

Fremtidens klima og ekstremvejr i Danmark

Hvad observationer og modeller fortæller os om fremtidens klima

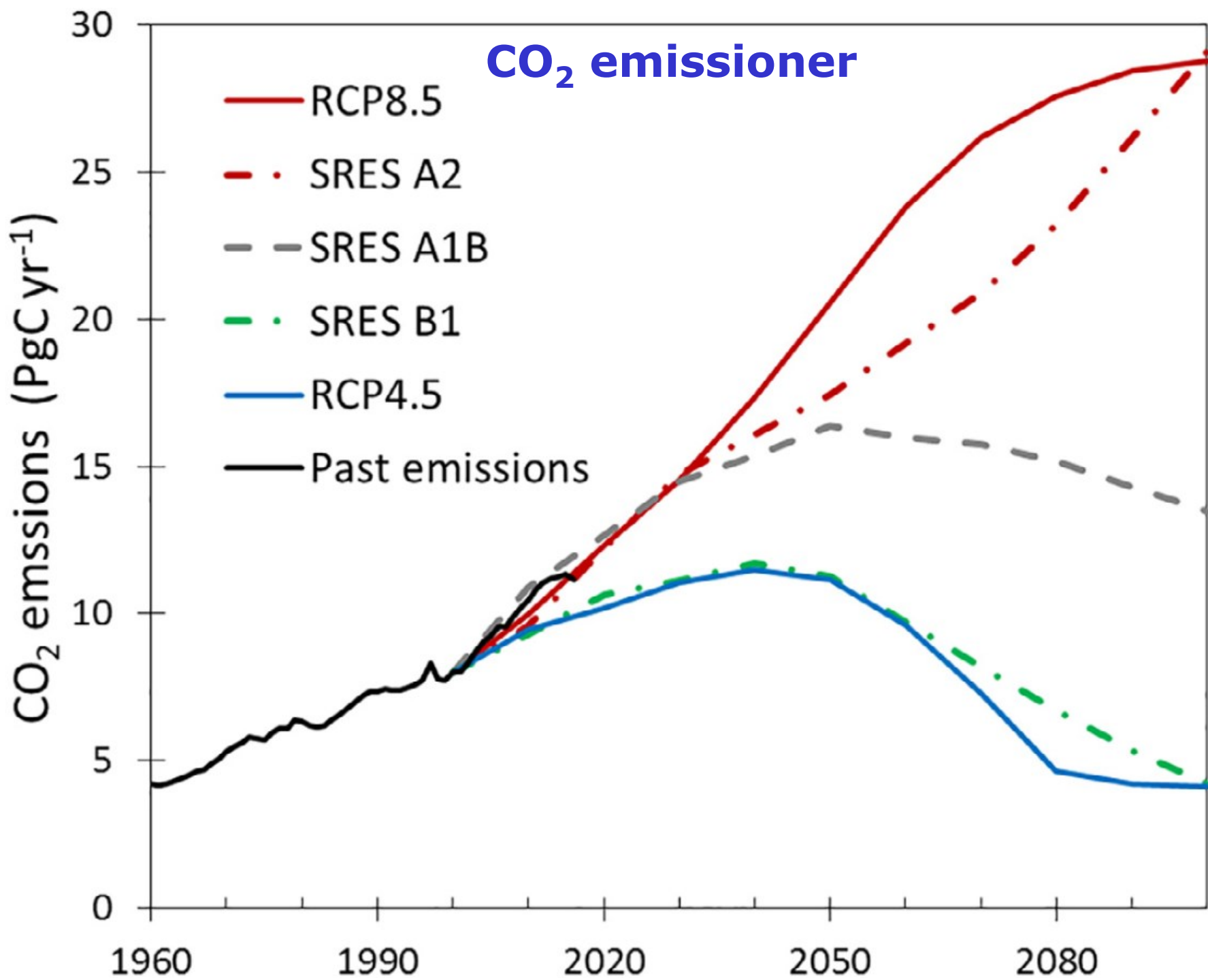
*Ole B. Christensen (PhD, seniorforsker)
Forsknings- og udviklingsafdelingen
Danmarks Meteorologiske Institut*



Det danske Klimaatlas

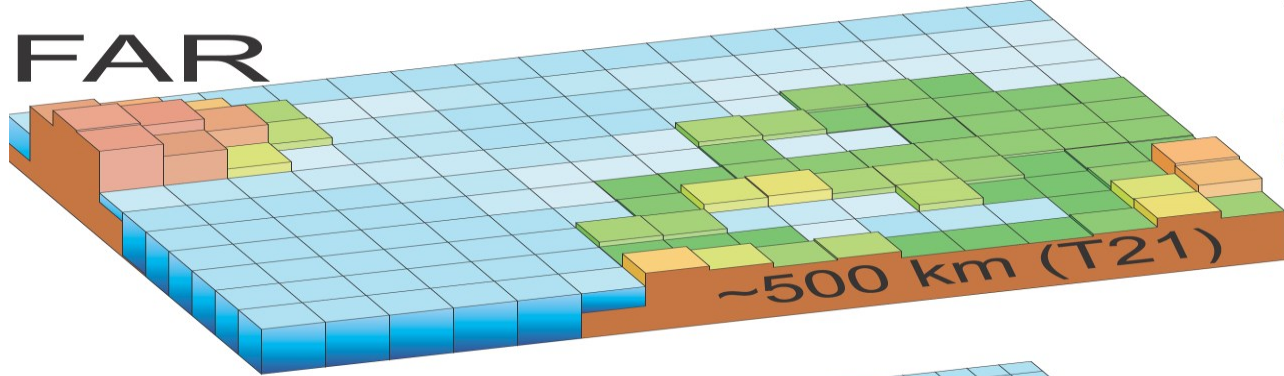
- Arbejde påbegyndt sidste år, med leveringer i år, i '20 og i '21.
- Baseret på observationsdata, CORDEX (12km, ca. 100 simuleringer) og Harmonie-Climate (nogle få simuleringer i 3km opløsning).
- Atmosfæreparametre af forskellig art beregnes på grundlag af klimamodeller, deriblandt højtopløste (3km)
- I '19 indices, senere tidsserier, som er "bias-korrigerede", altså tilnærmet observationer i en nutidsperiode





