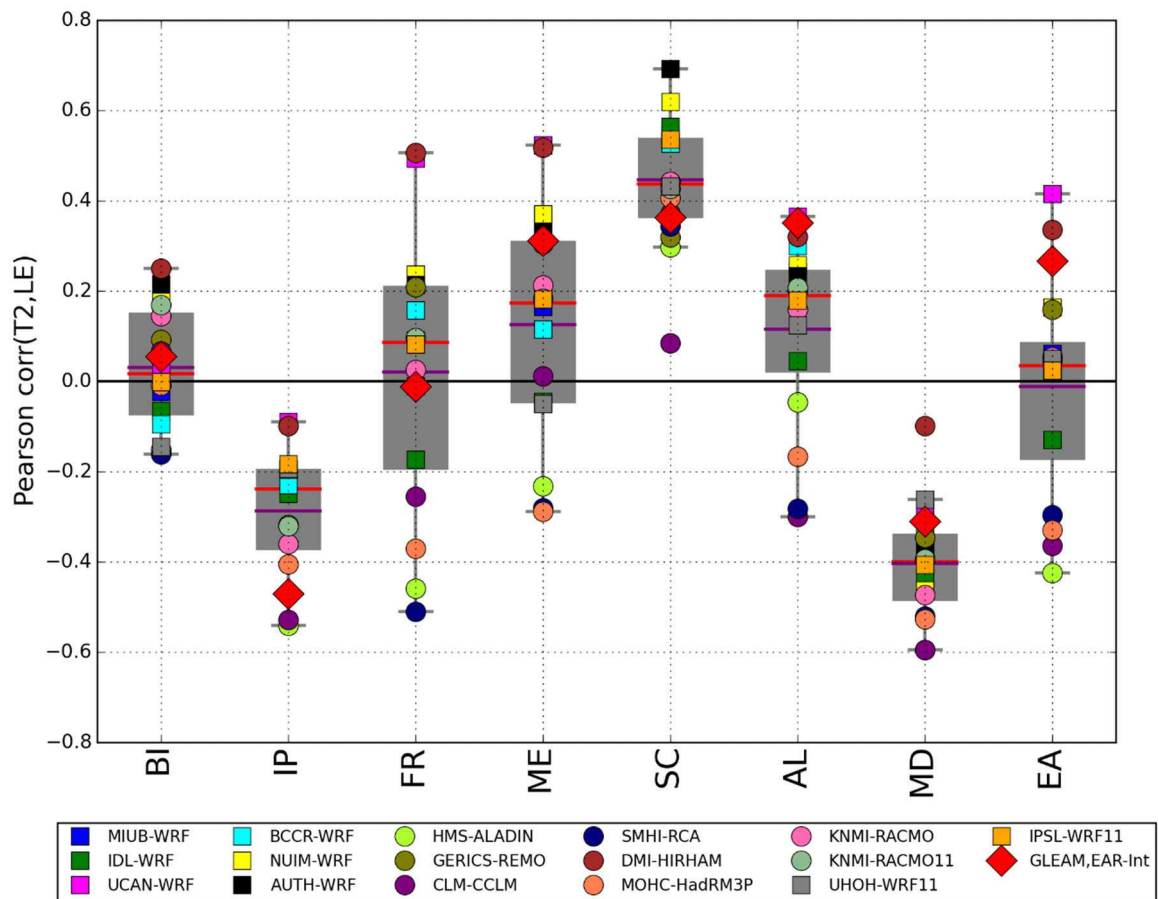


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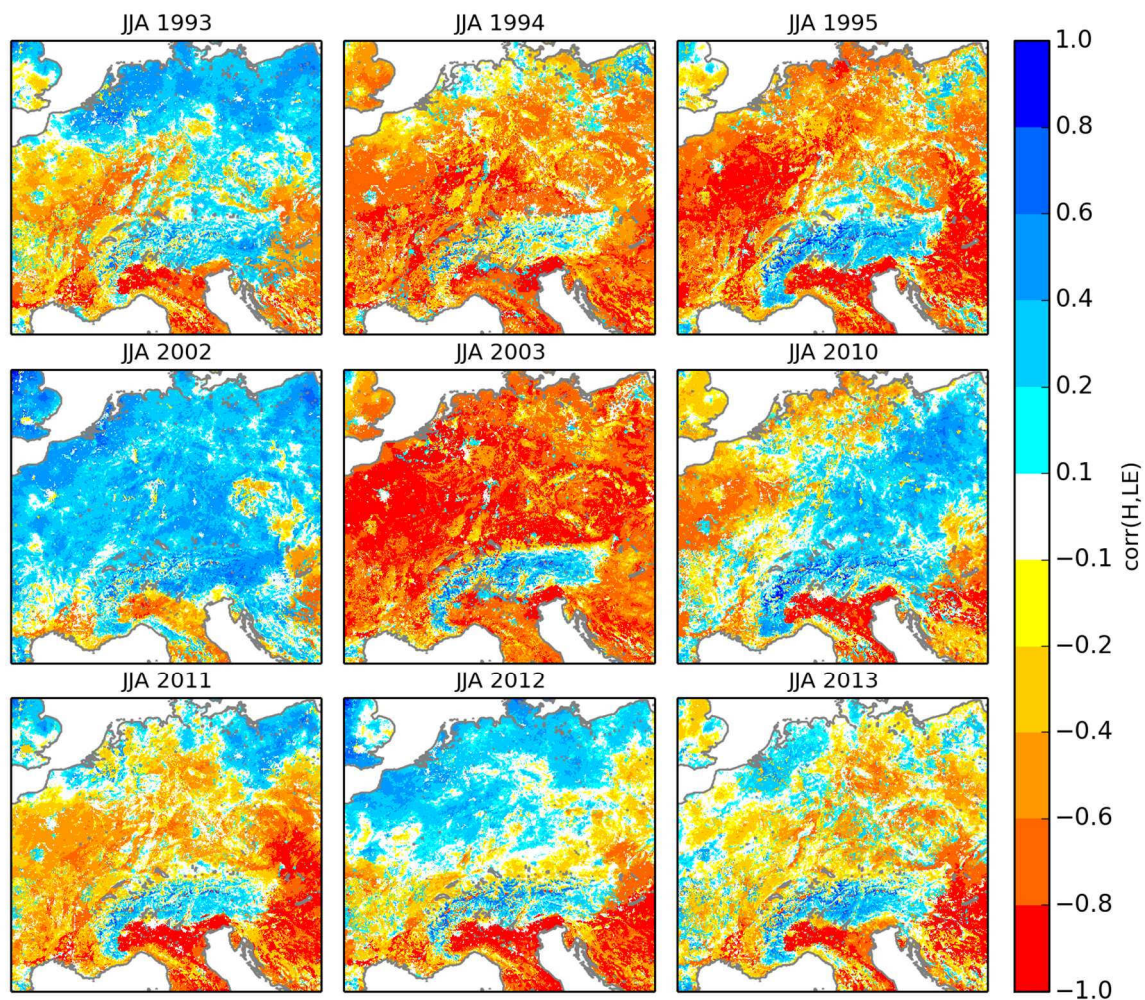
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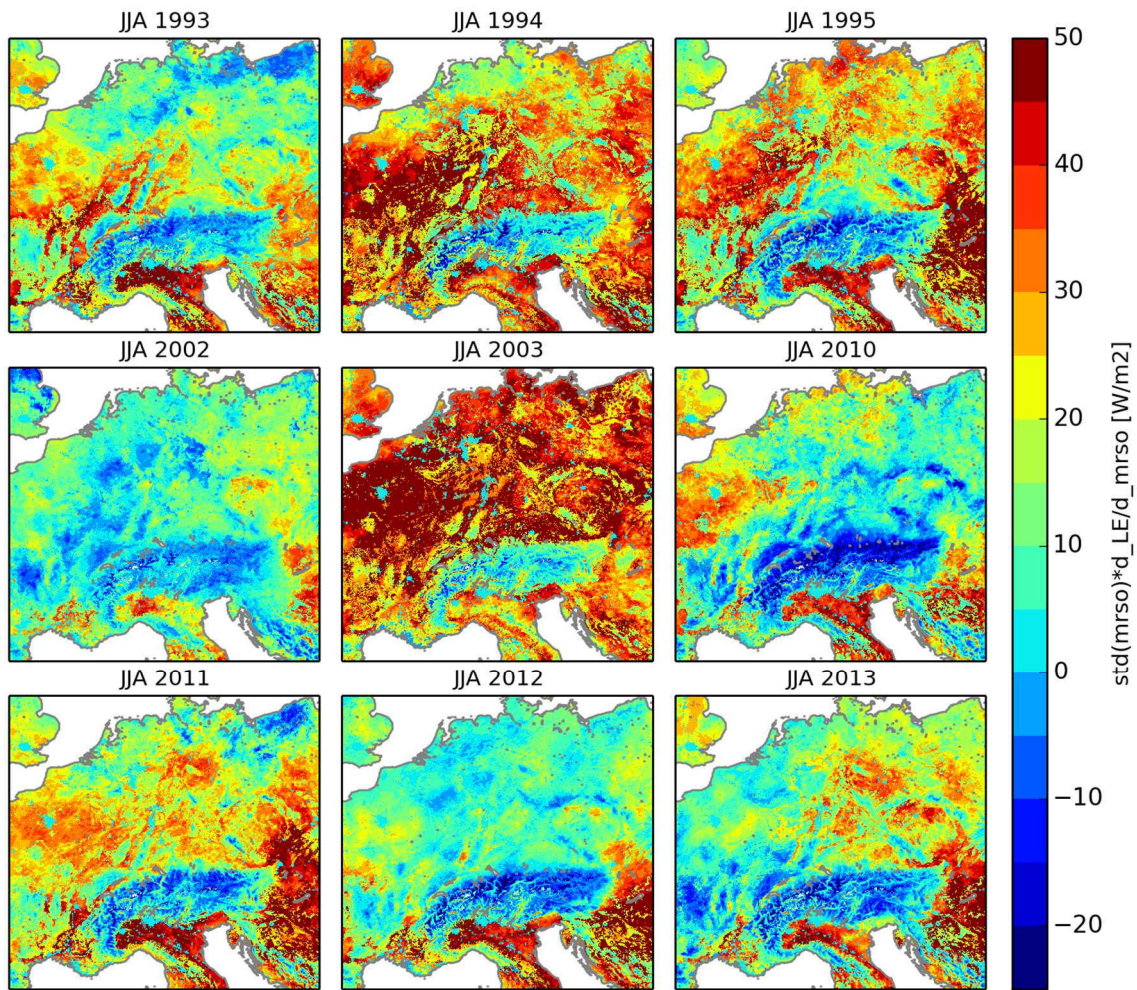
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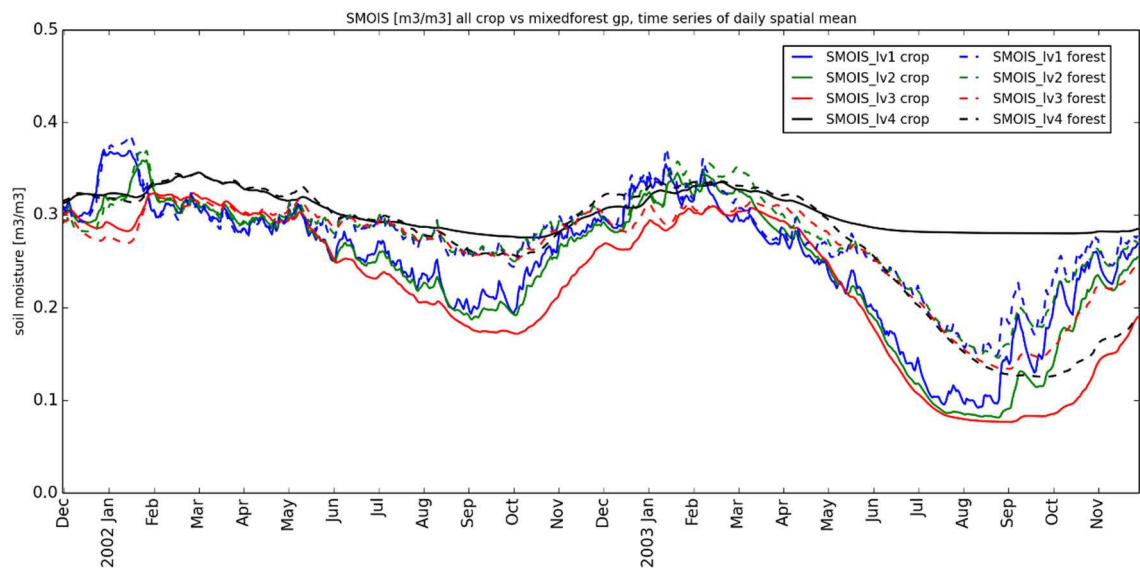
13. (+) 1993-1995, 2002-2003, 2010-2013

14. (+) 1993-1995, 2002-2003, 2010-2013

15. (+) 1993-1995, 2002-2003, 2010-2013

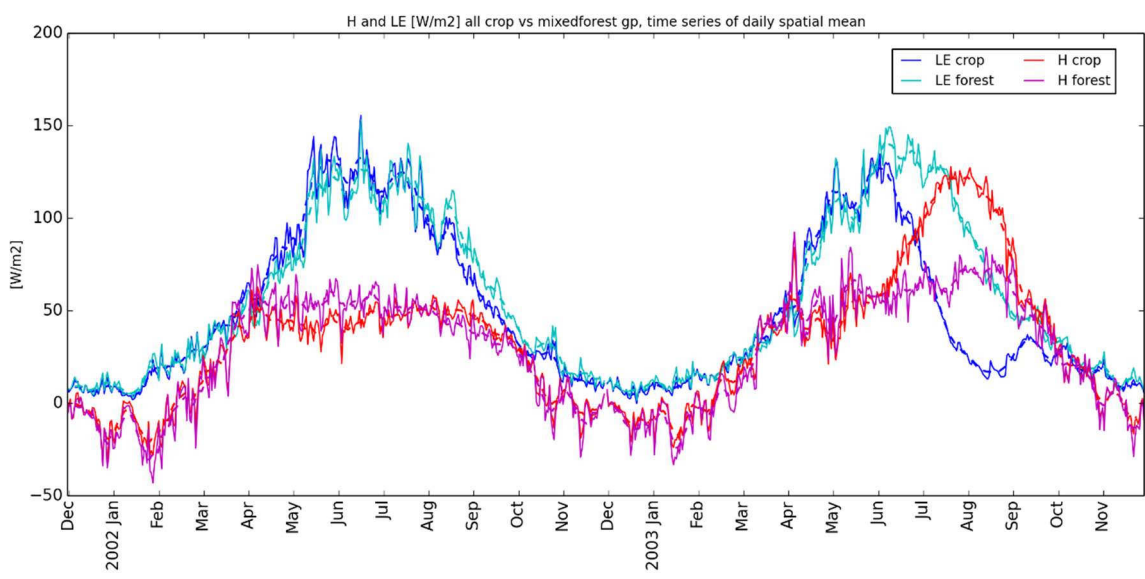
16. (+) 1993-1995, 2002-2003, 2010-2013

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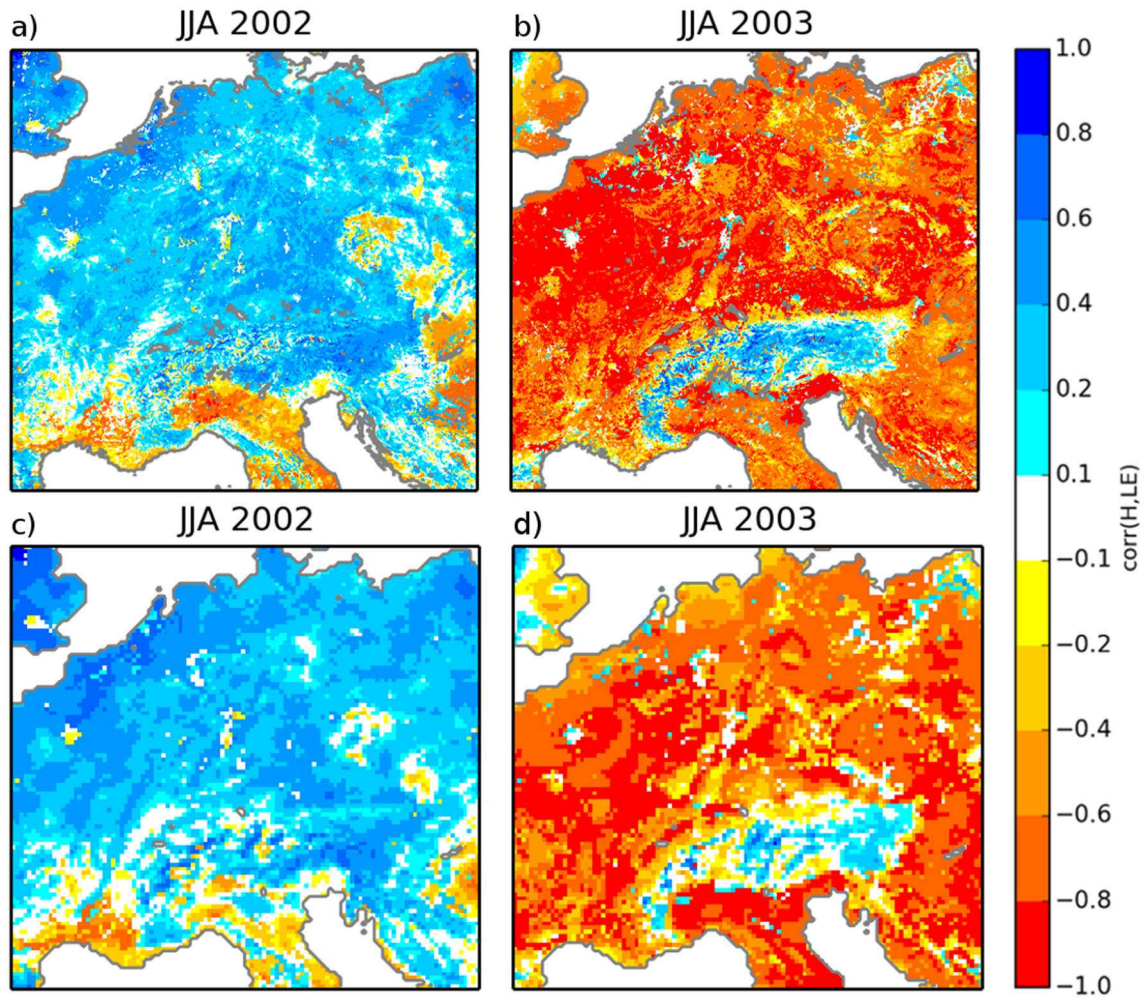
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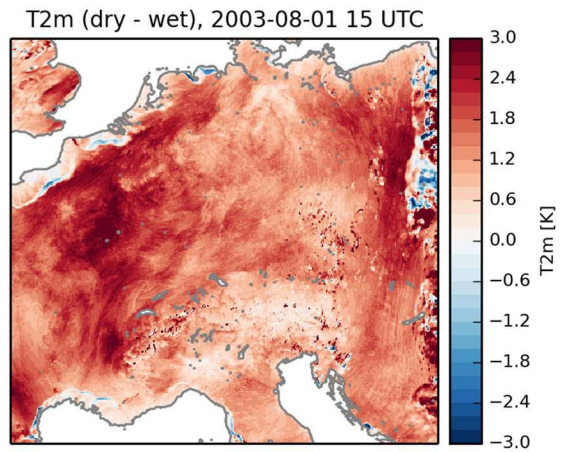
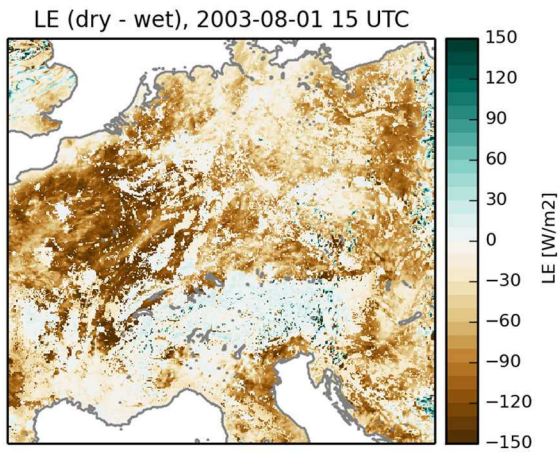
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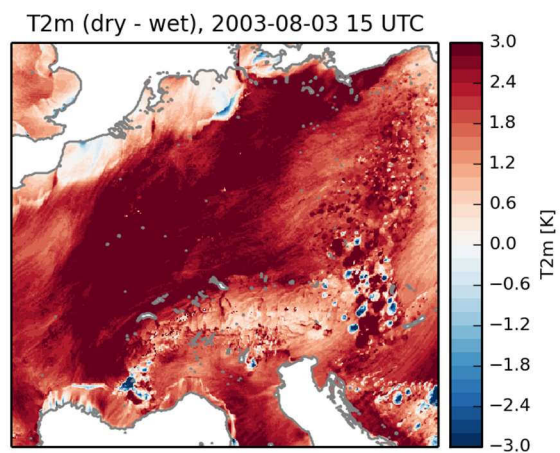
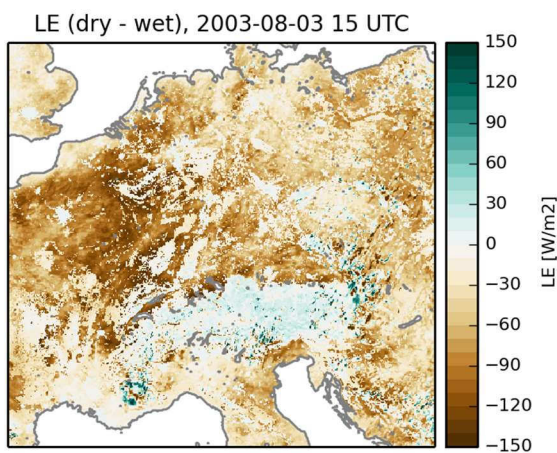


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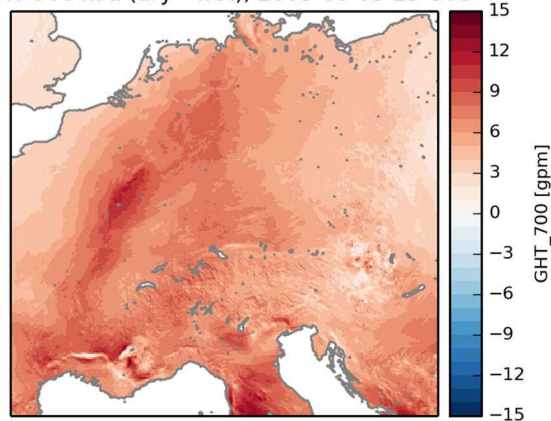
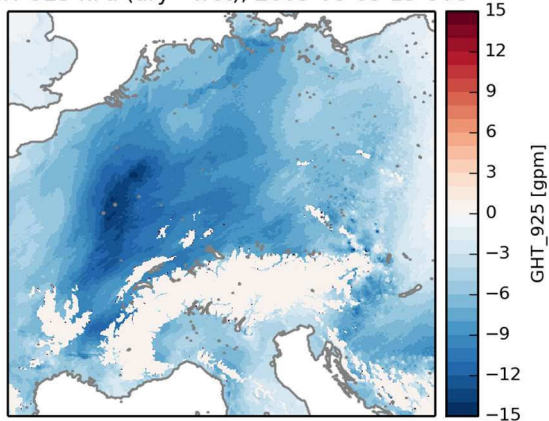
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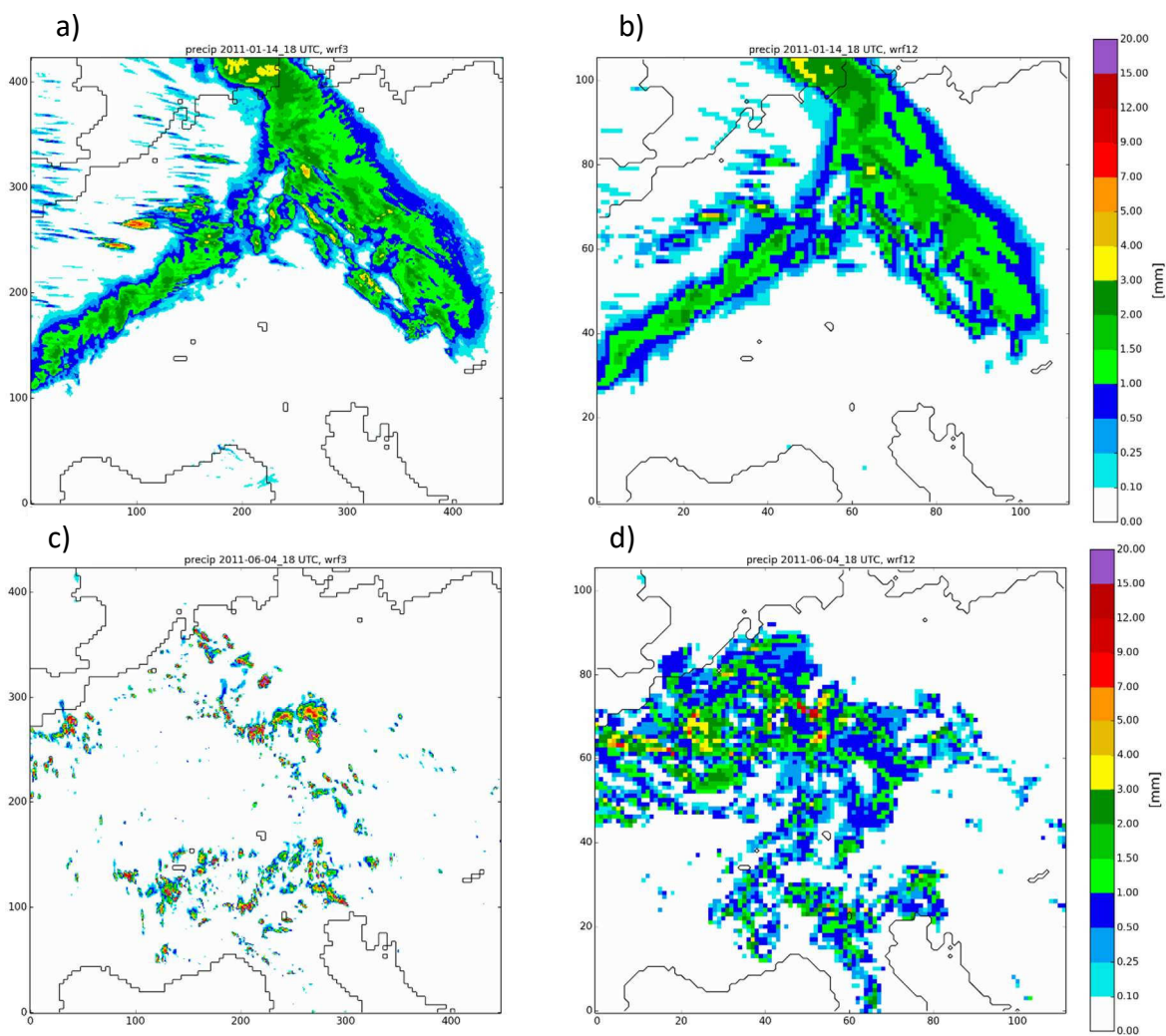
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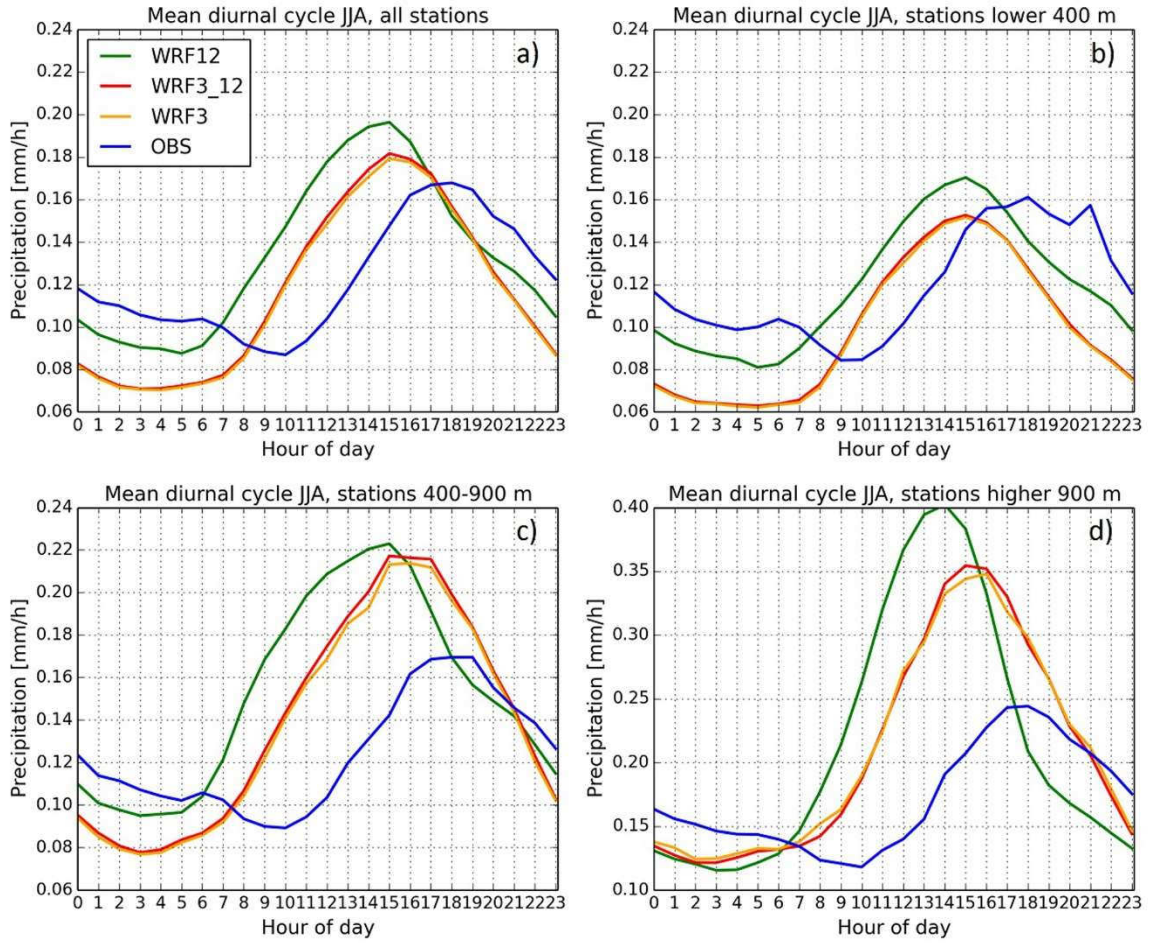
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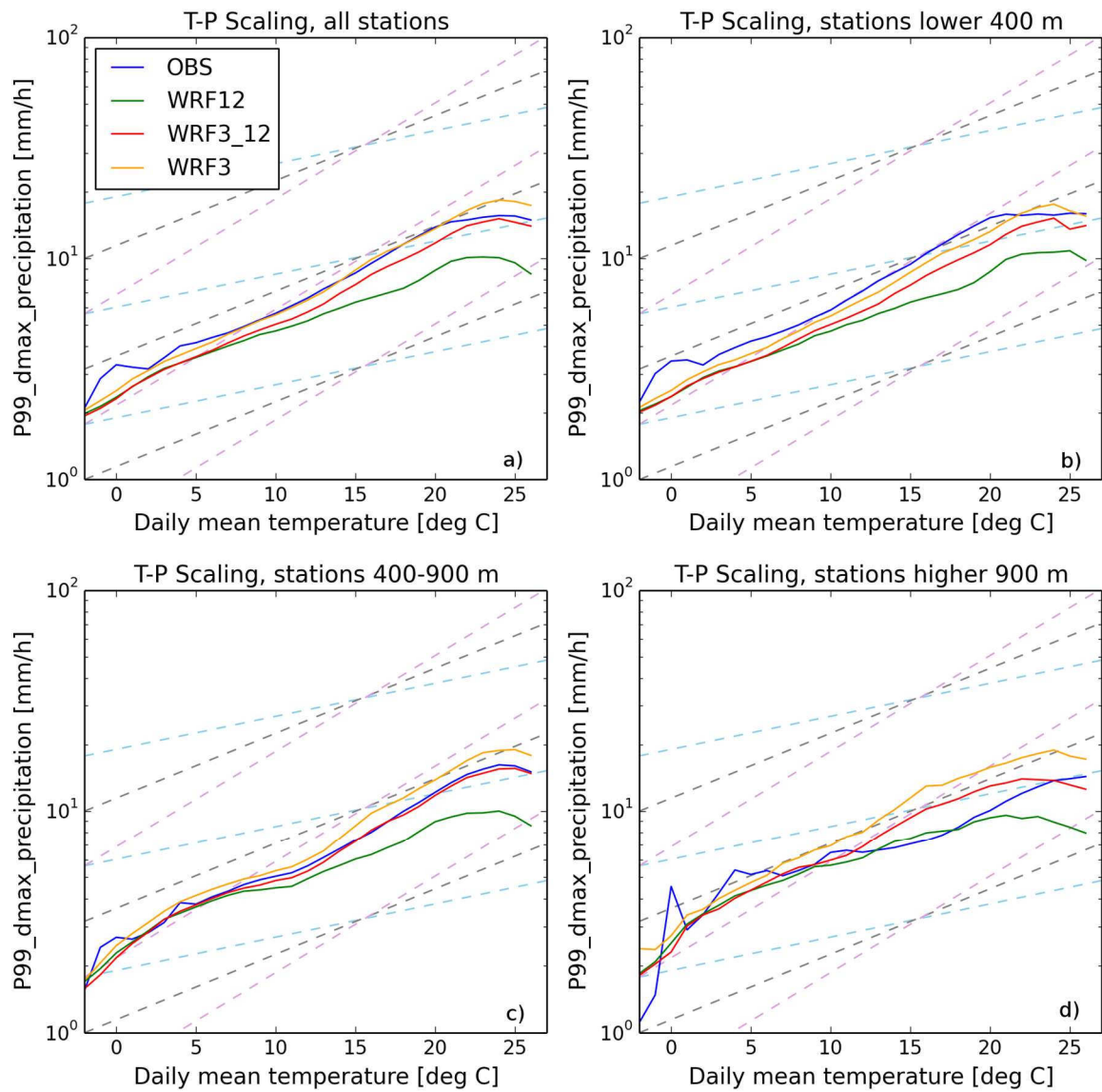
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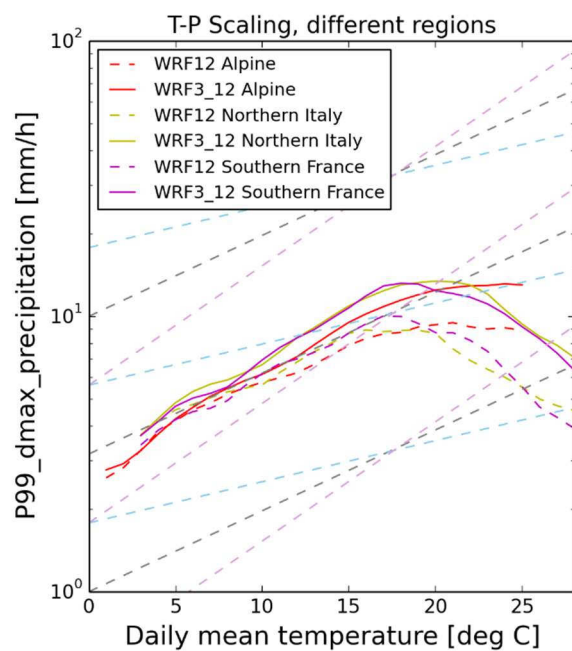
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⁴In the case of a non-terminating sequence, we can consider the limit as $n \rightarrow \infty$. In this case, the limit exists if and only if the sequence is bounded.