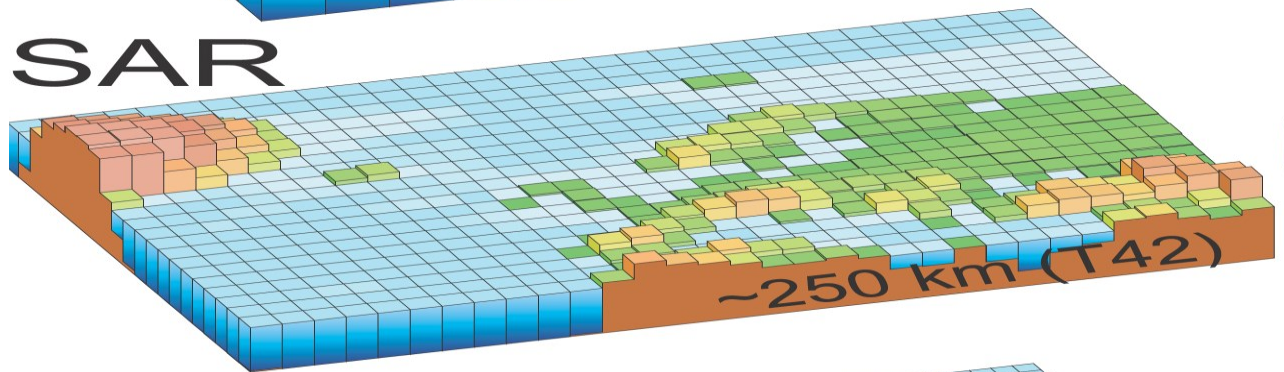
1992

FAR



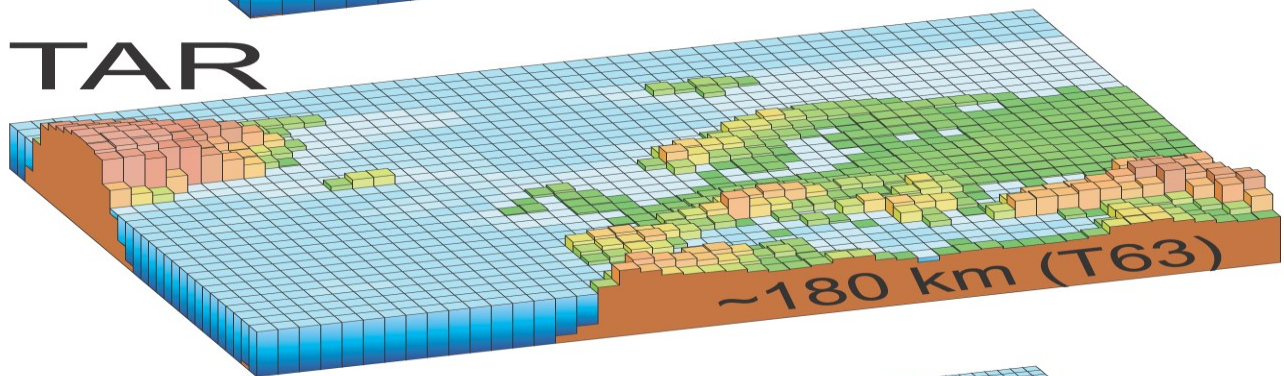
1996

SAR



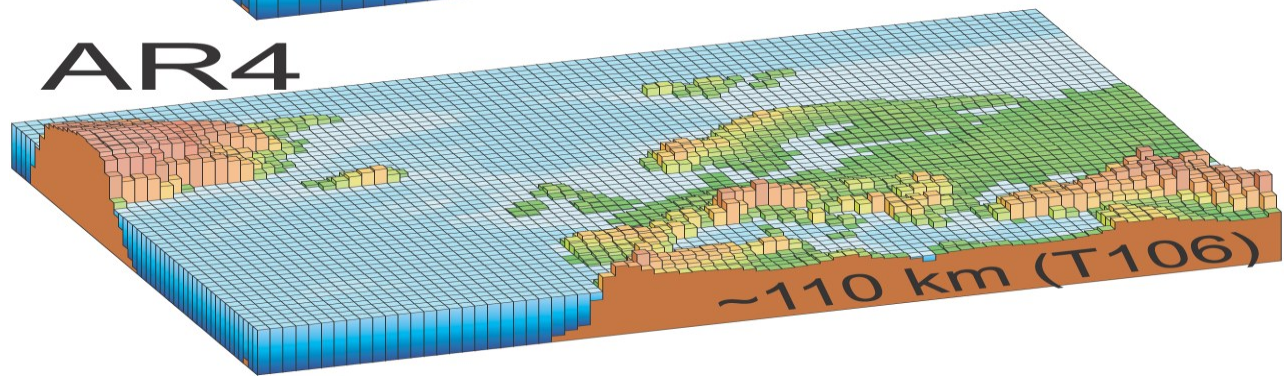
2001

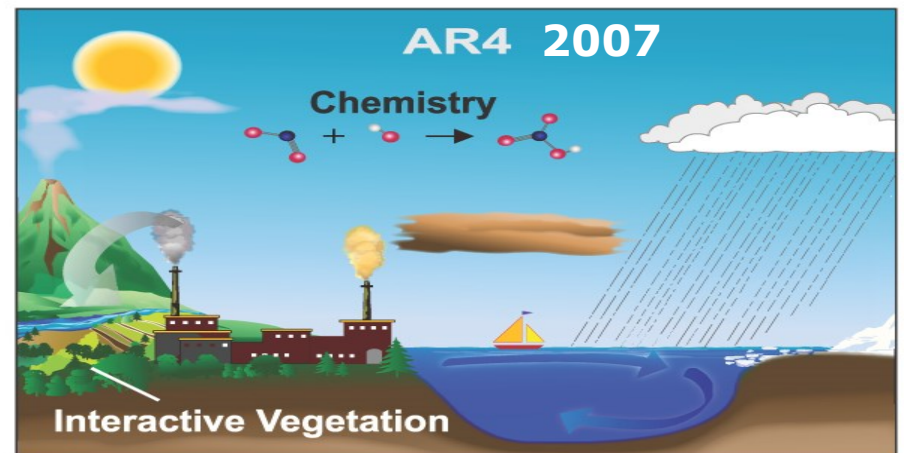
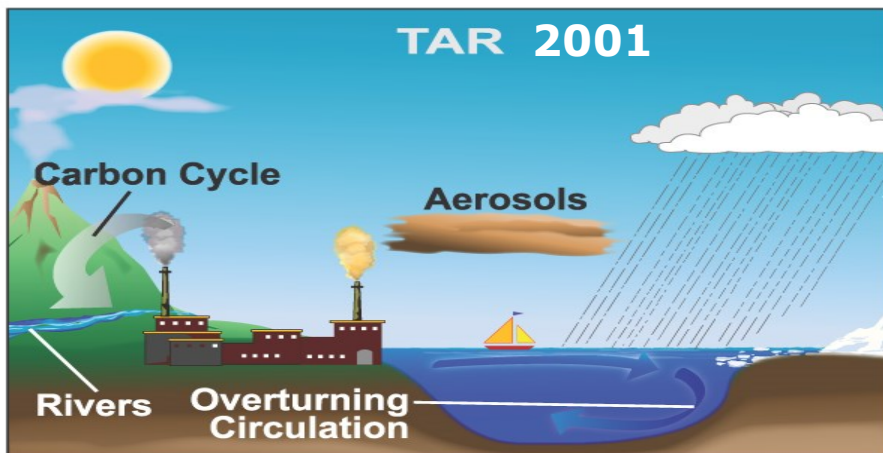
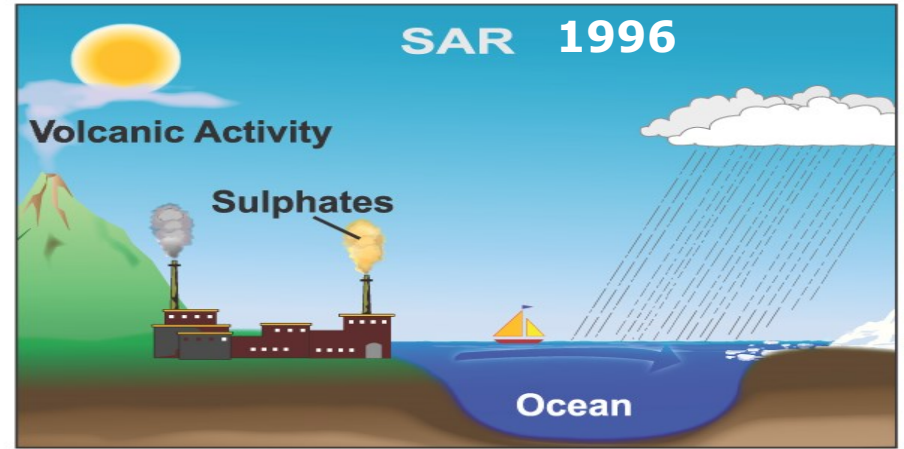
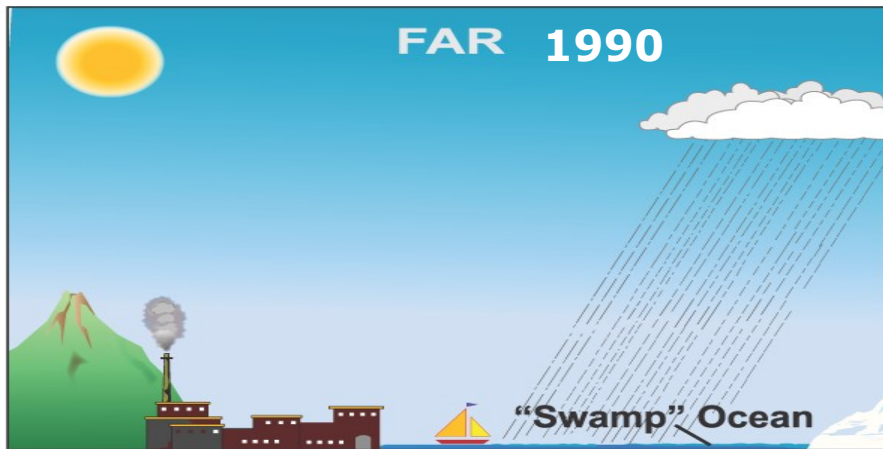
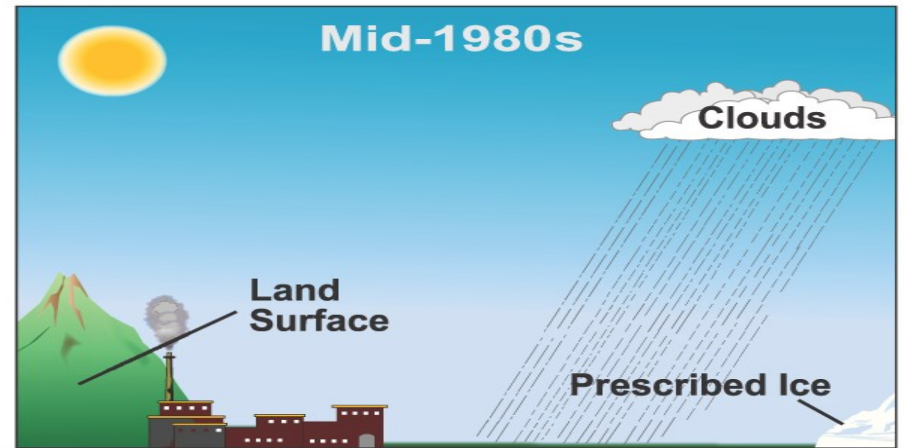
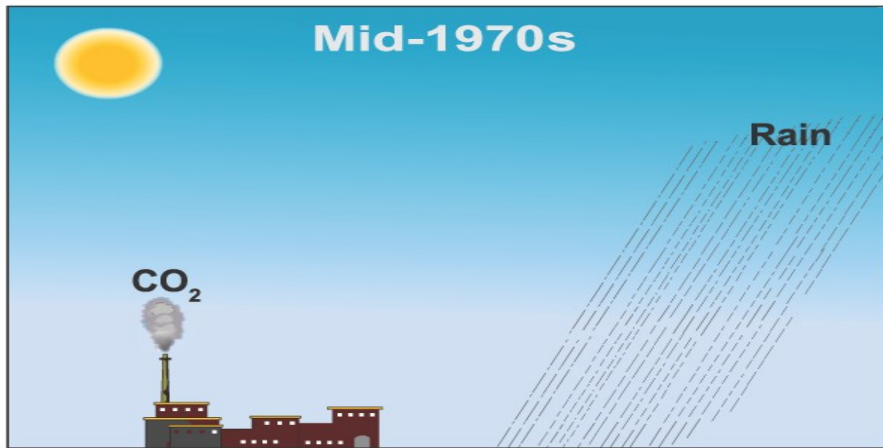
TAR

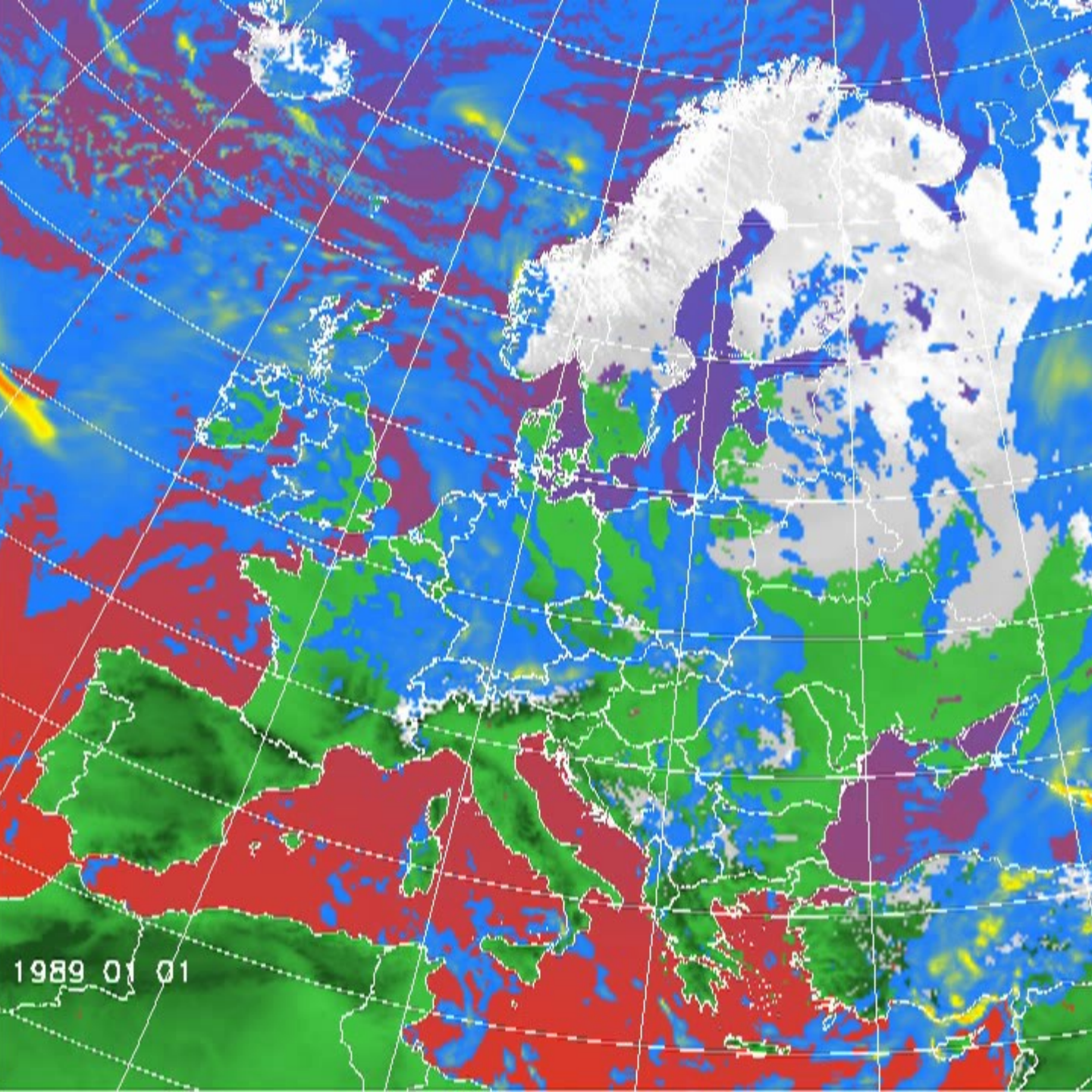


2007

AR4







**HIRHAM5 12
km
(DMI's
klimamodel)**

Et års vejr

Land:

grøn

Ocean:

blå->rød

Regn:

blå->gul->rød

Sne:

hvid

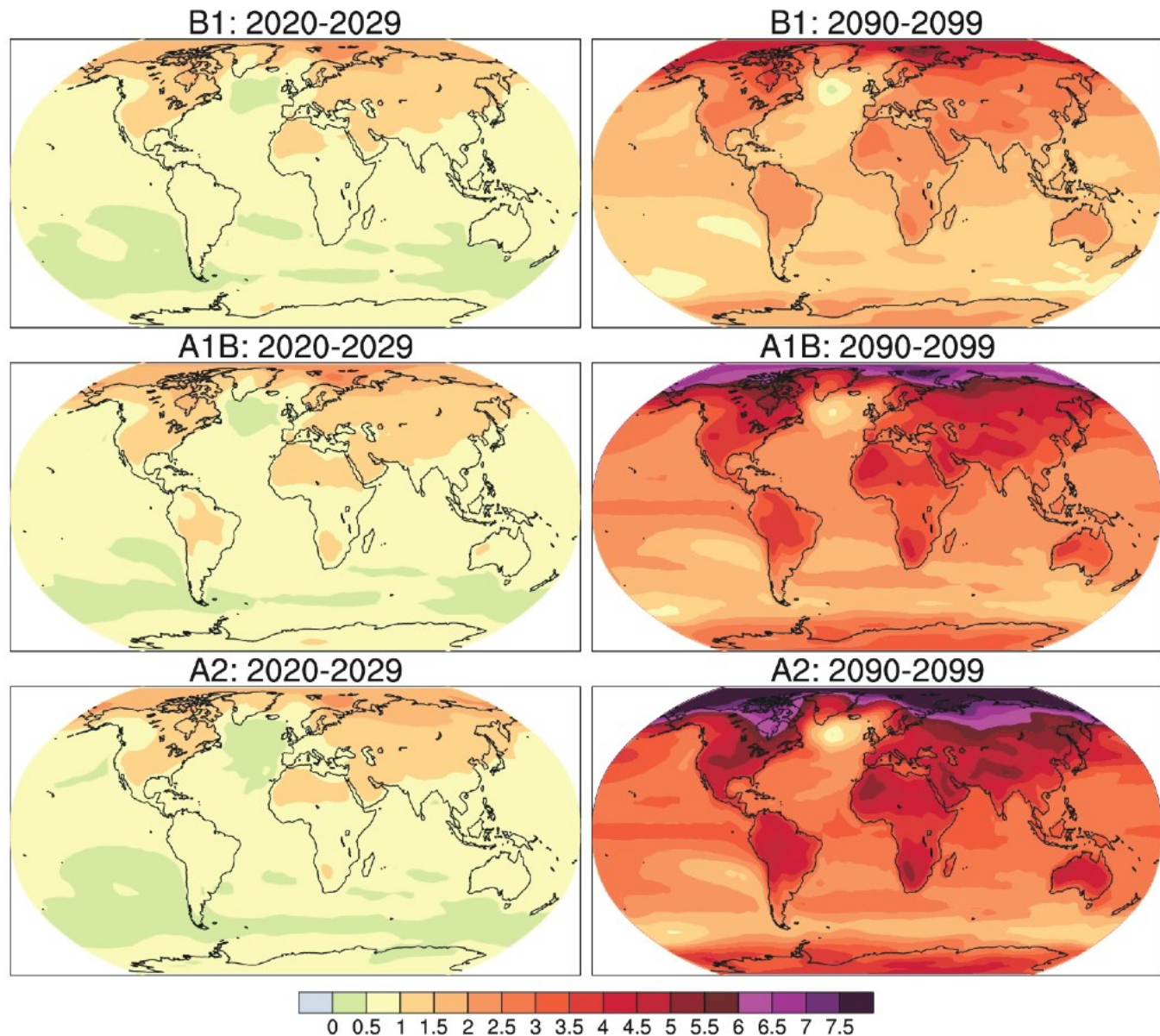
Snedække:

grå

**Storskala-nedbør
om vinteren,
byger om
sommeren**

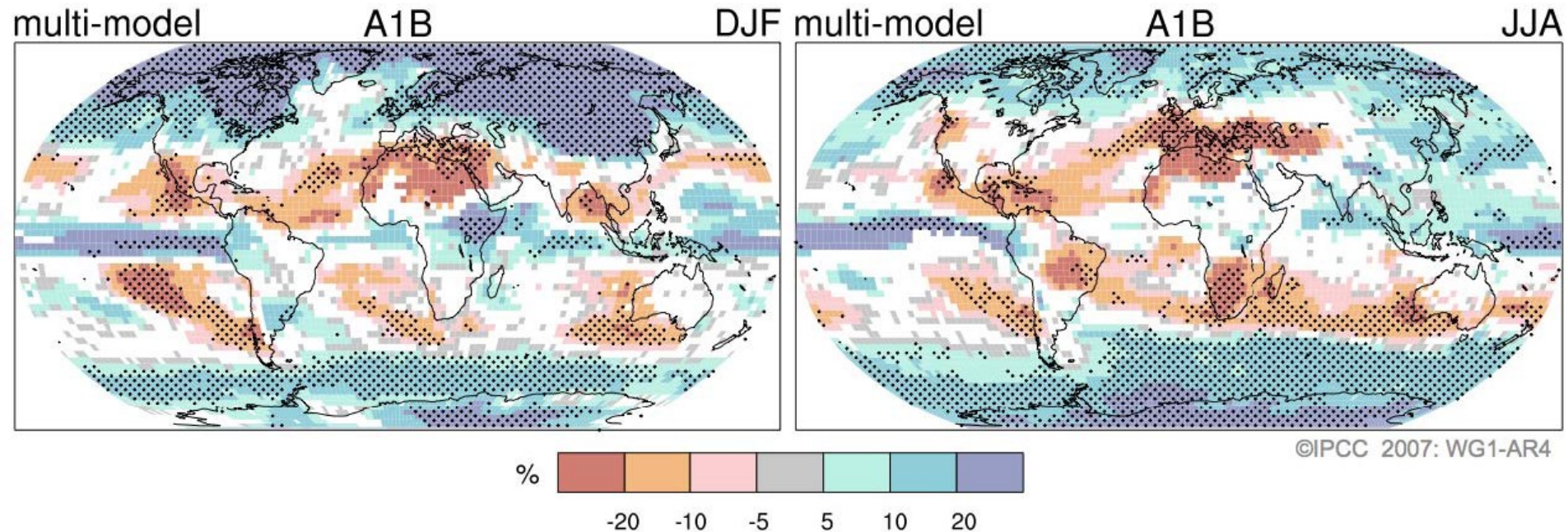
1989 01 01

Fremtidens klima



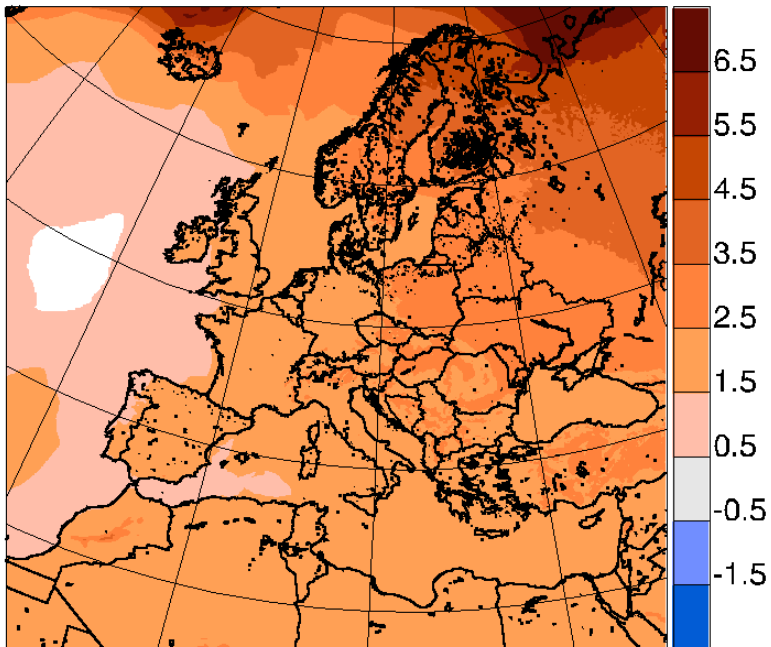
Nedbørændringer

Projected Patterns of Precipitation Changes

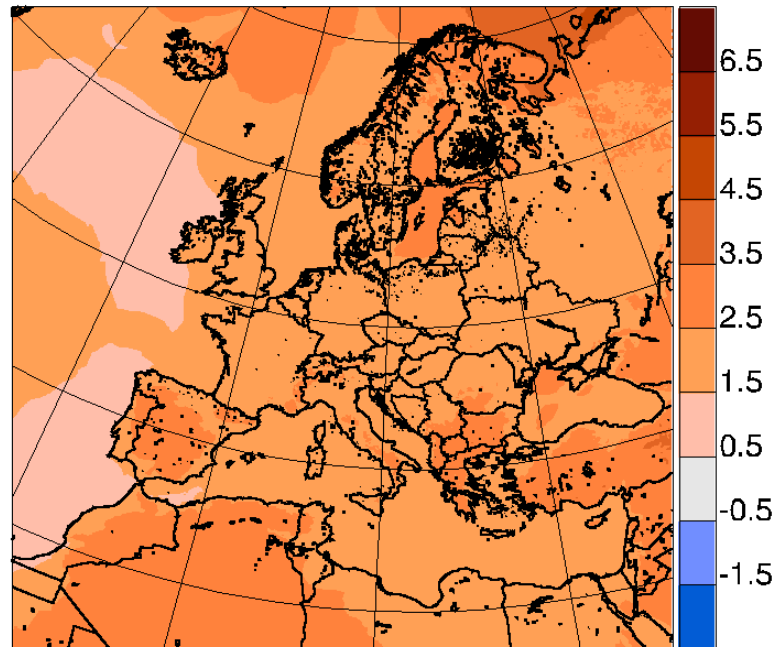




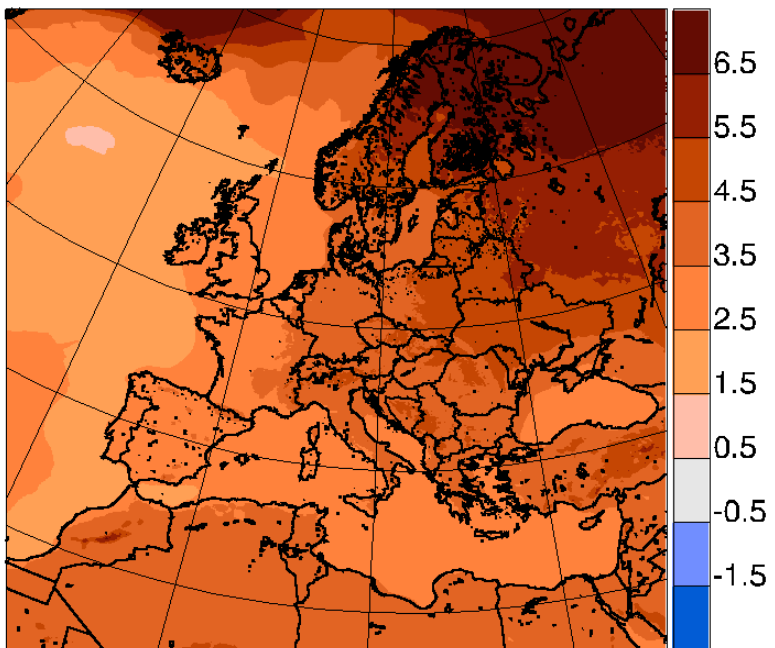
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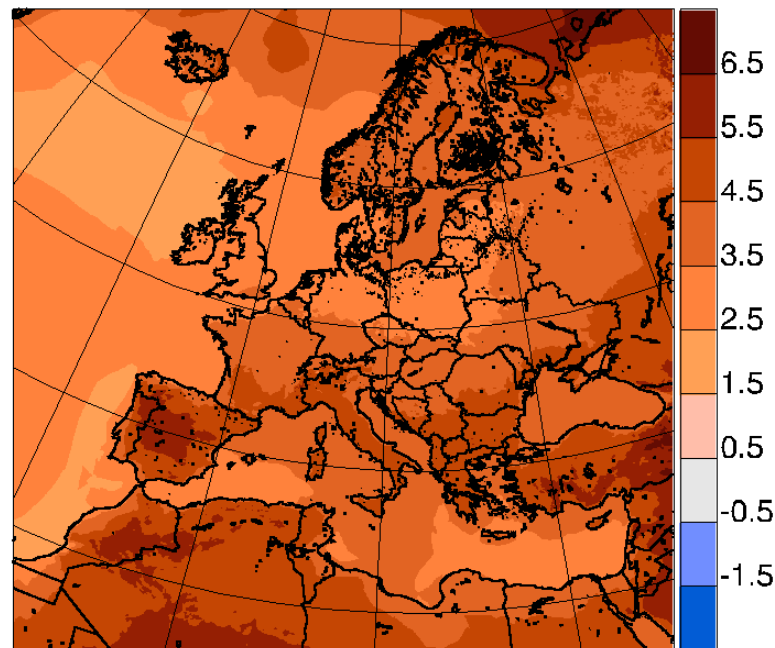
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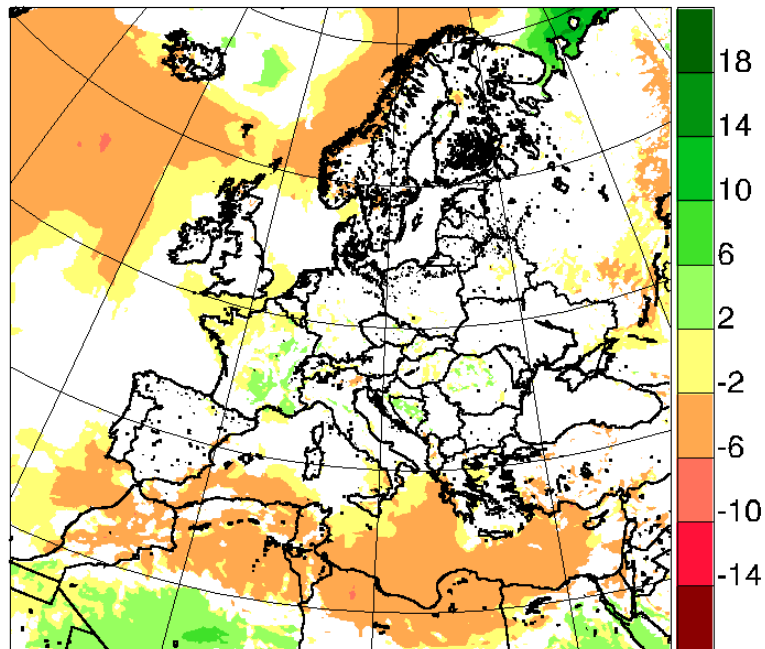
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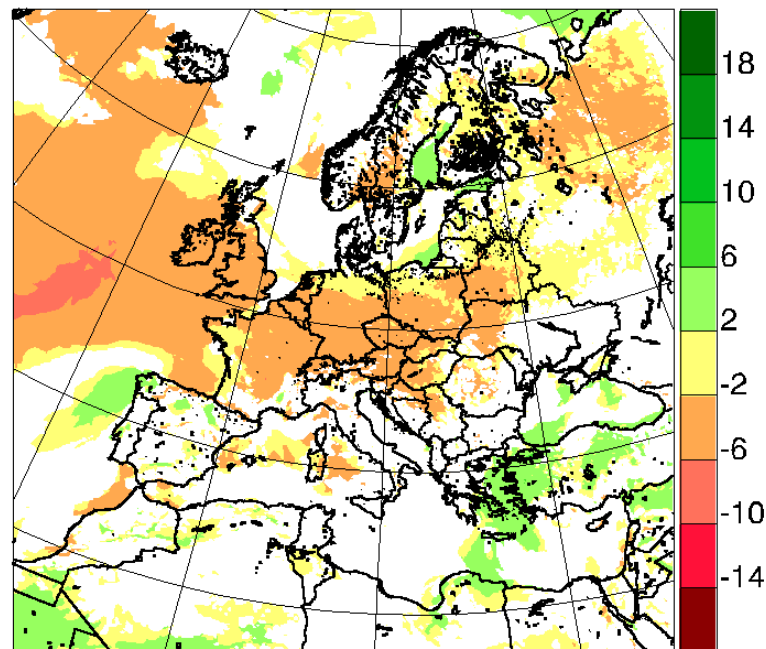
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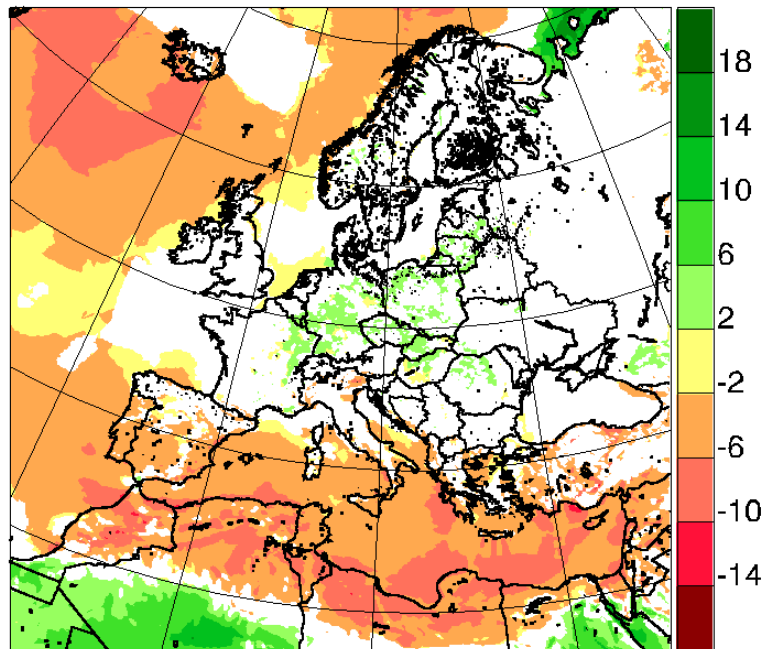
Wind RCP4.5 DJF 2085 vs. 1985