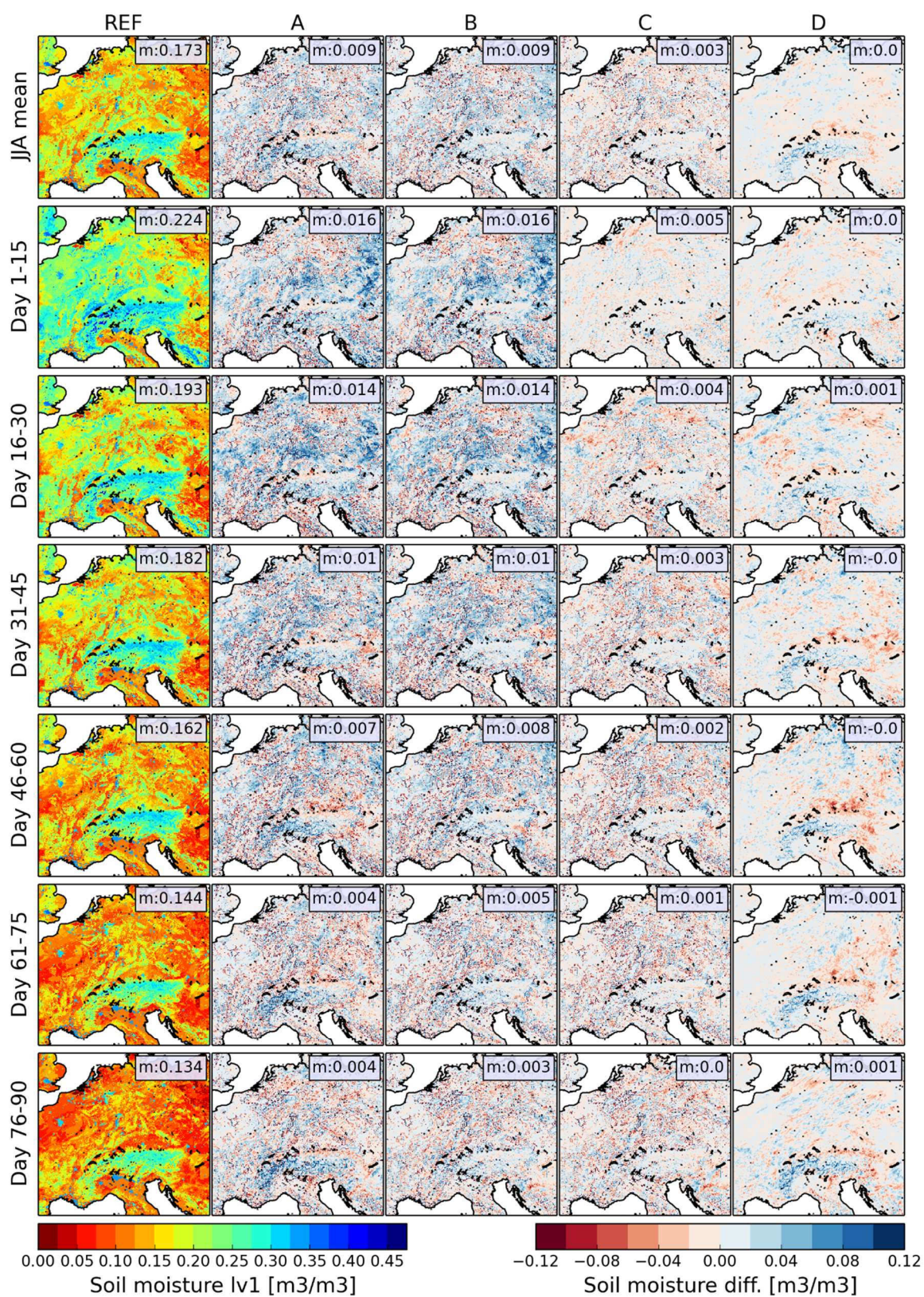
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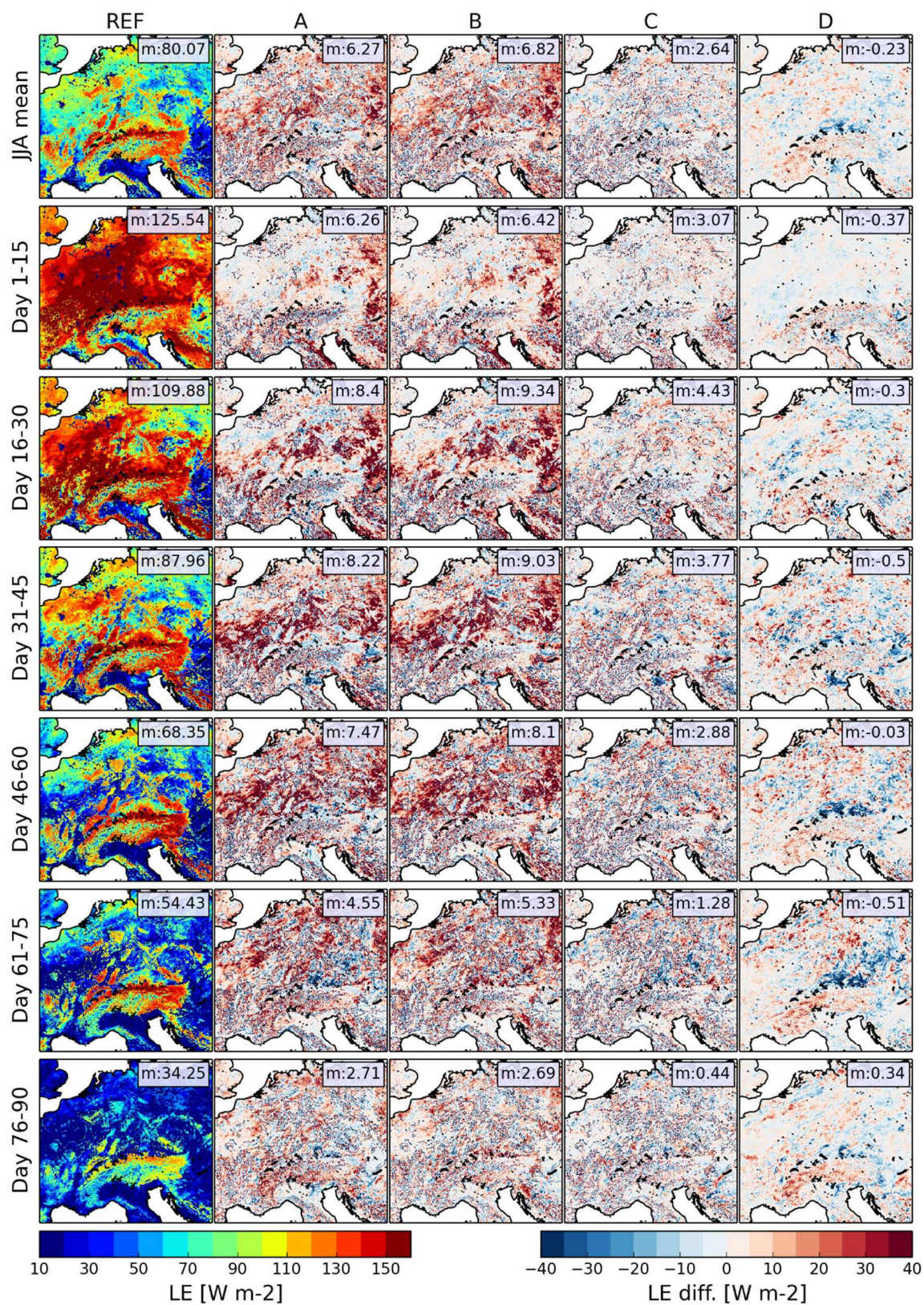
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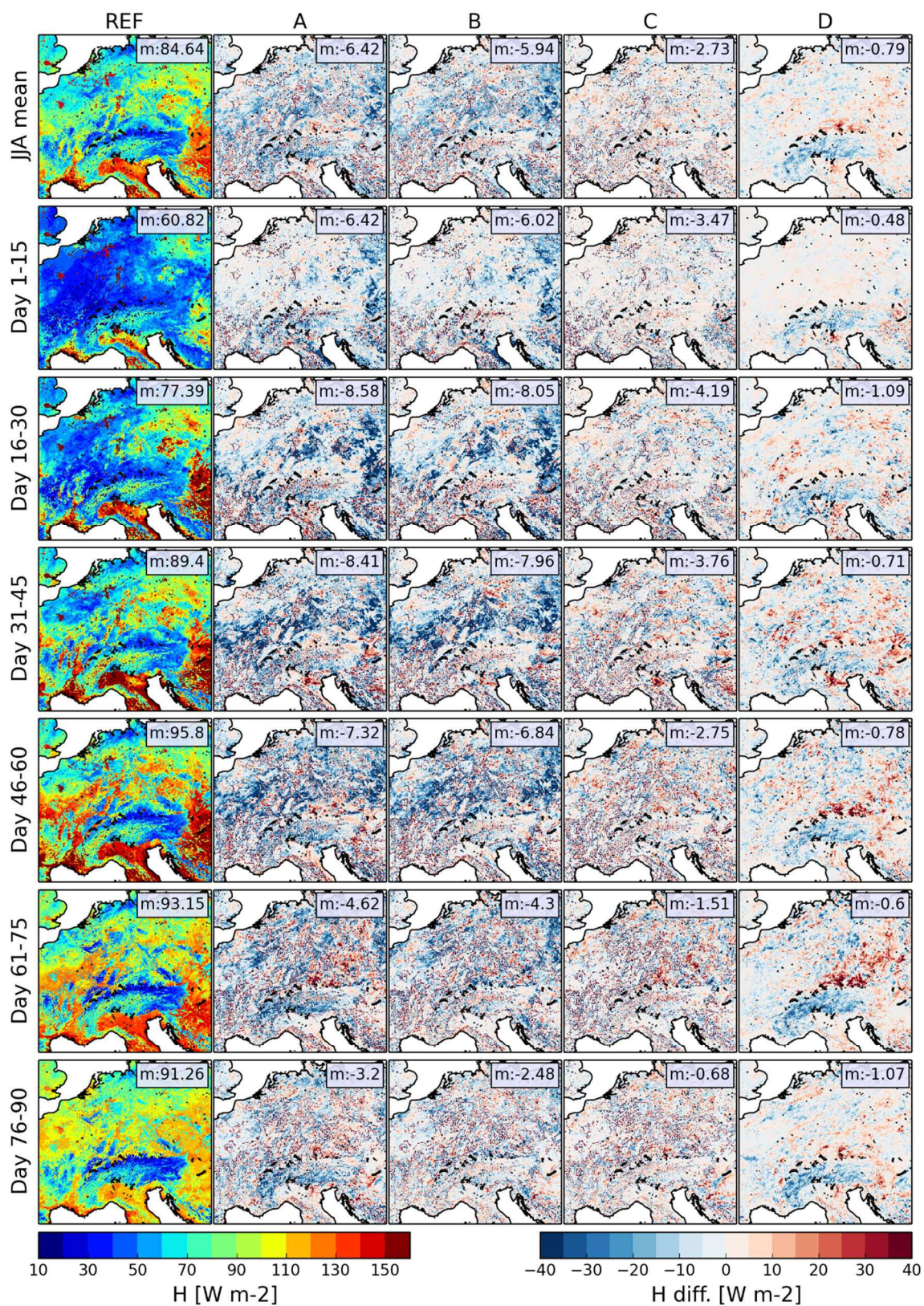
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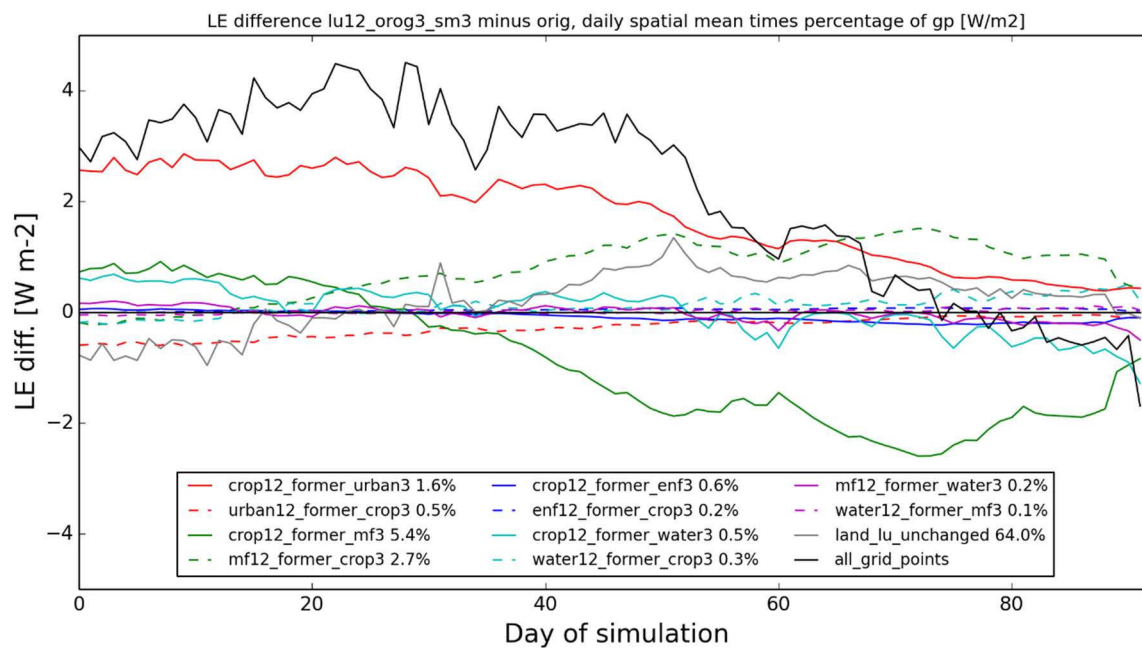
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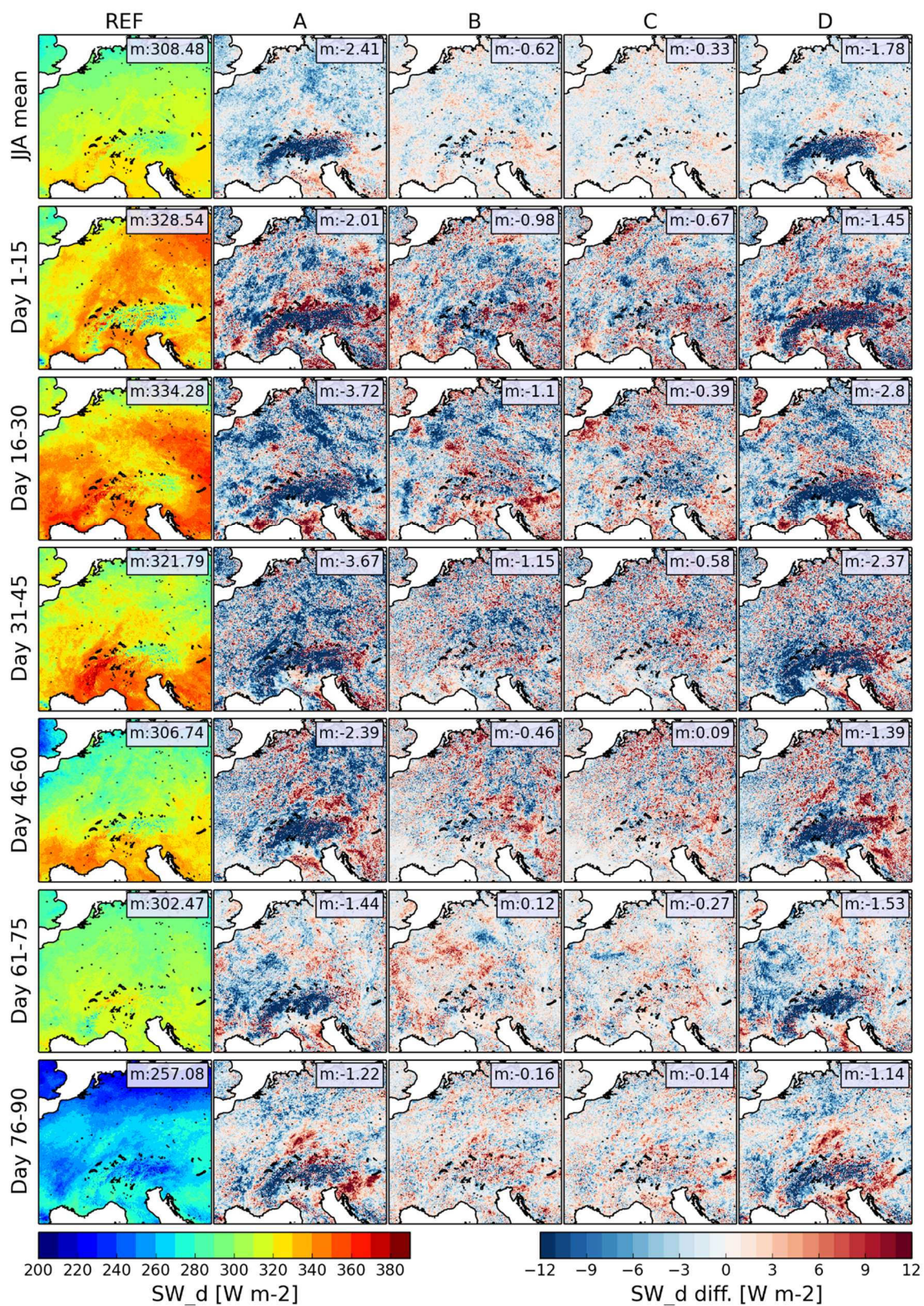
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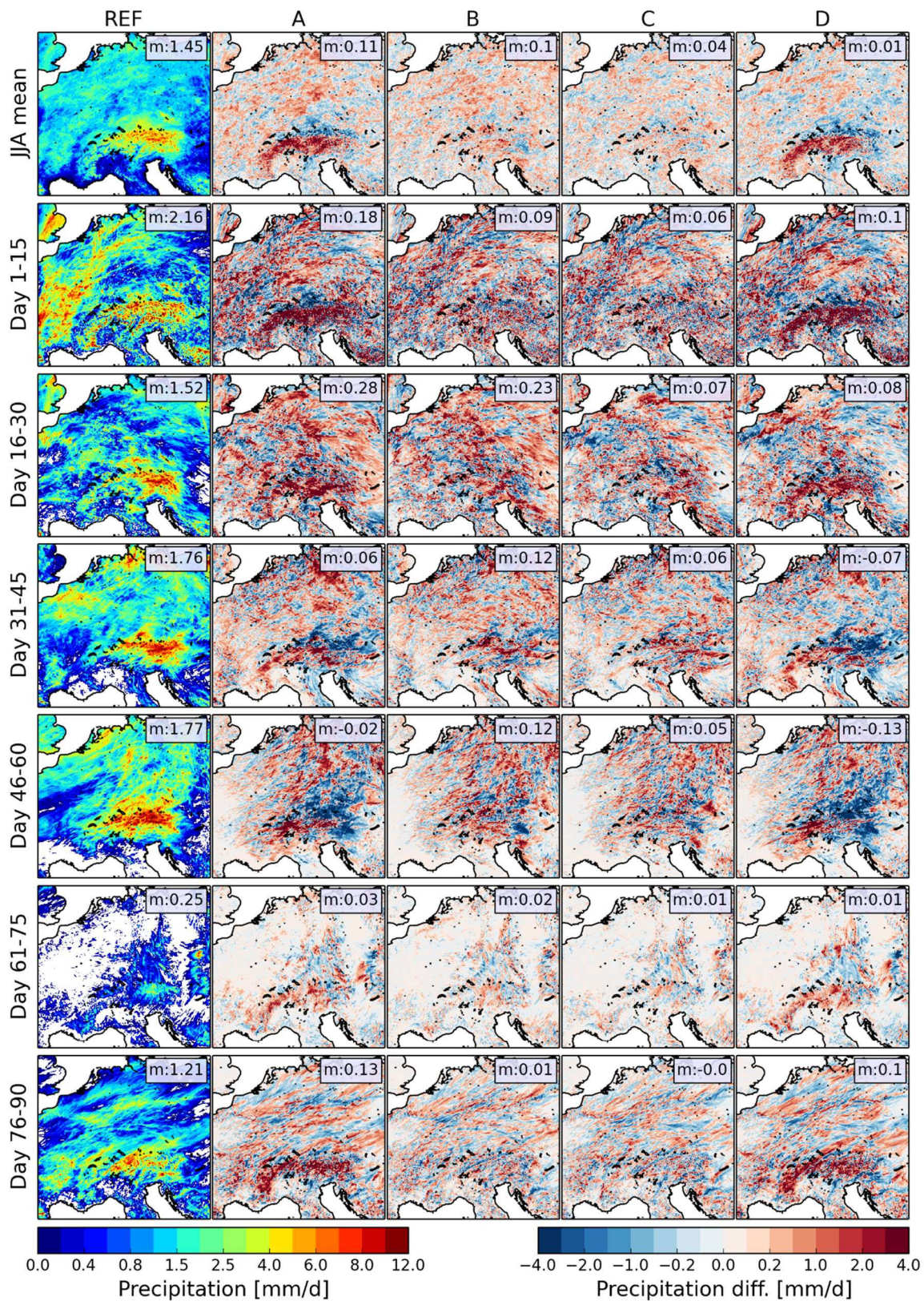
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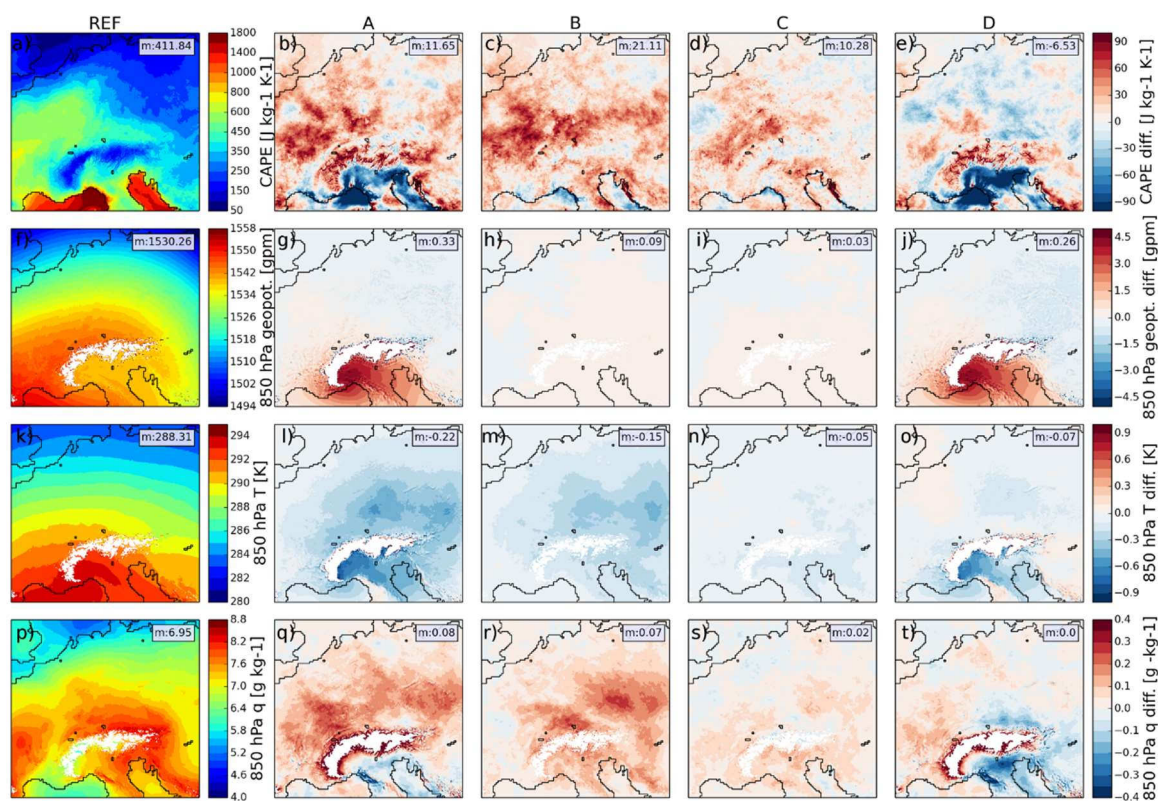
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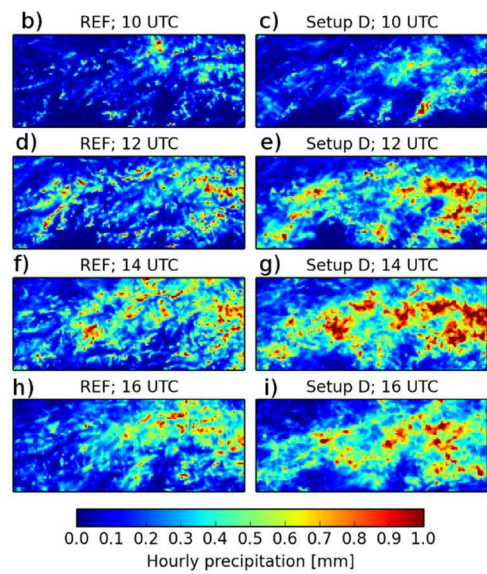
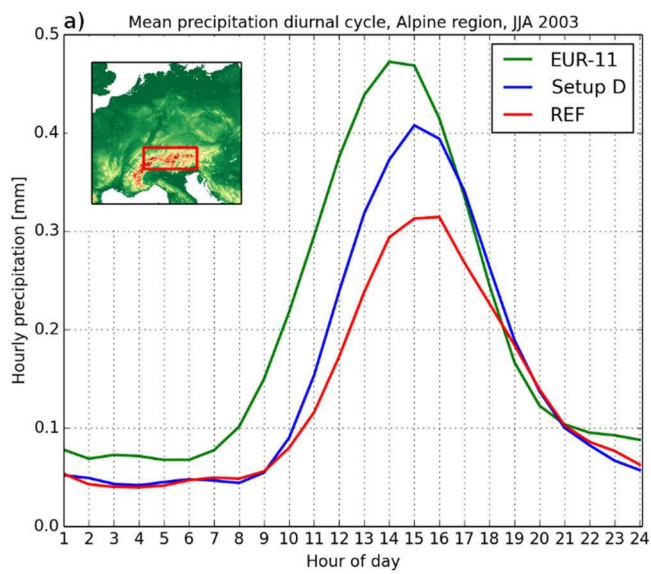