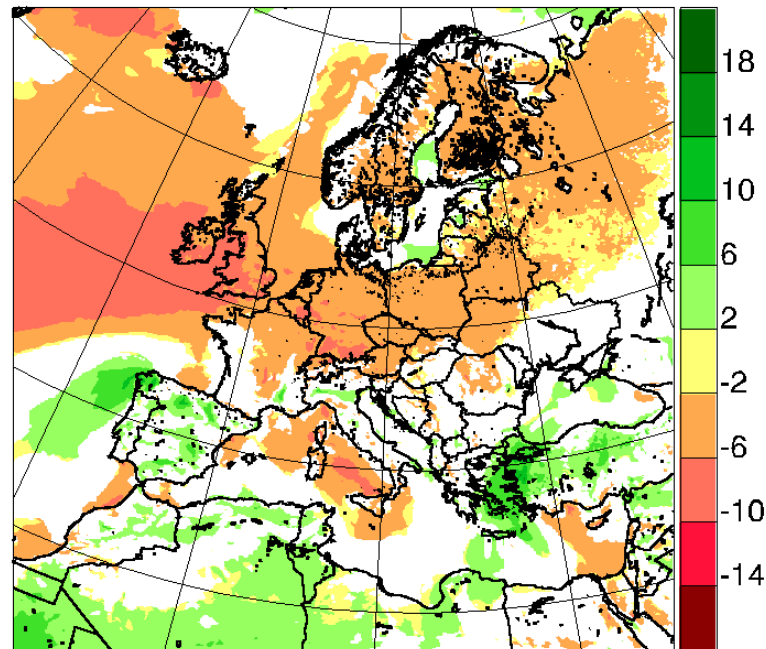
Wind RCP4.5 JJA 2085 vs. 1985



Wind RCP8.5 DJF 2085 vs. 1985

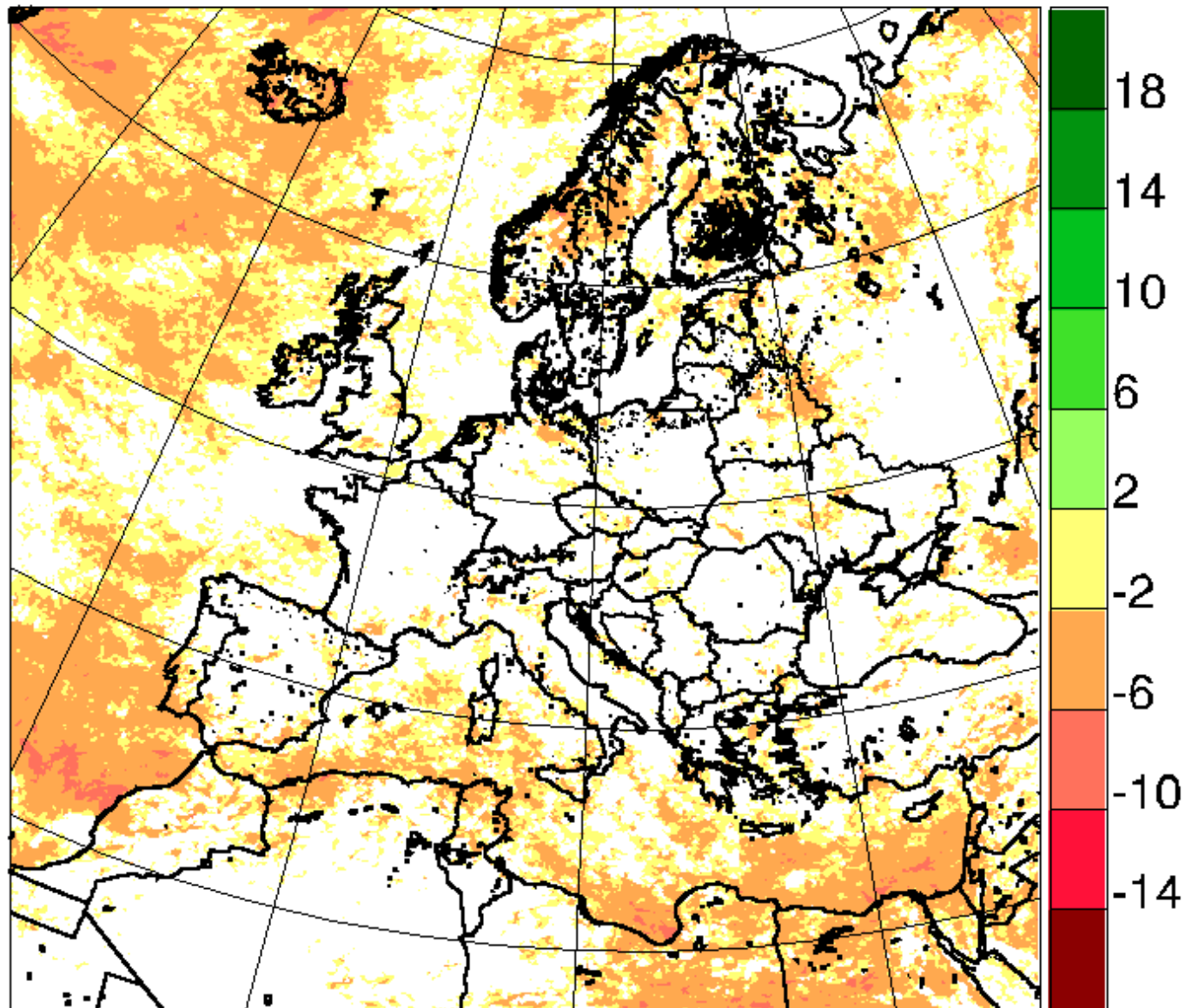


Wind RCP8.5 JJA 2085 vs. 1985



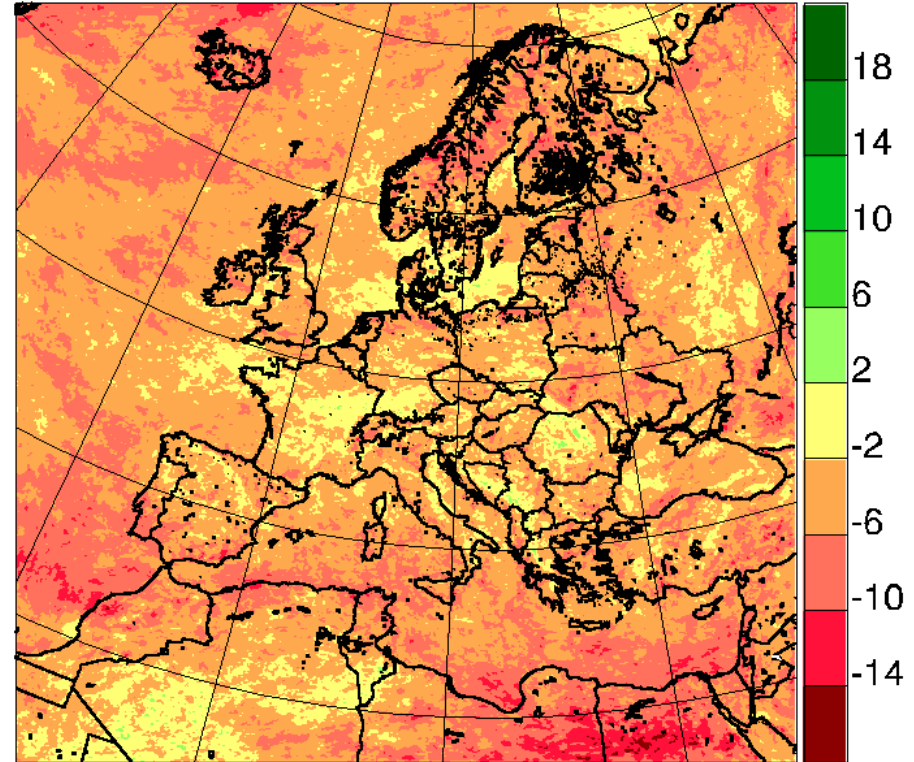
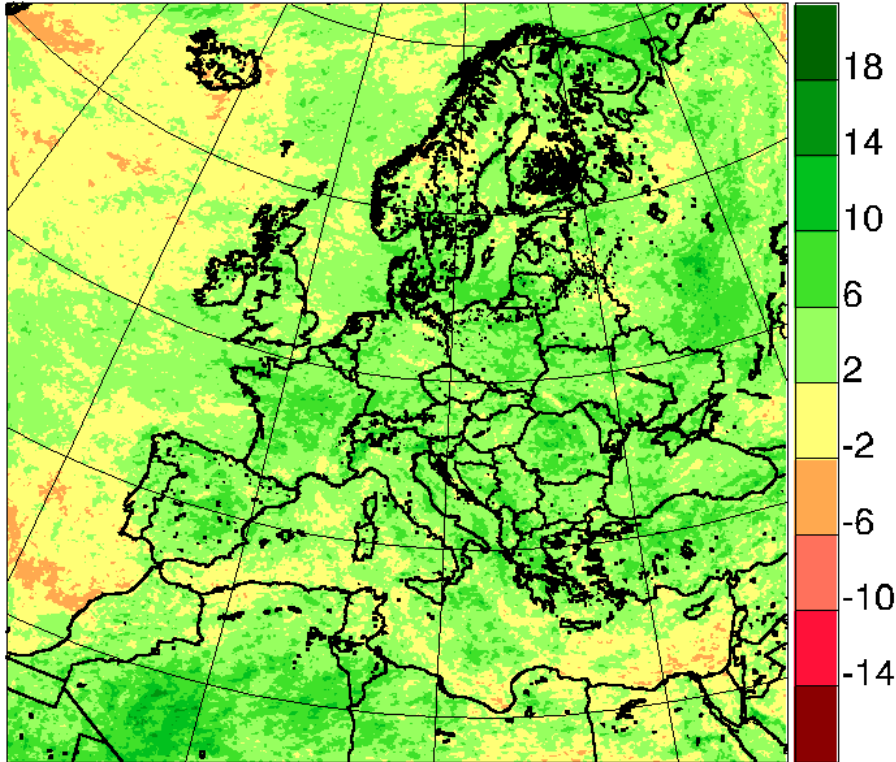
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Max wind 10 yrv RCP8.5 year 2085 vs. 19⁰⁵

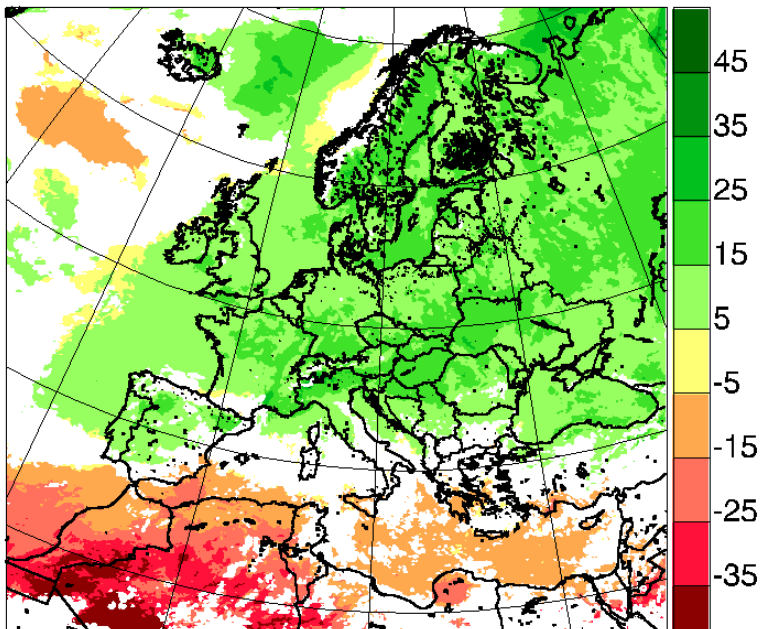


Stor forskel på modelresultater

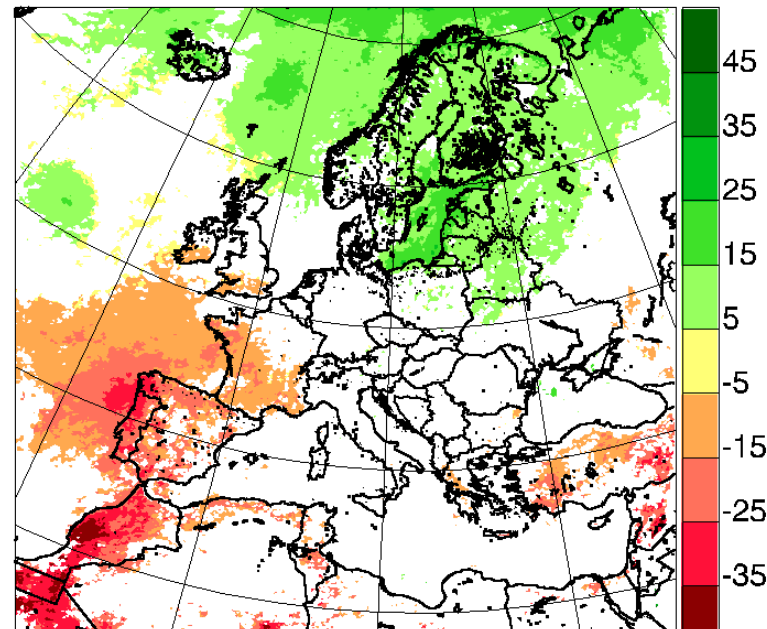
er q Max wind 10 yrv RCP8.5 year 2085 vs 1995q Max wind 10 yrv RCP8.5 year 2085 vs 1995