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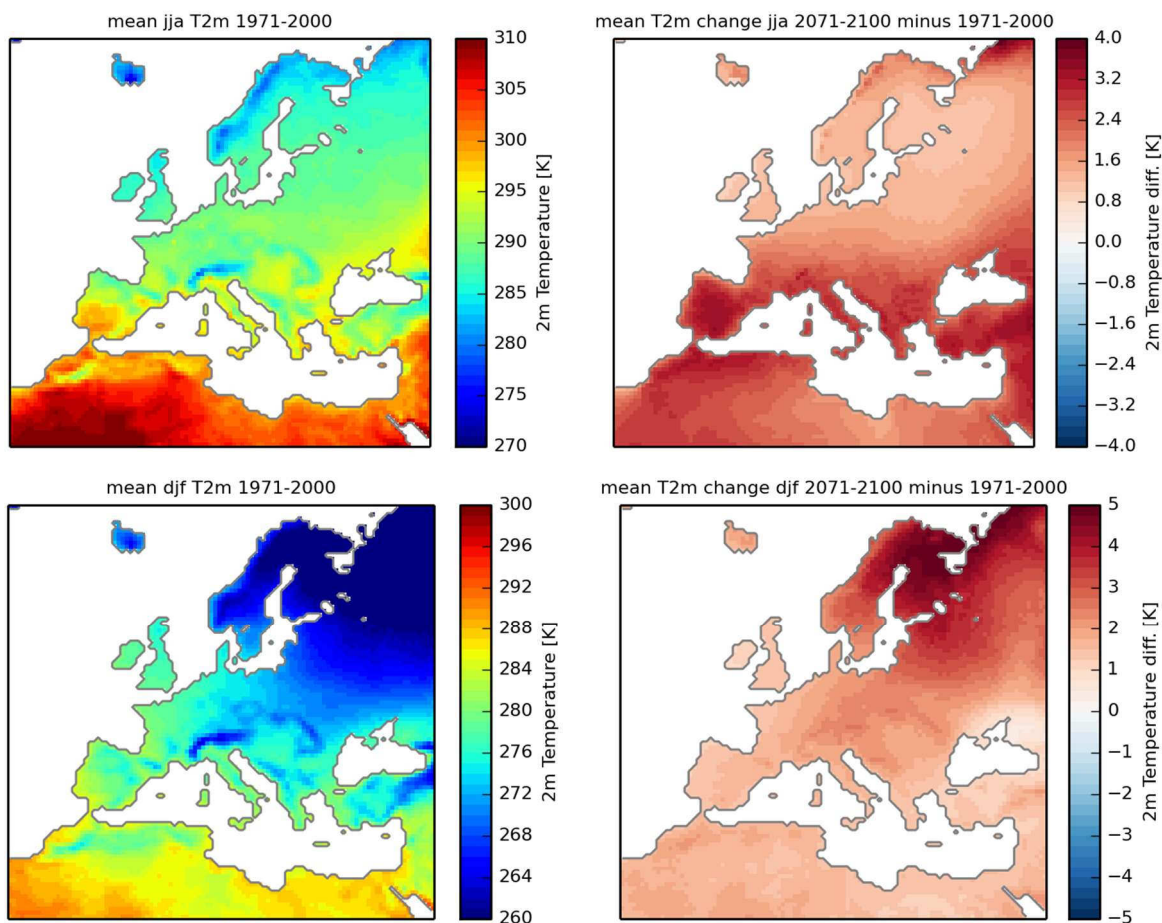
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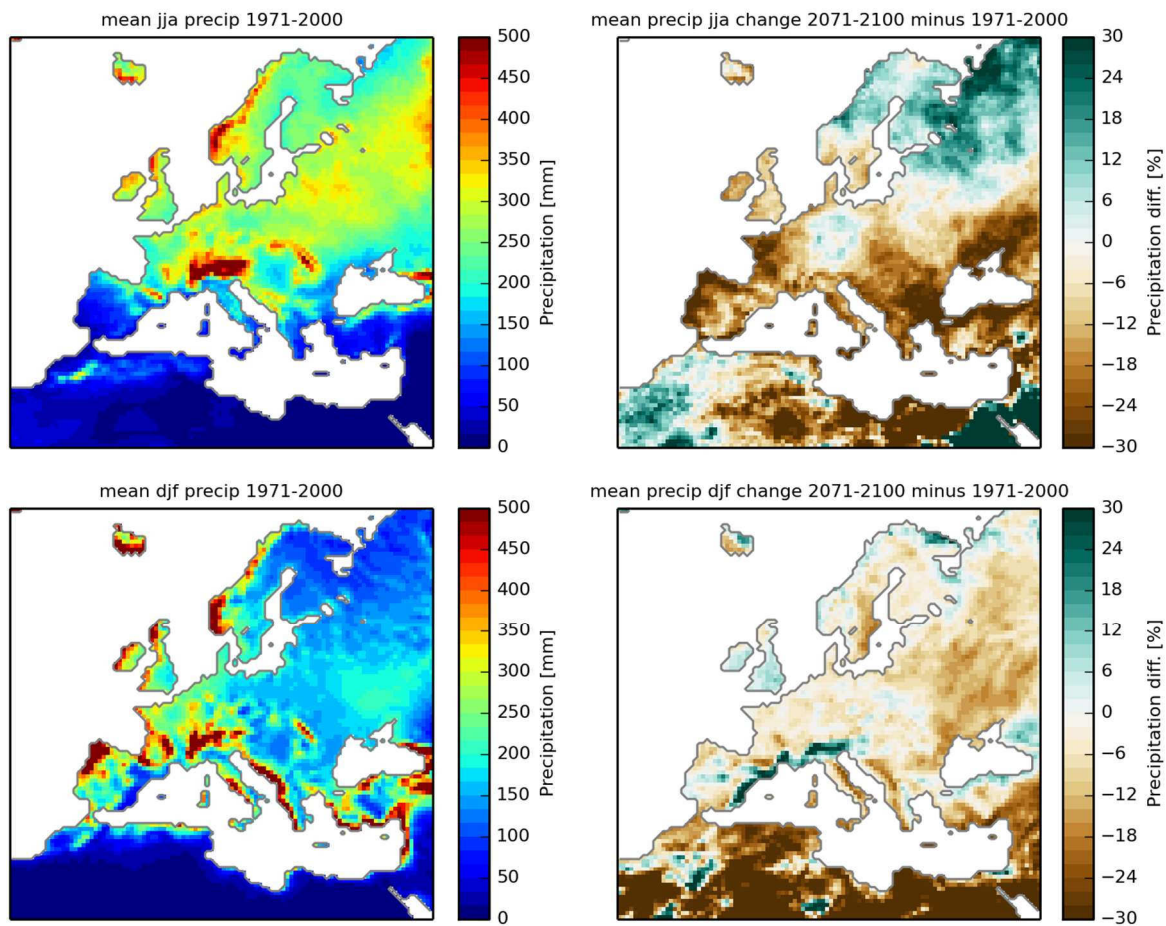
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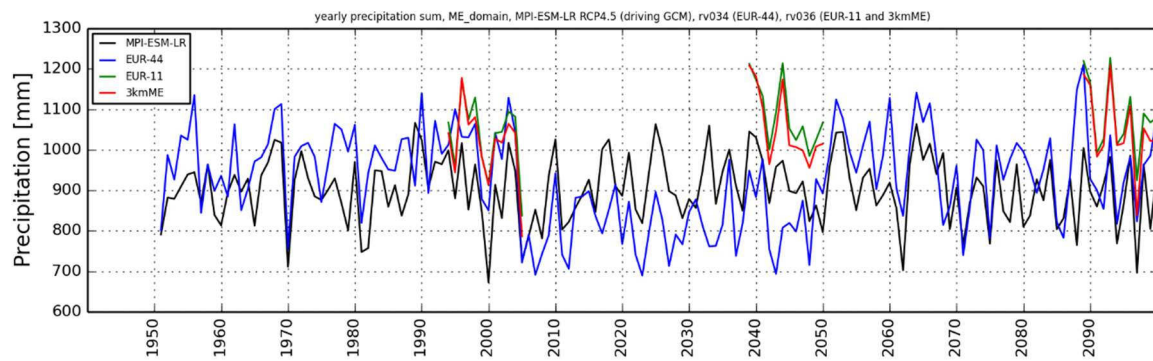