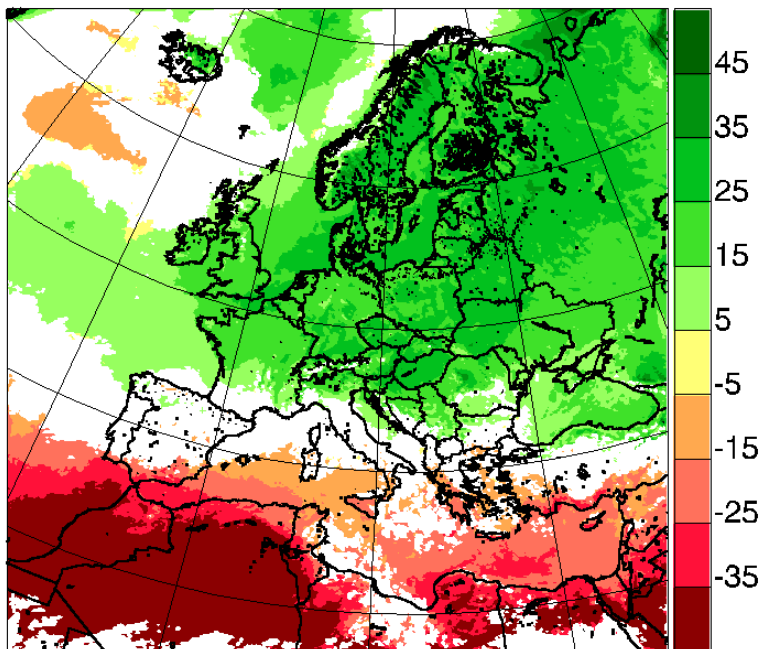
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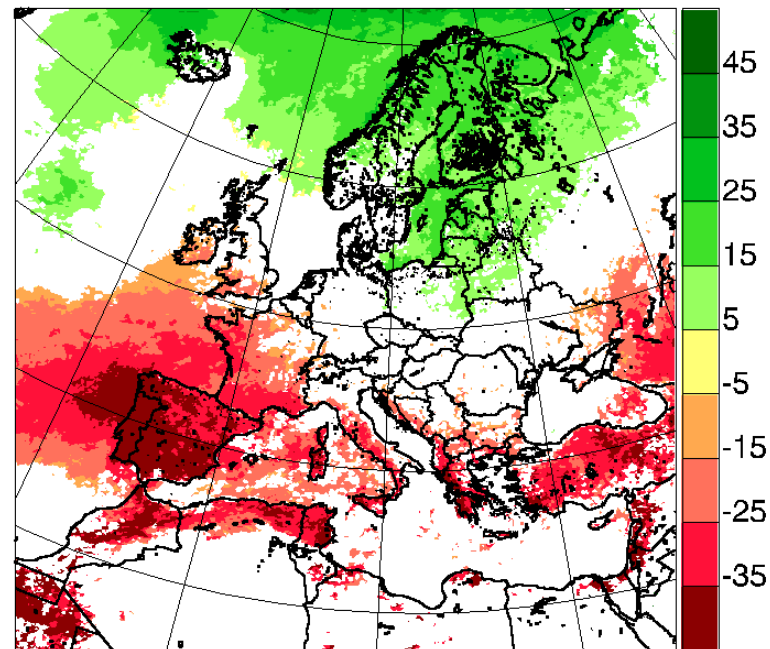
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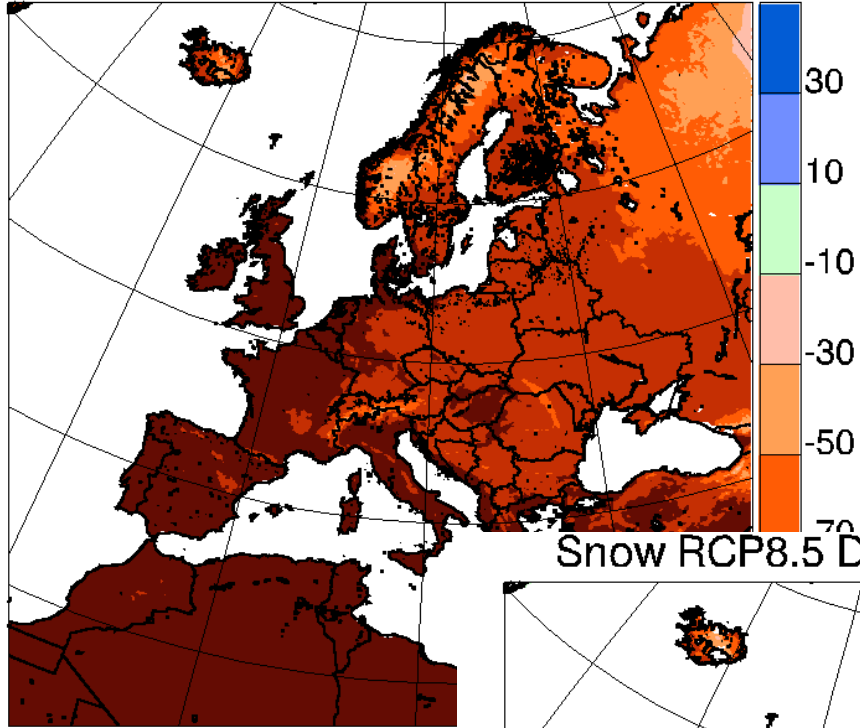
Pr RCP8.5 DJF 2085 vs. 1985



Pr RCP8.5 JJA 2085 vs. 1985

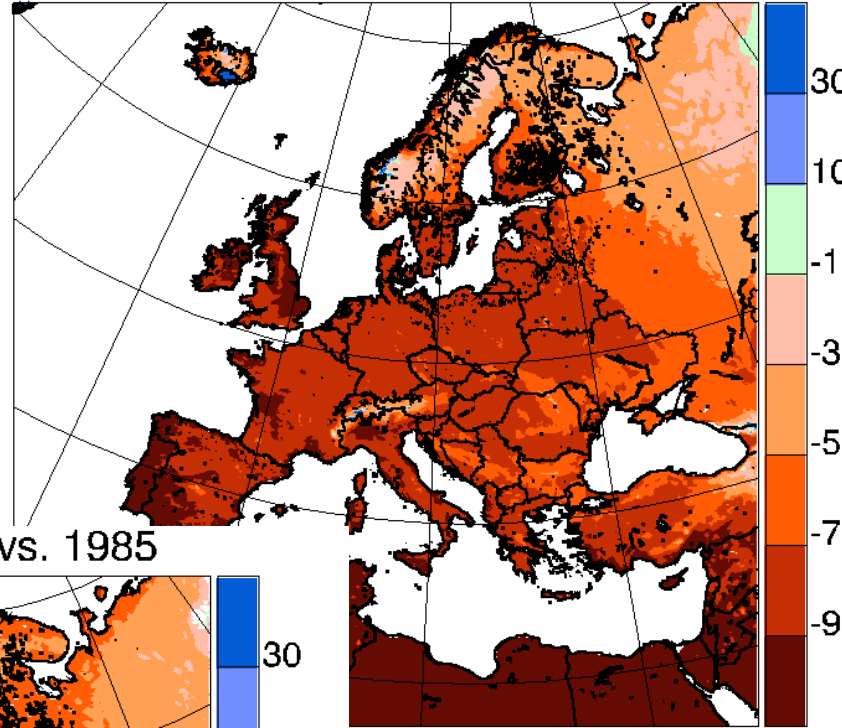


Lower q Snow RCP8.5 DJF 2085 vs. 1985

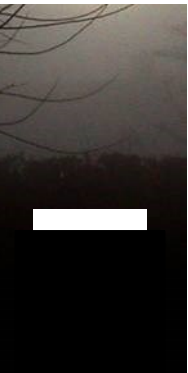
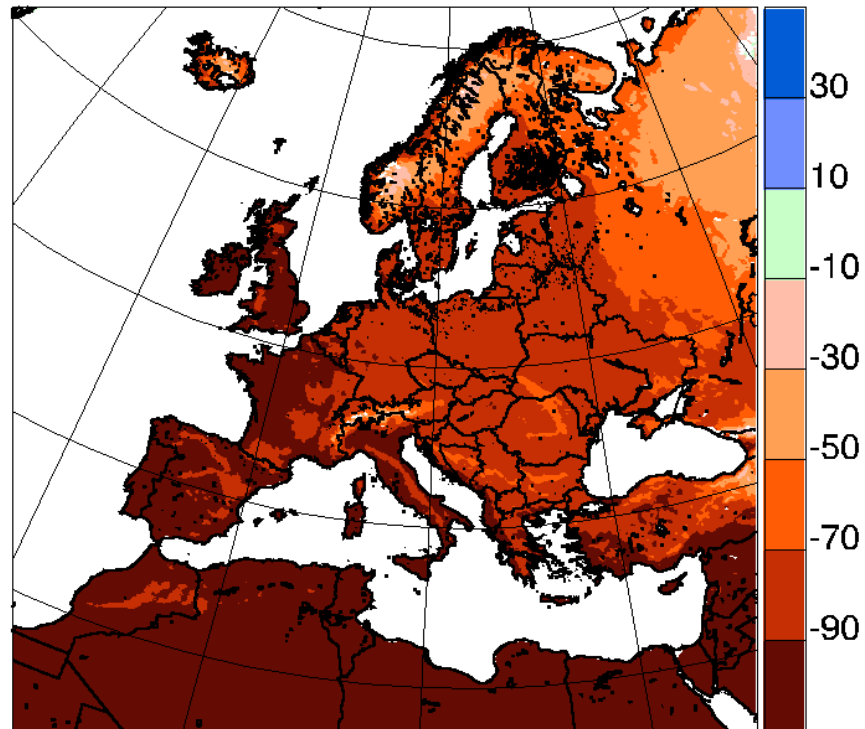


Higher q Snow RCP8.5 DJF 2085 vs. 1985

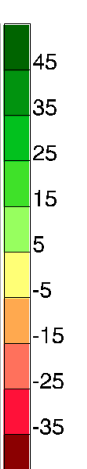
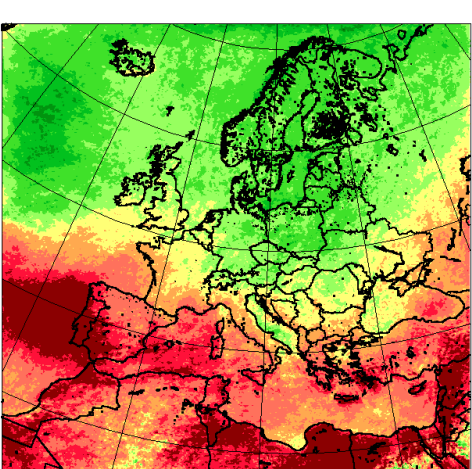
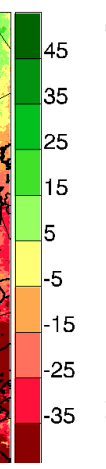
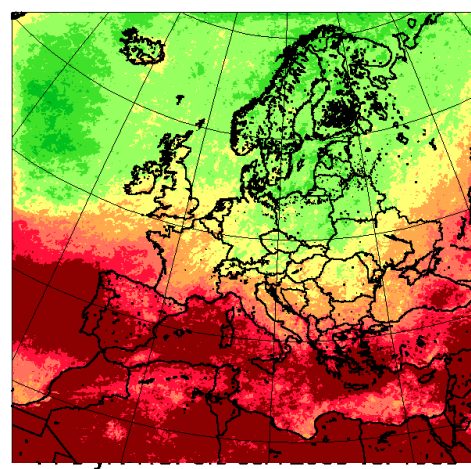
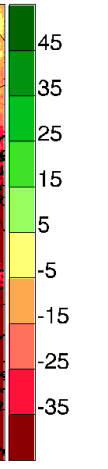
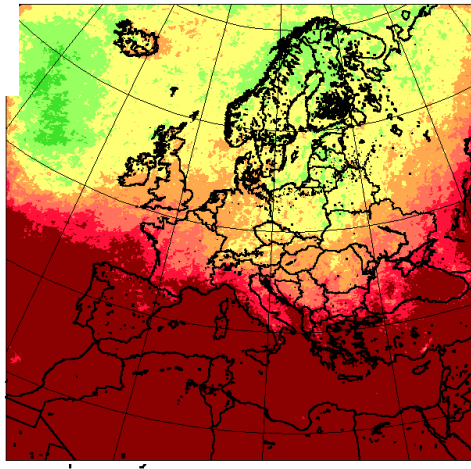
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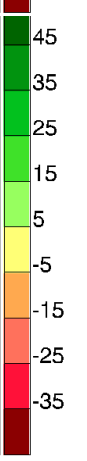
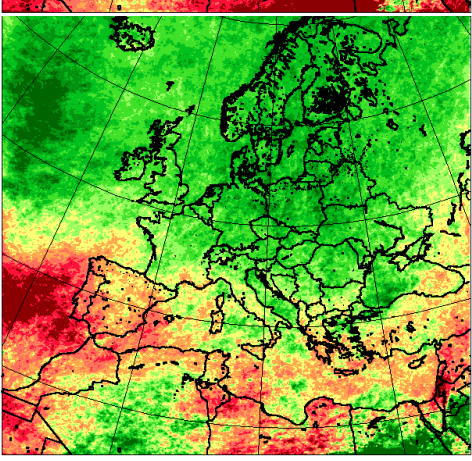
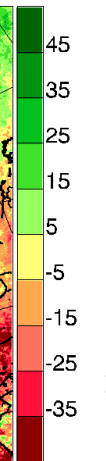
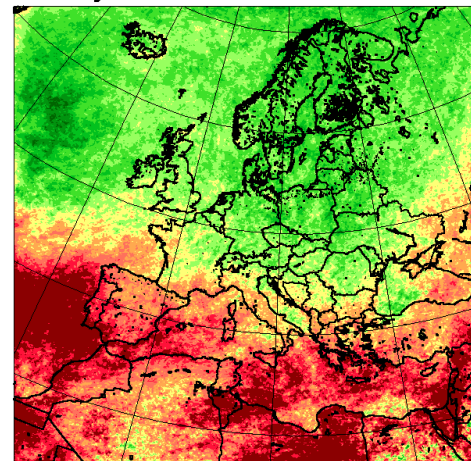
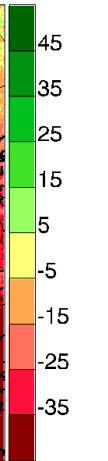
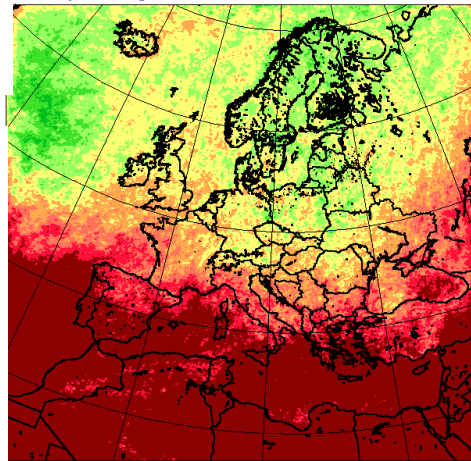
Snow RCP8.5 DJF 2085 vs. 1985



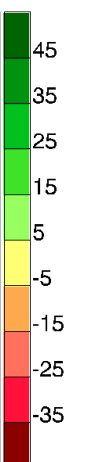
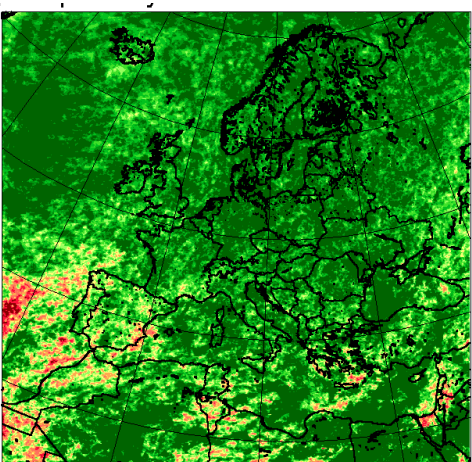
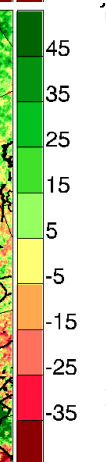
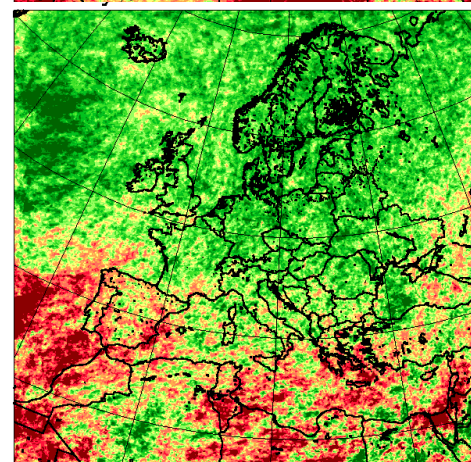
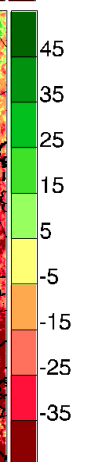
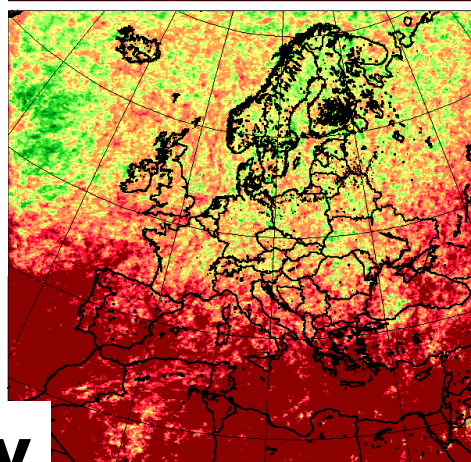
1 år



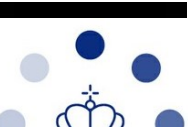
5 år



**Som
mer**



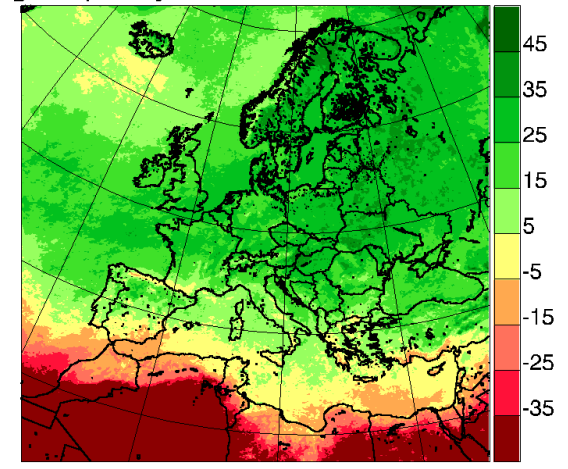
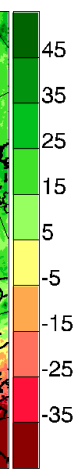
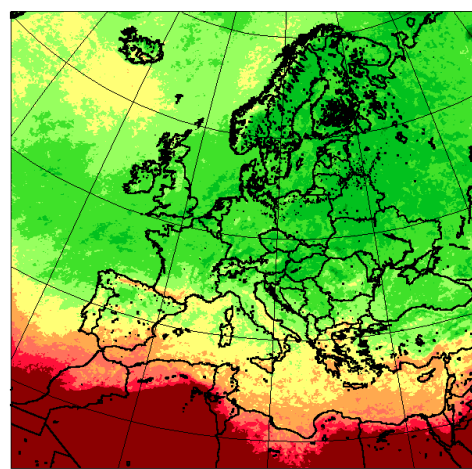
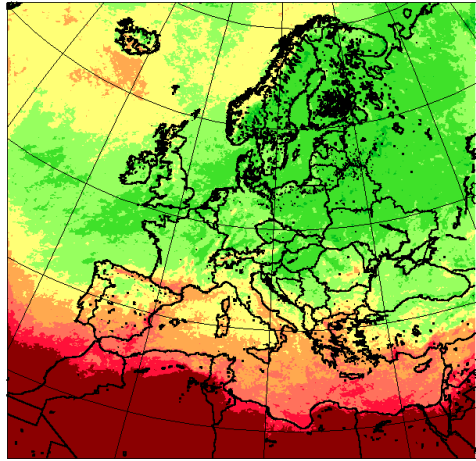
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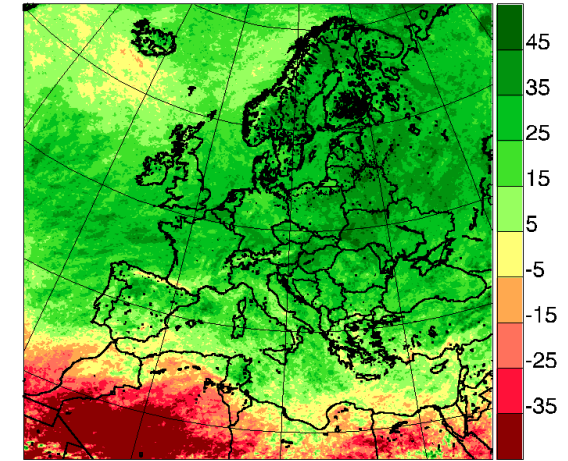
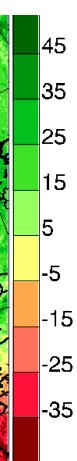
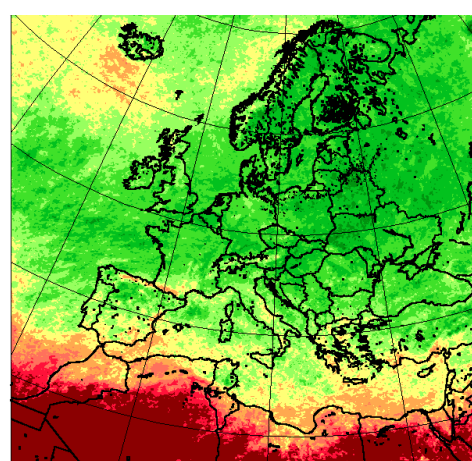
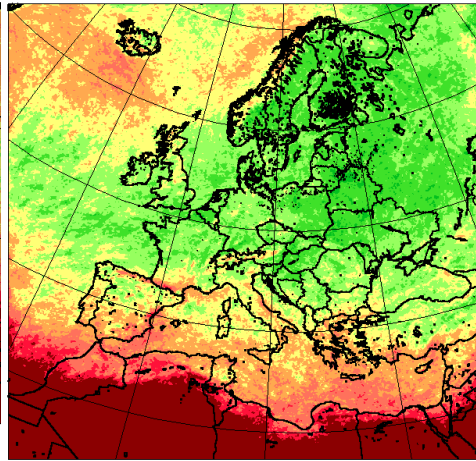
30 år