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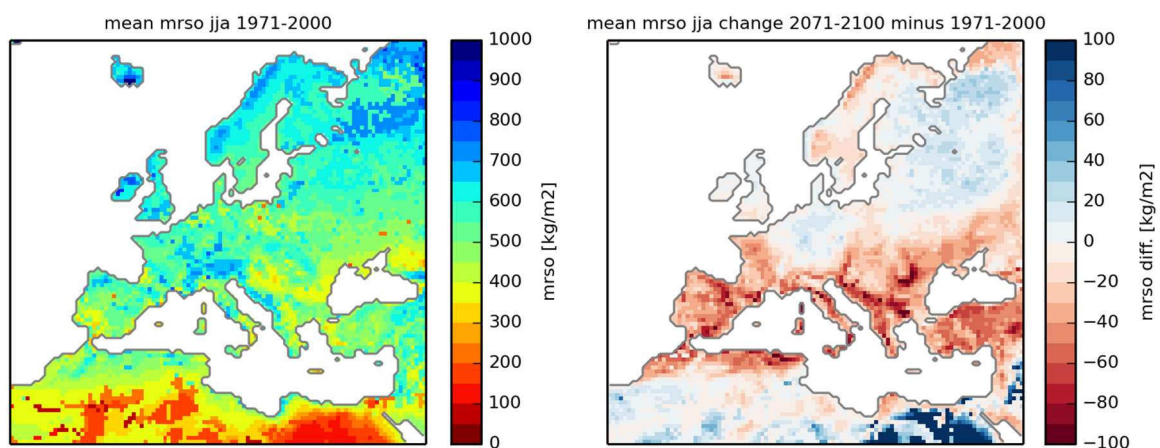
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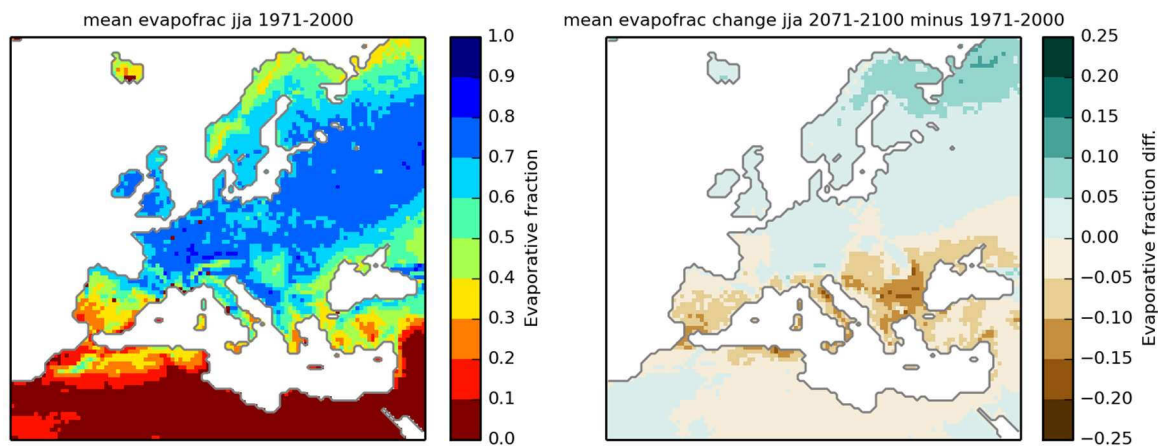


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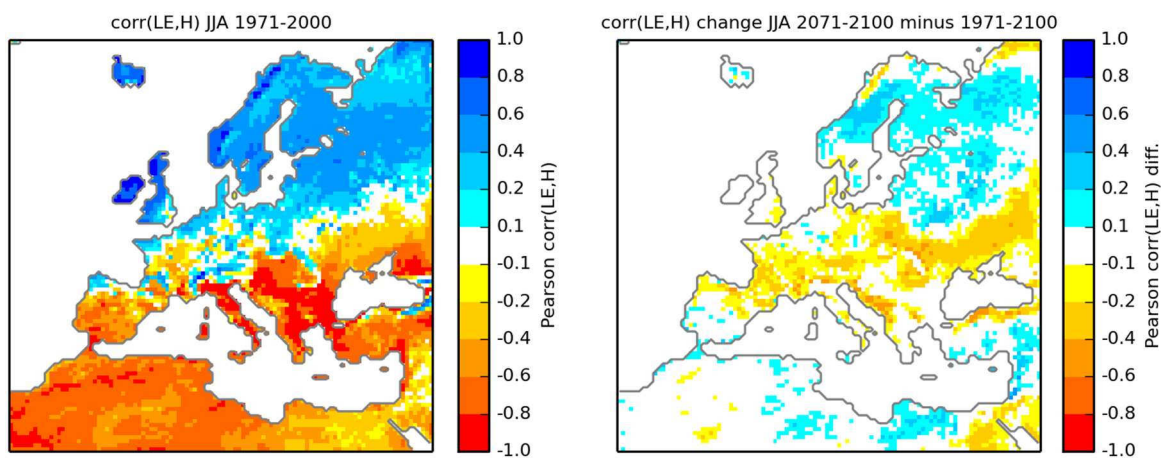
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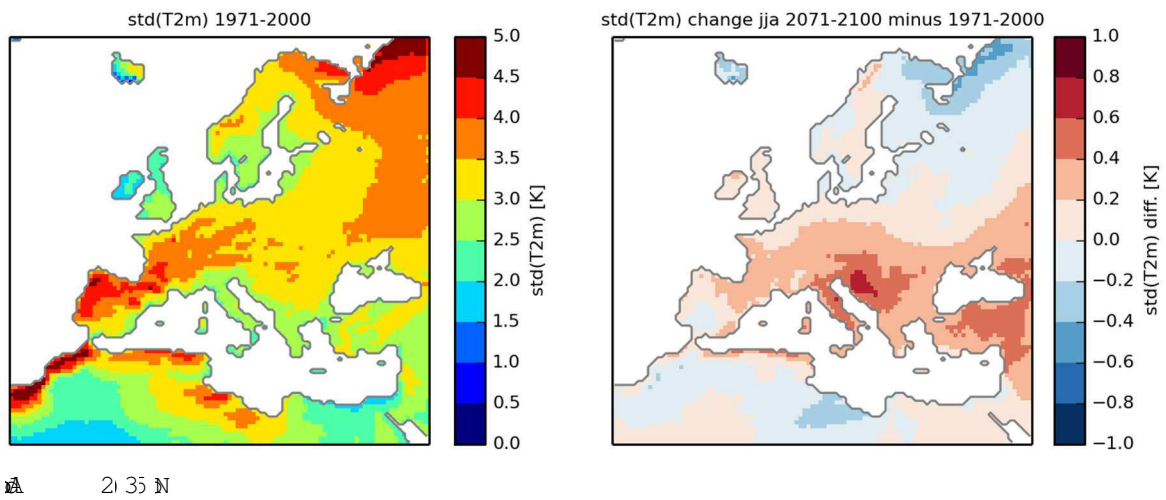
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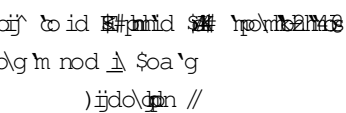
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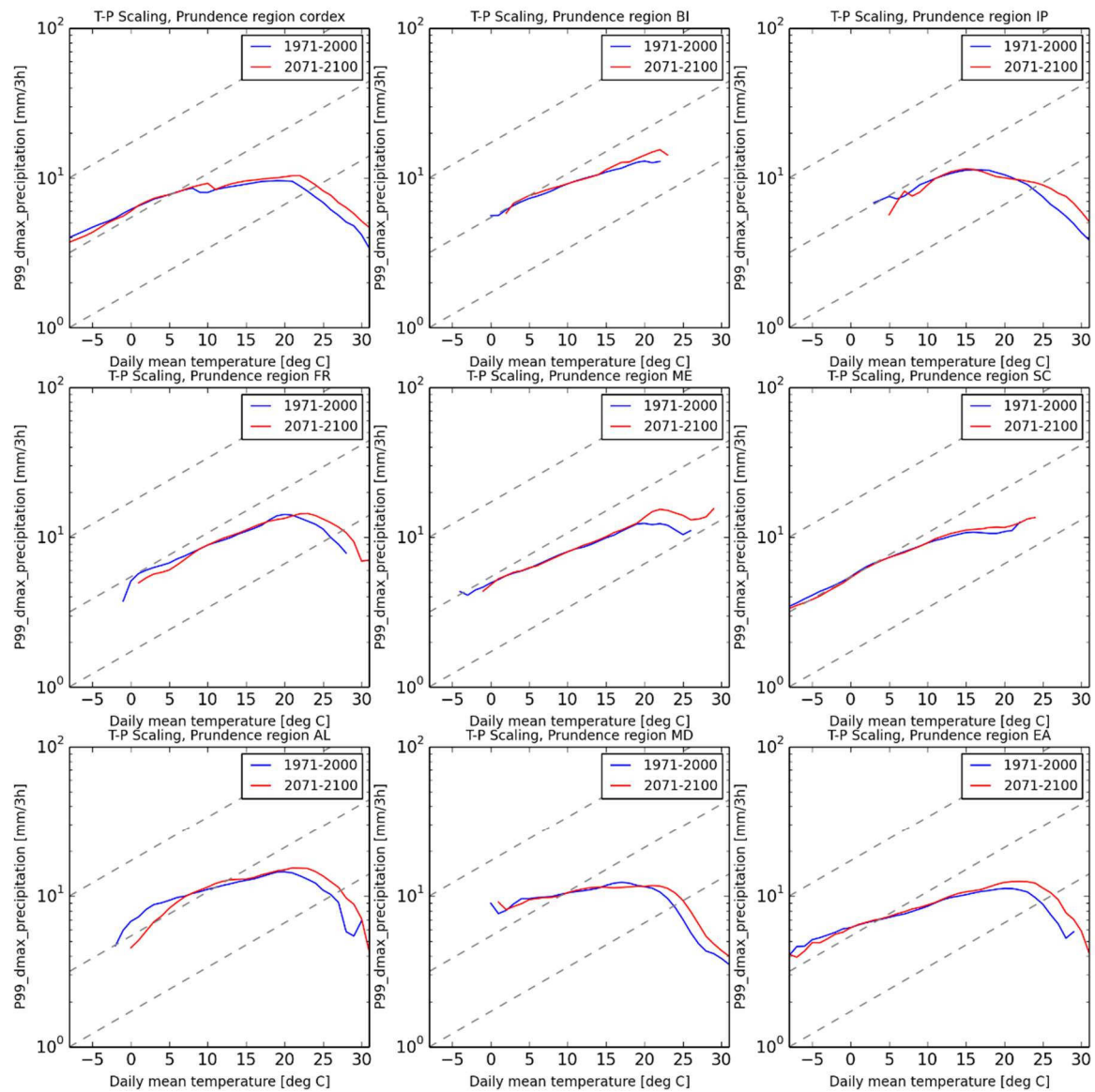
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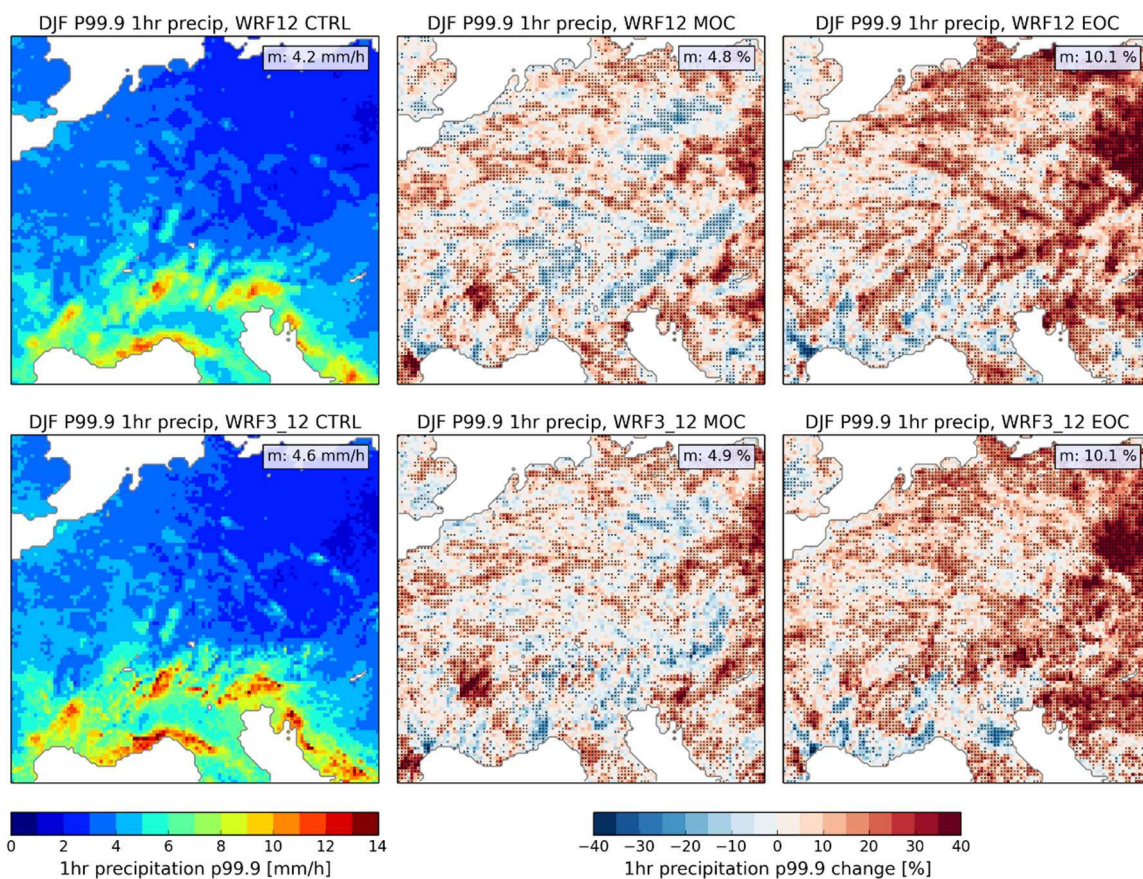
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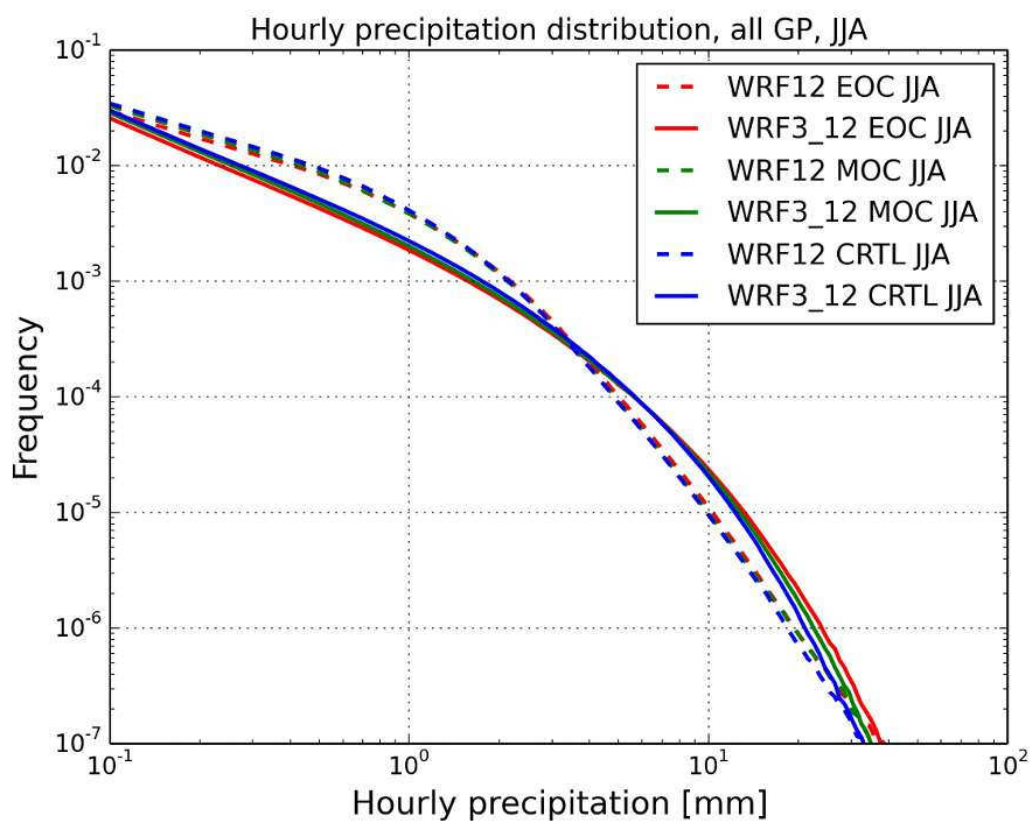
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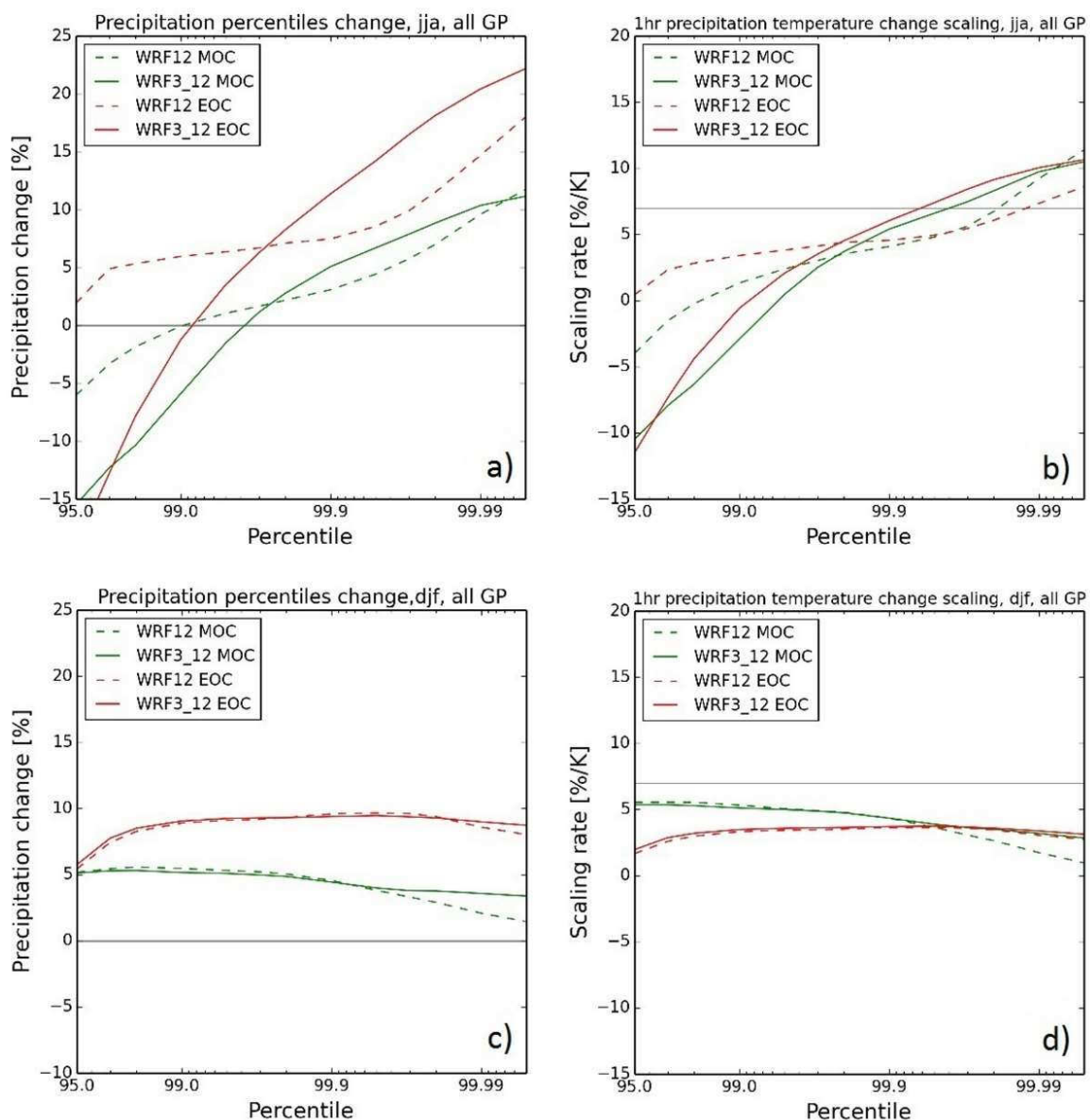
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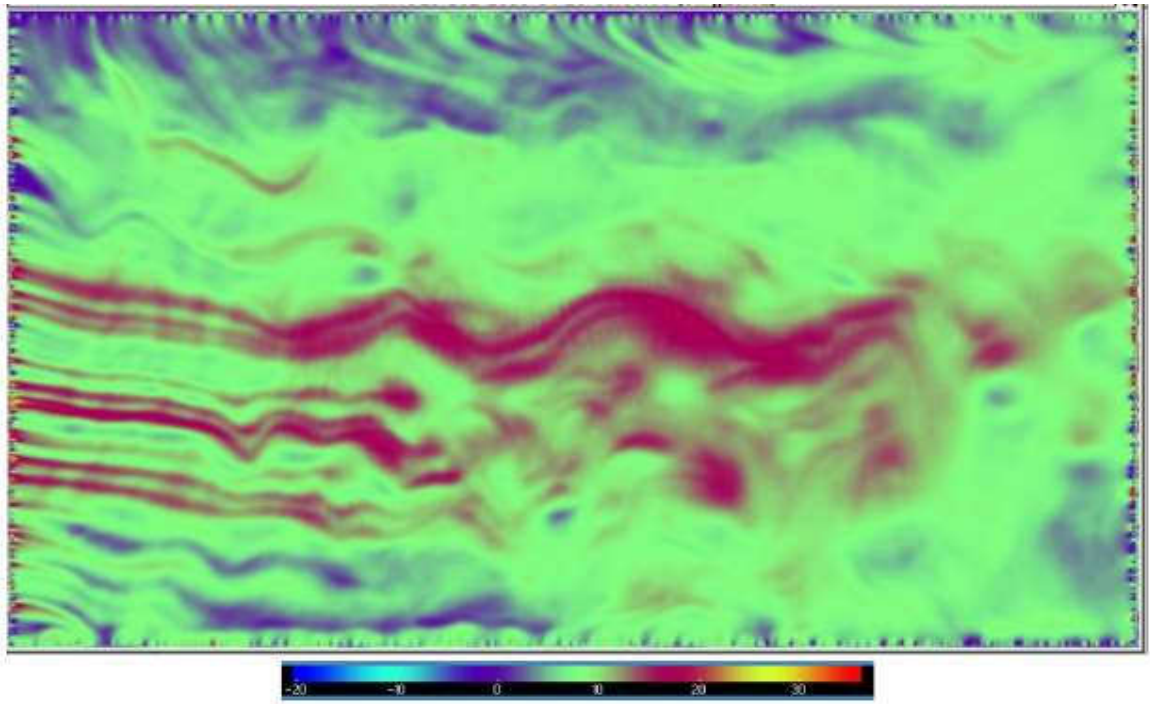
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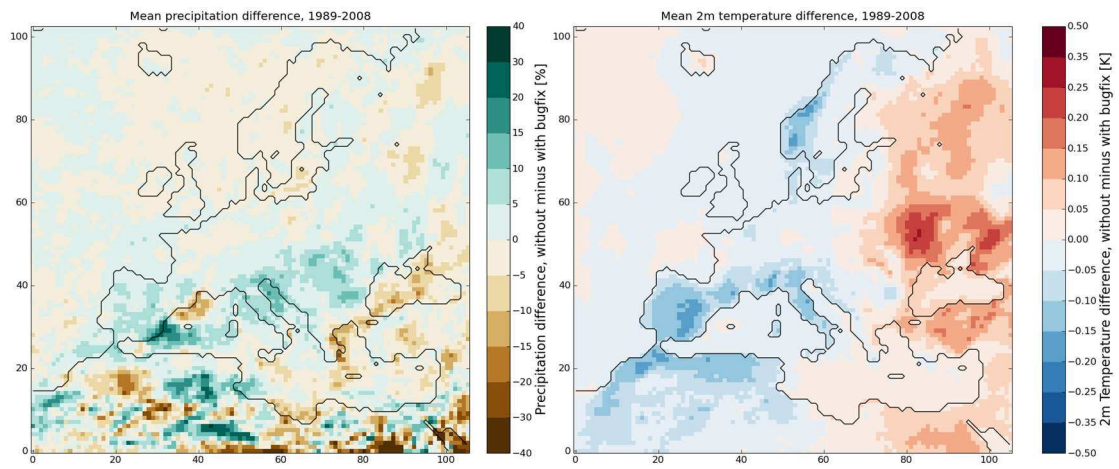
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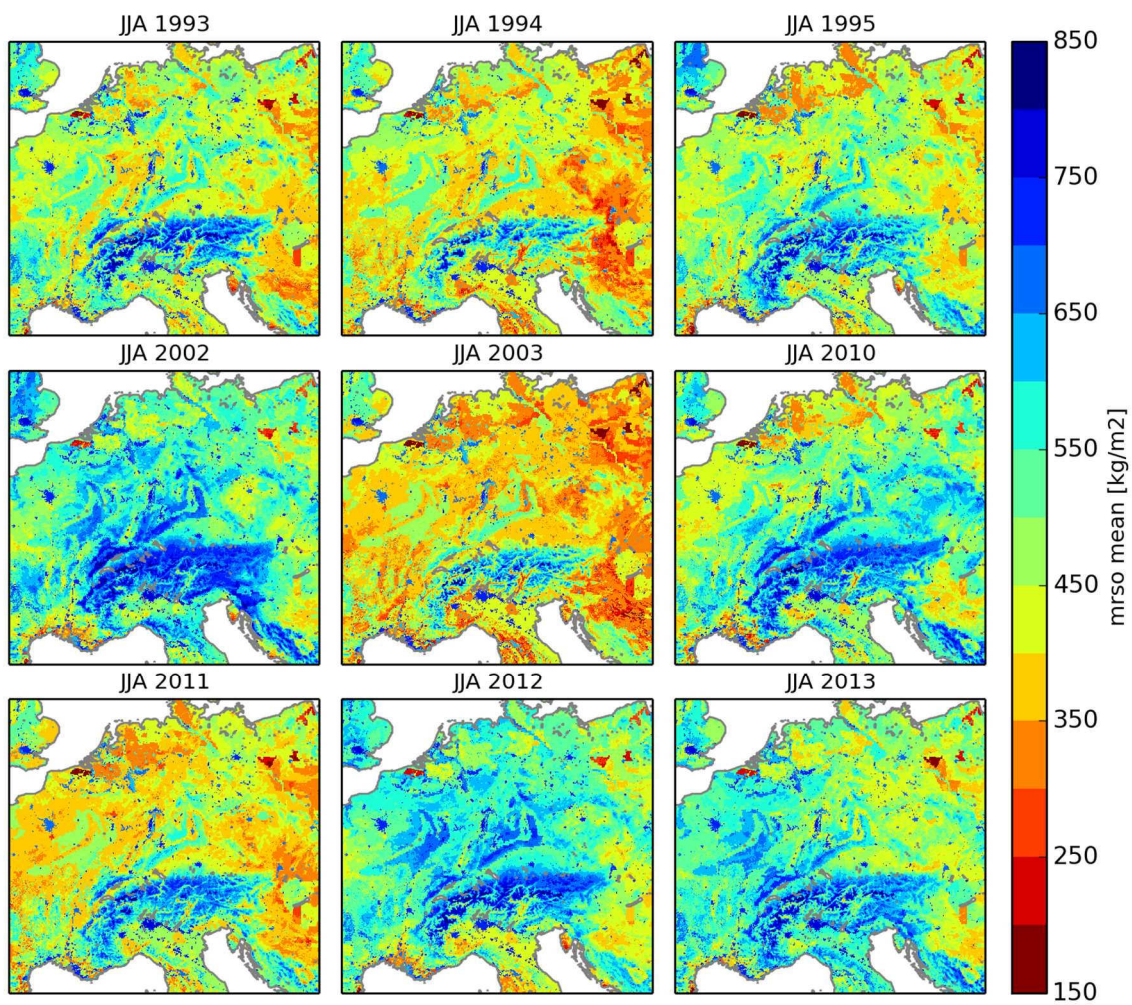
1. With the help of the map, it is possible to see the spatial distribution of the values. The map shows that the values are highest in the tropics and lowest in the poles. This is due to the fact that the tropics receive more solar radiation than the poles.



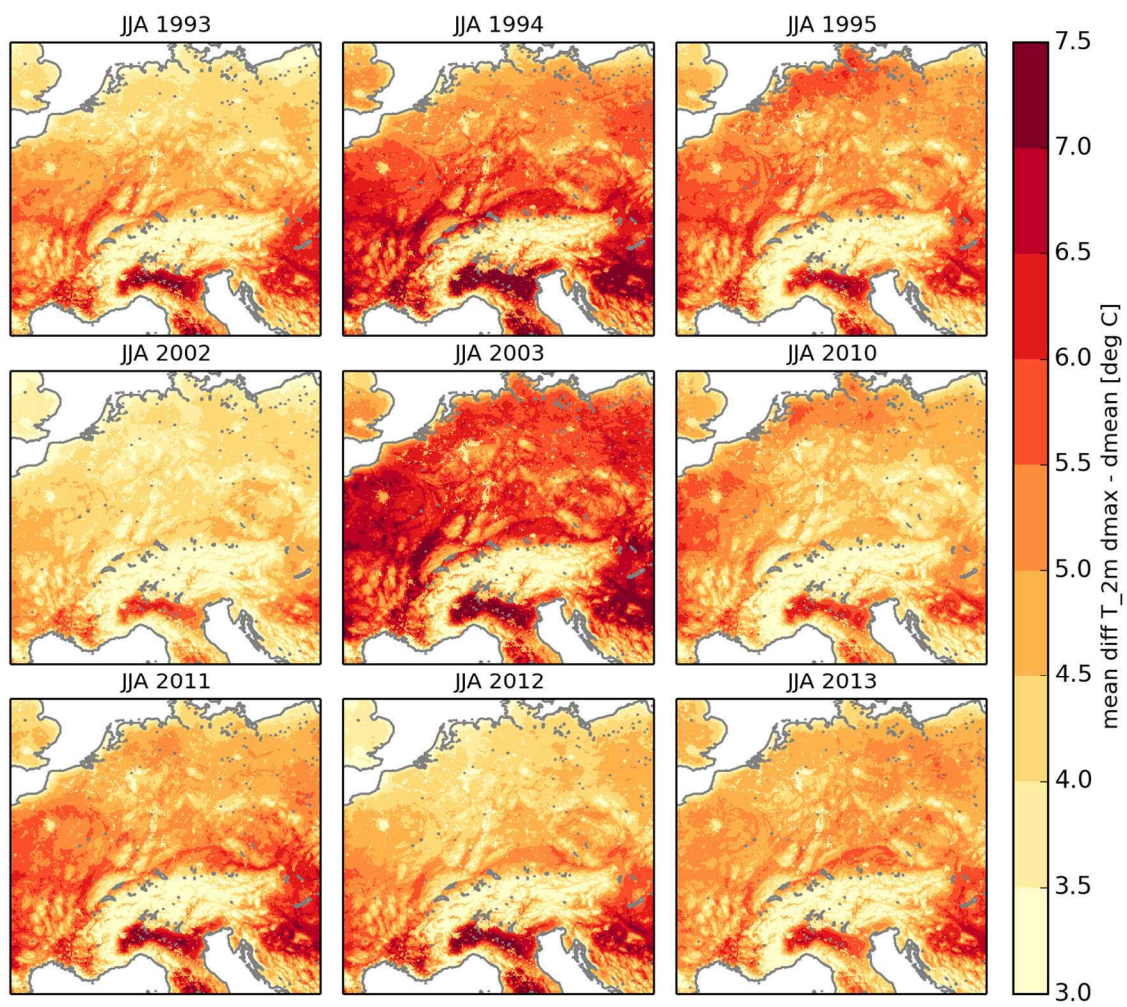
2. The map shows that the precipitation difference is highest in the north and lowest in the south. This is due to the fact that the north receives more precipitation than the south. The temperature difference is highest in the east and lowest in the west. This is due to the fact that the east is further from the ocean than the west.

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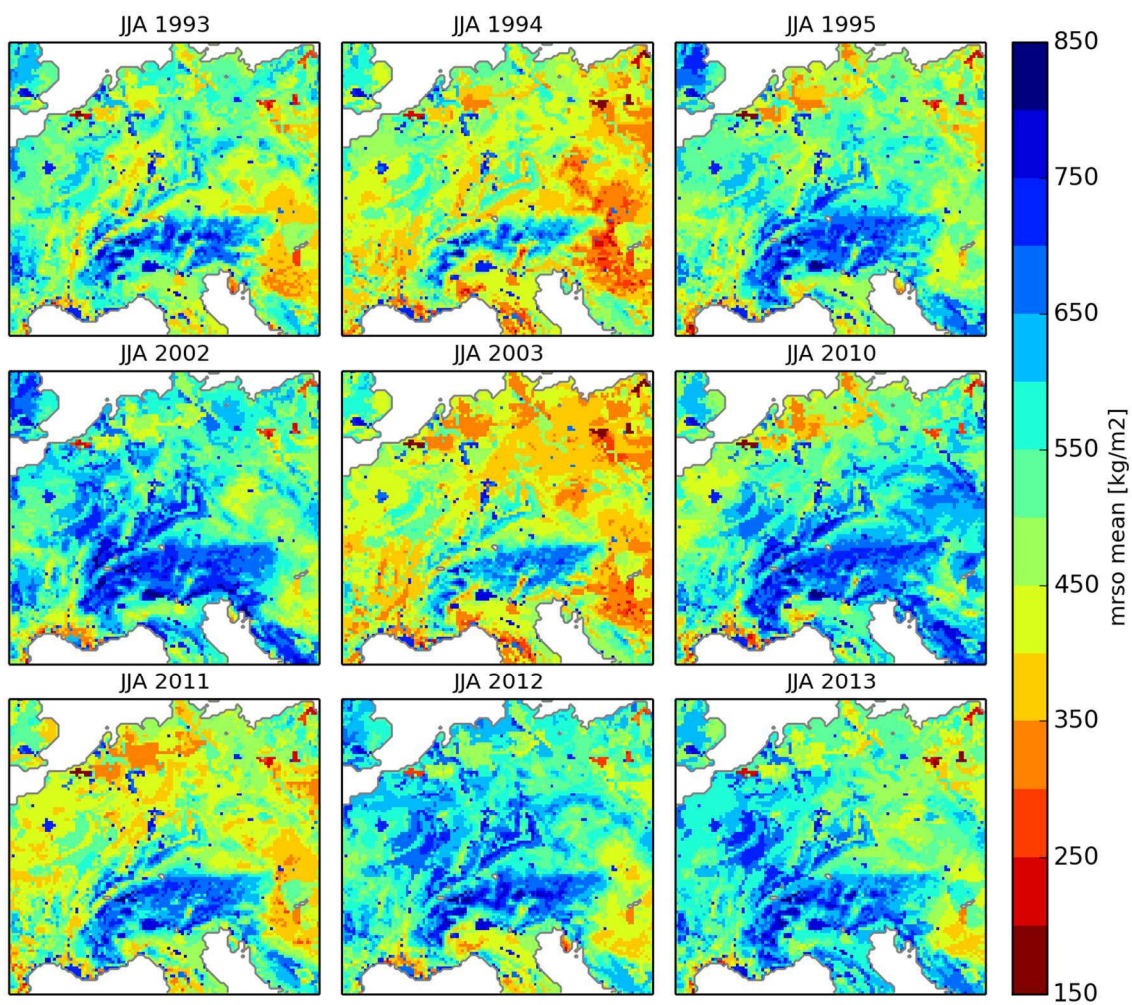
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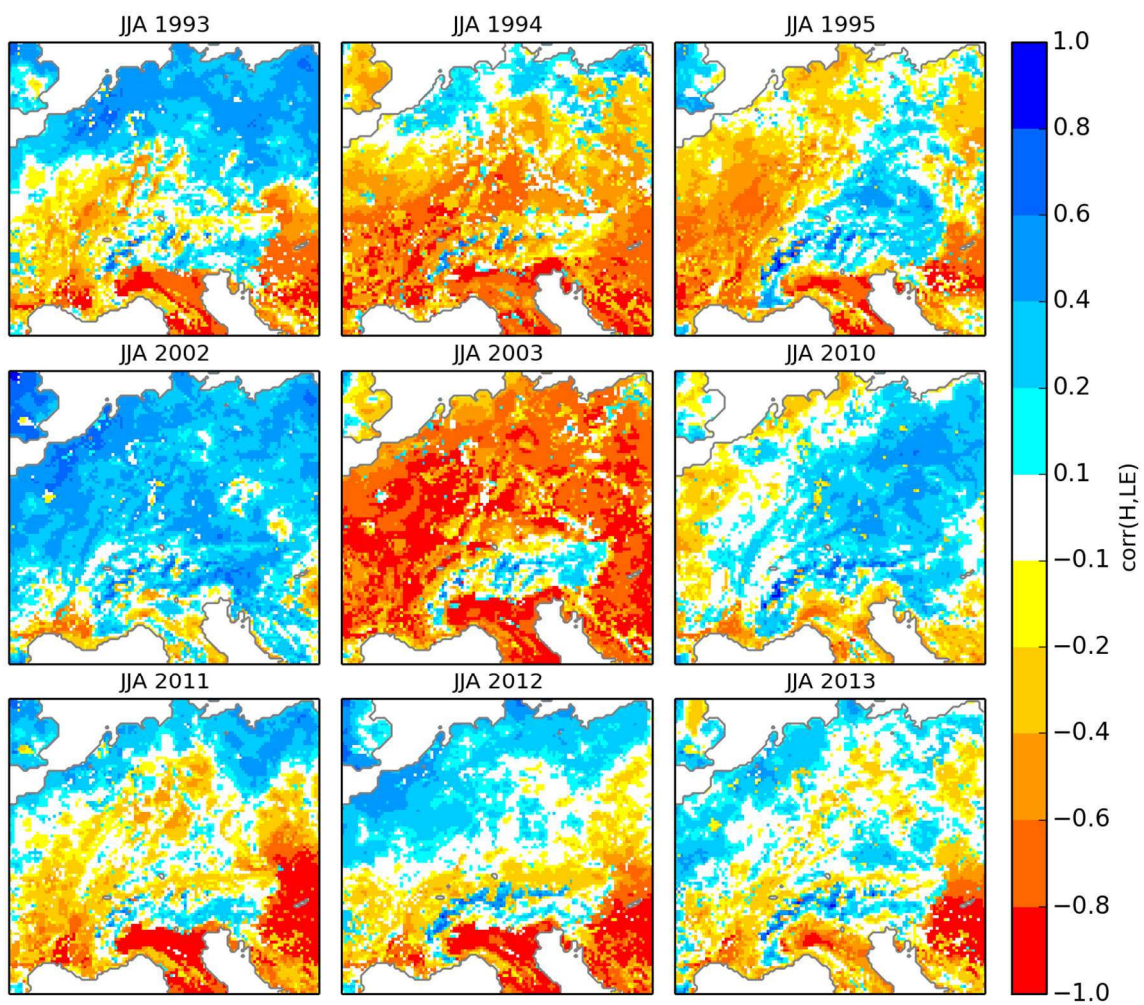
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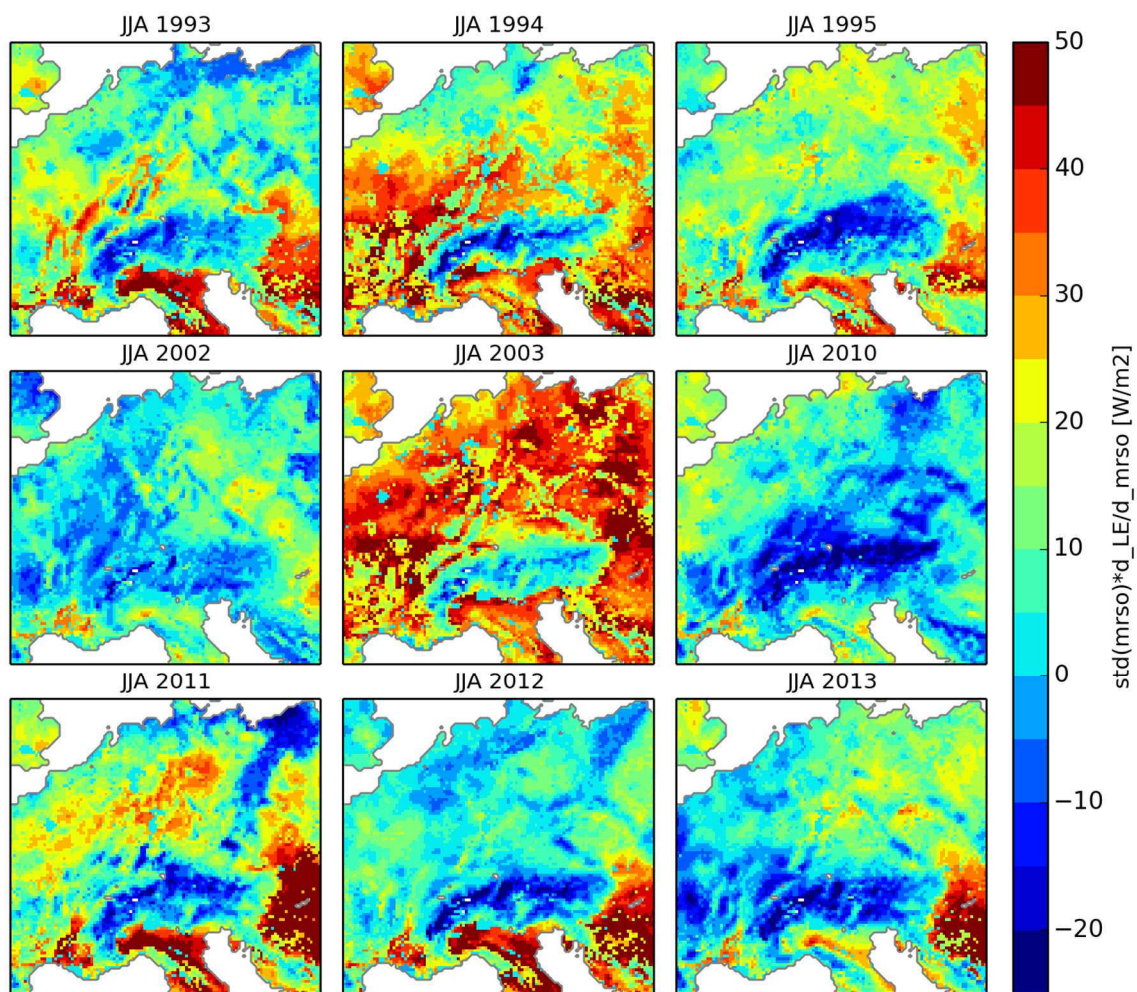
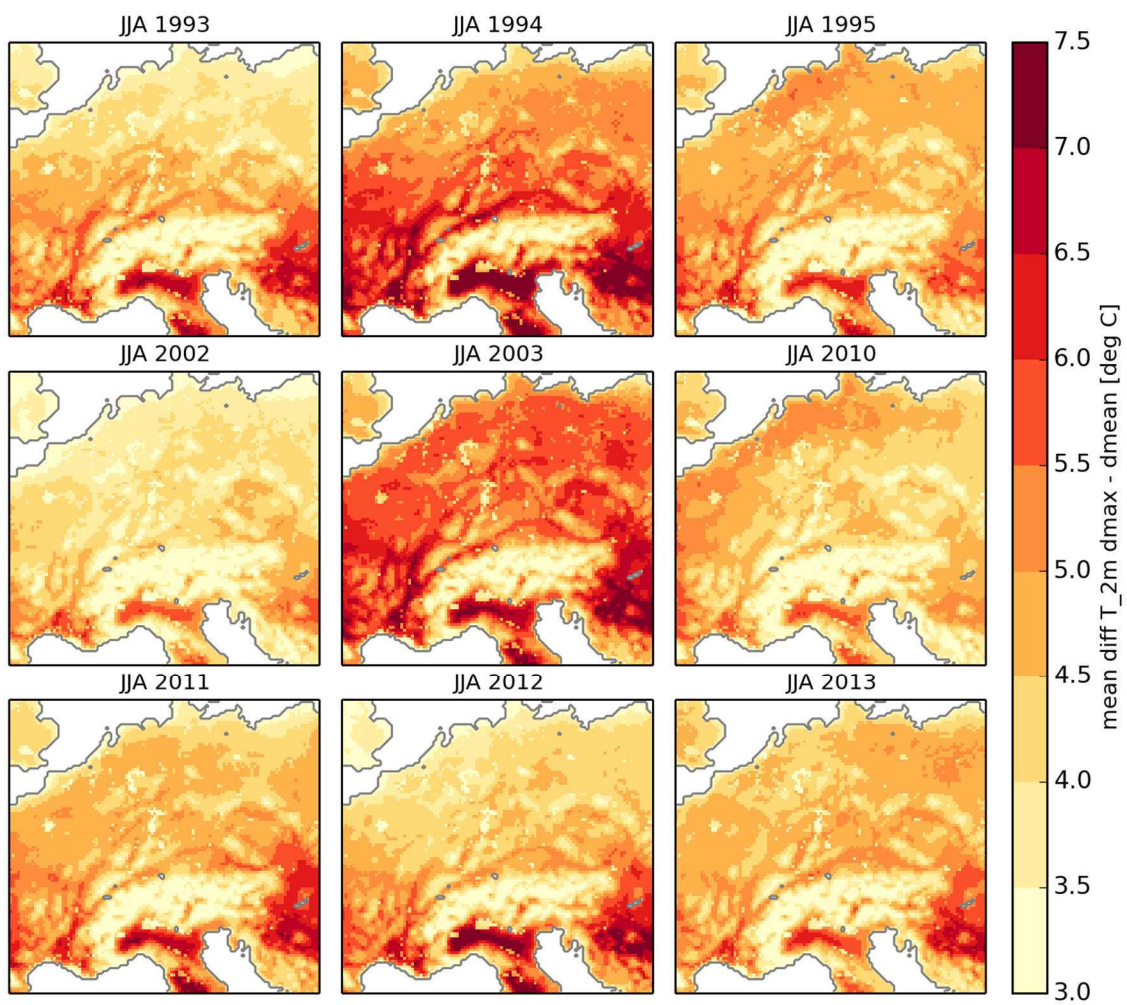


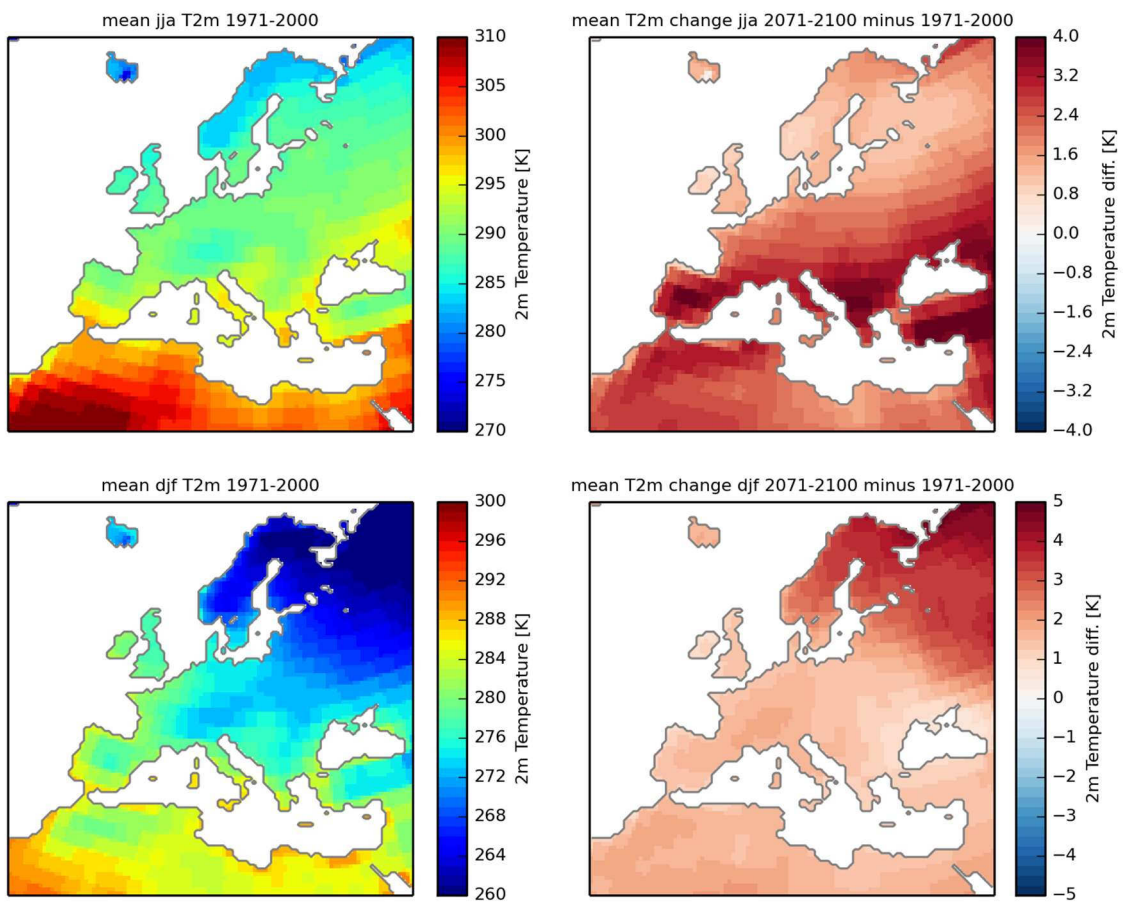
Figure 4: JJA precipitation anomalies (mm/day) for the years 1993, 1994, 1995, 2002, 2003, 2010, 2011, 2012, and 2013.

Figure 4: JJA precipitation anomalies (mm/day) for the years 1993, 1994, 1995, 2002, 2003, 2010, 2011, 2012, and 2013.

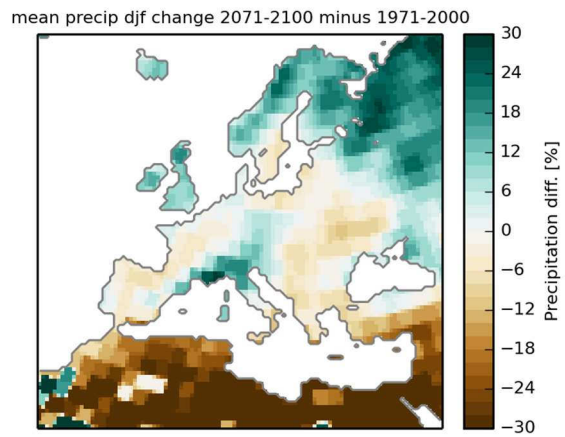
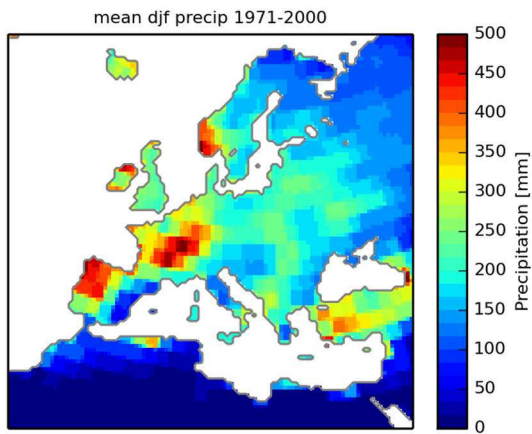
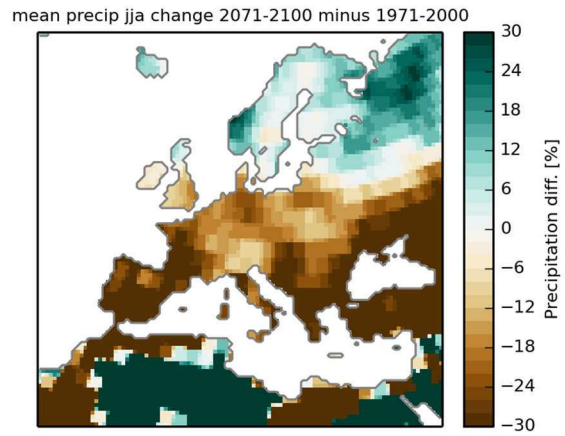
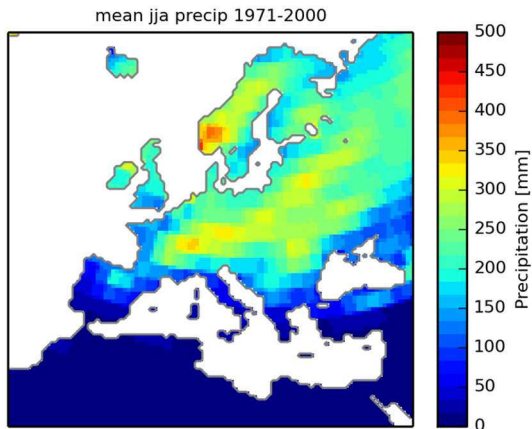
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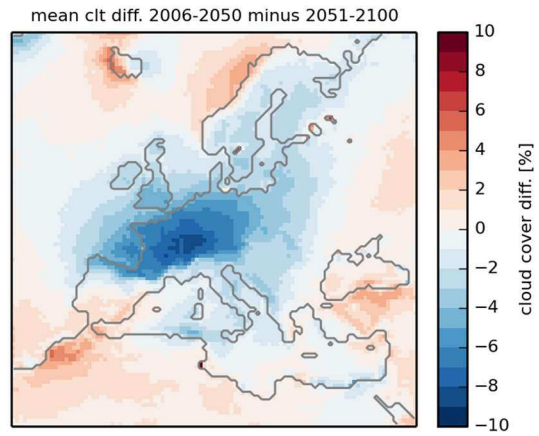
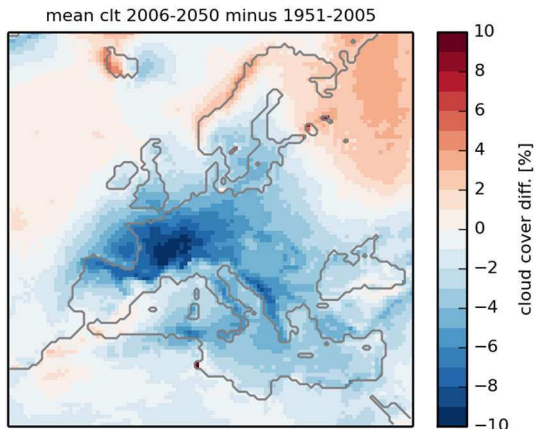
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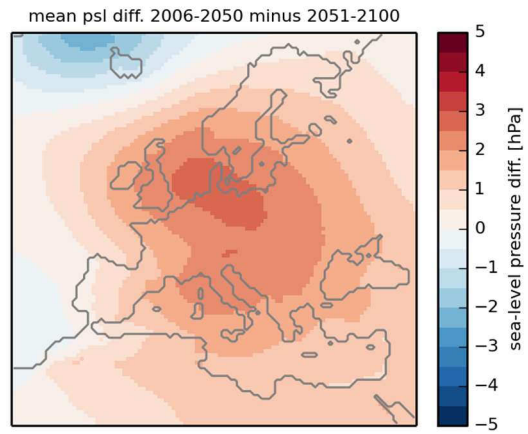
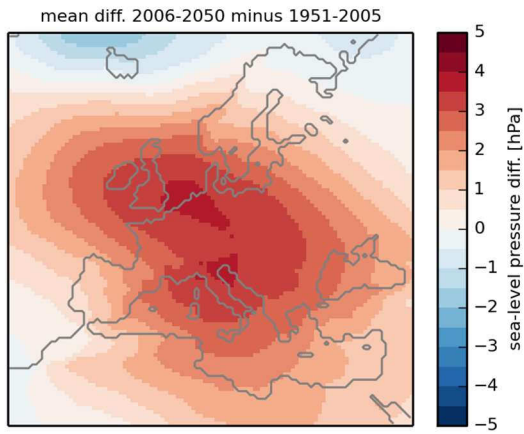
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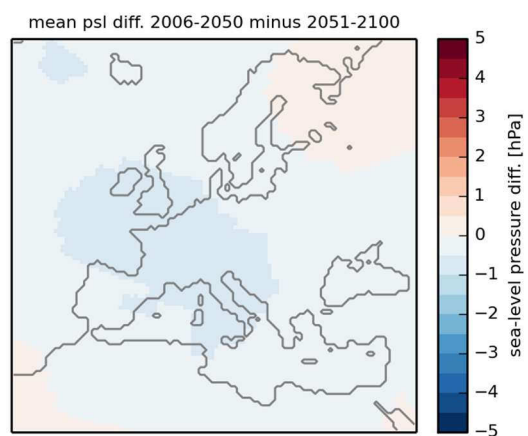
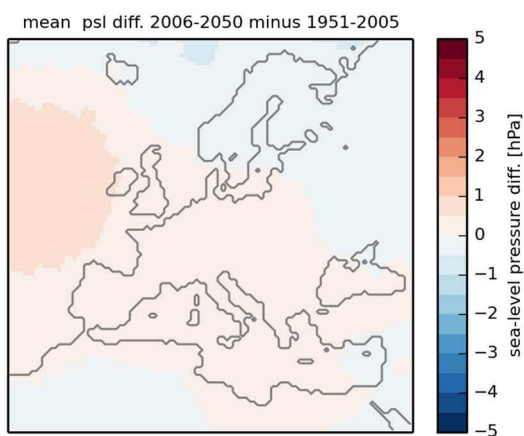
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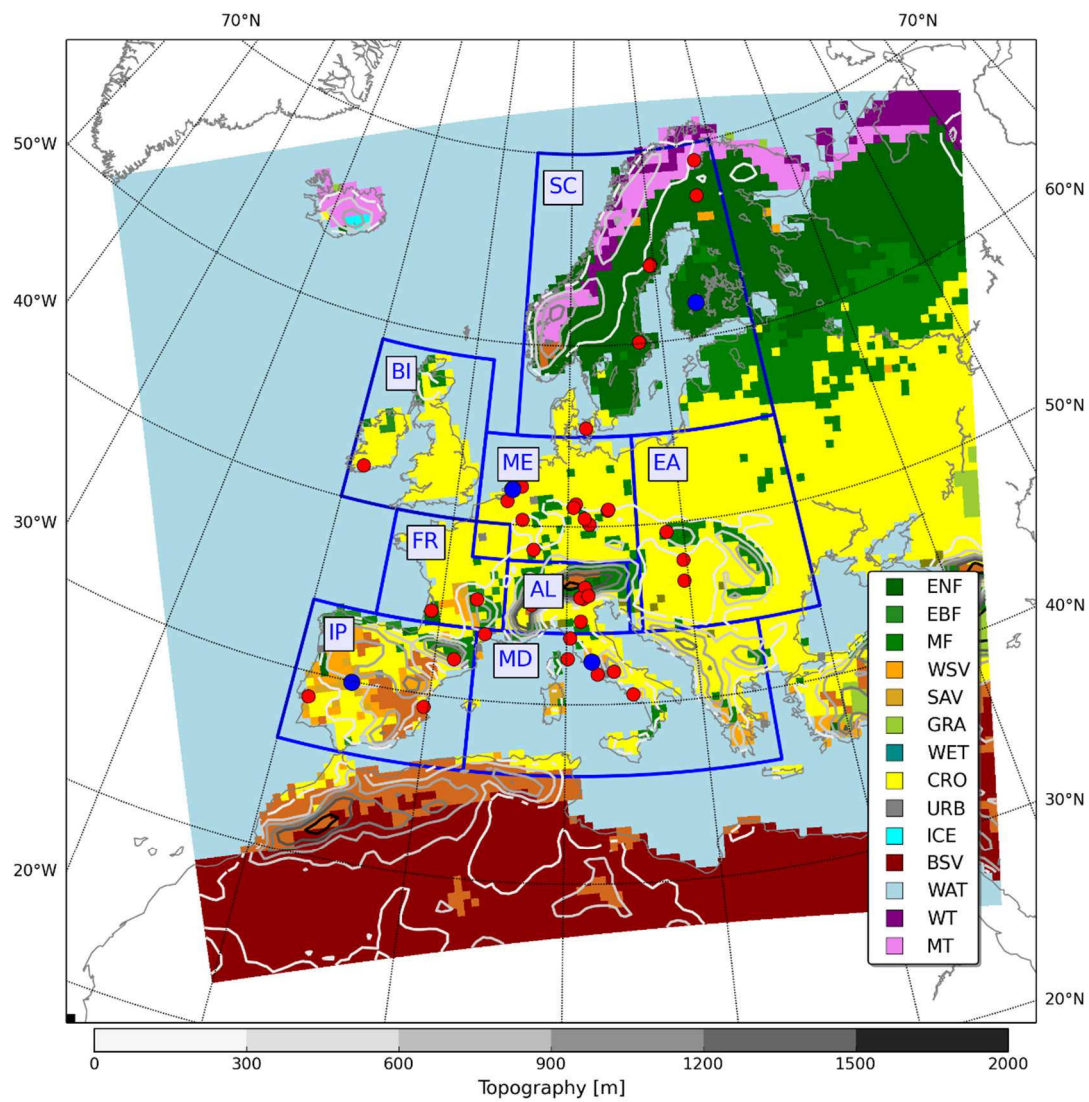
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