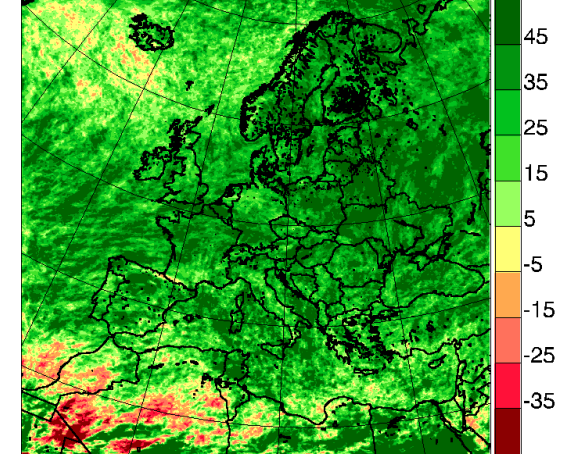
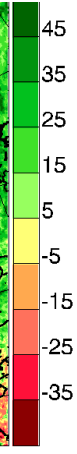
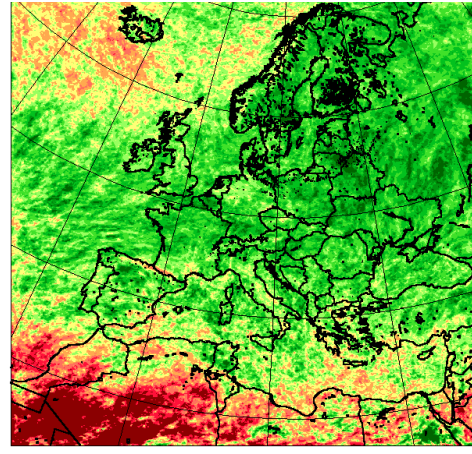
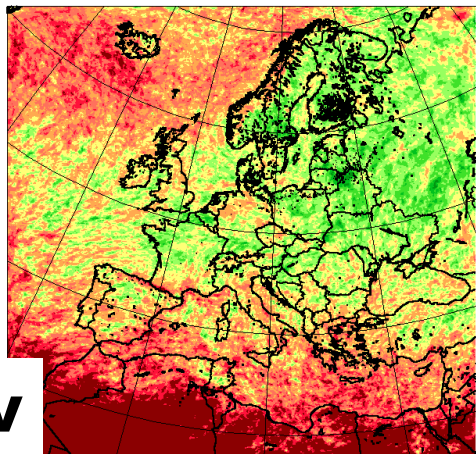
1 år



5 år



Vinter

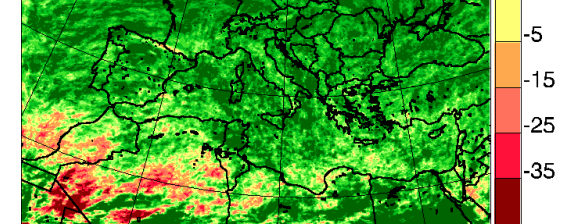
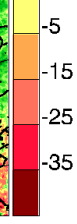
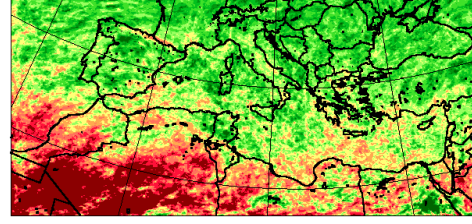
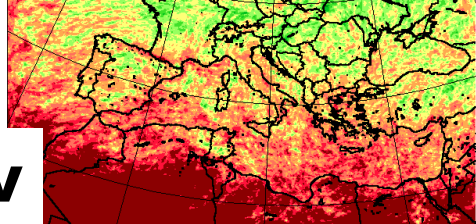


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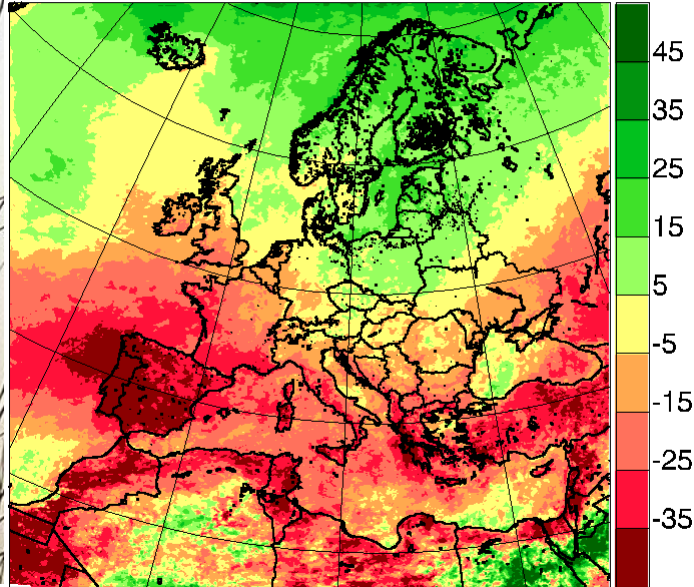
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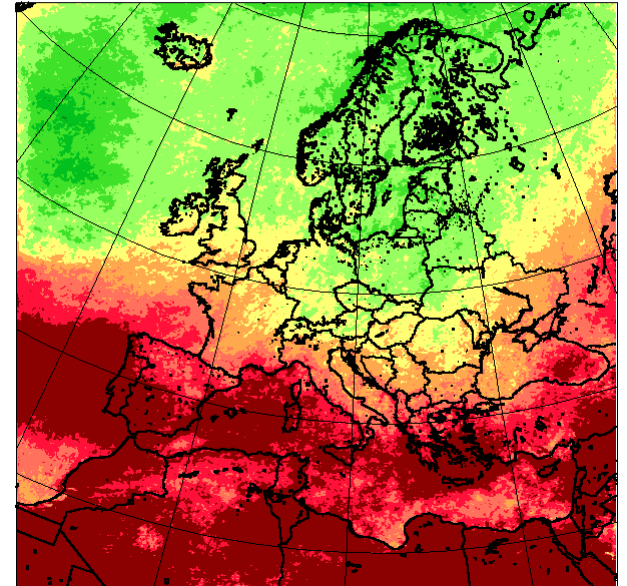
30 år



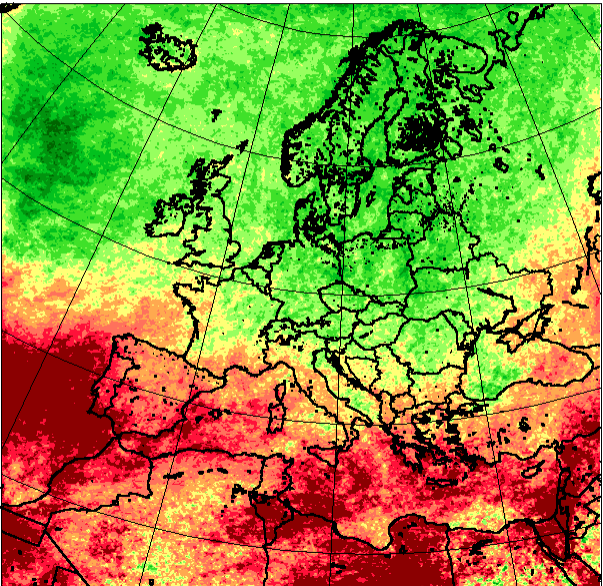
Pr RCP8.5 JJA 2085 vs. 1985



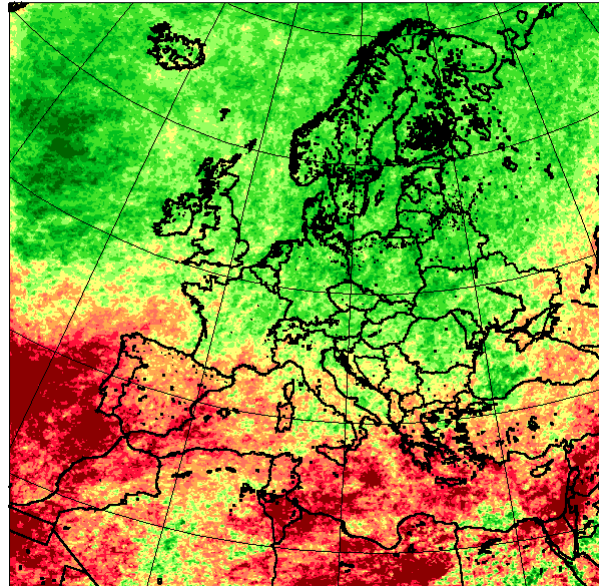
Pr 1 yrv RCP8.5 JJA 2085 vs. 1985



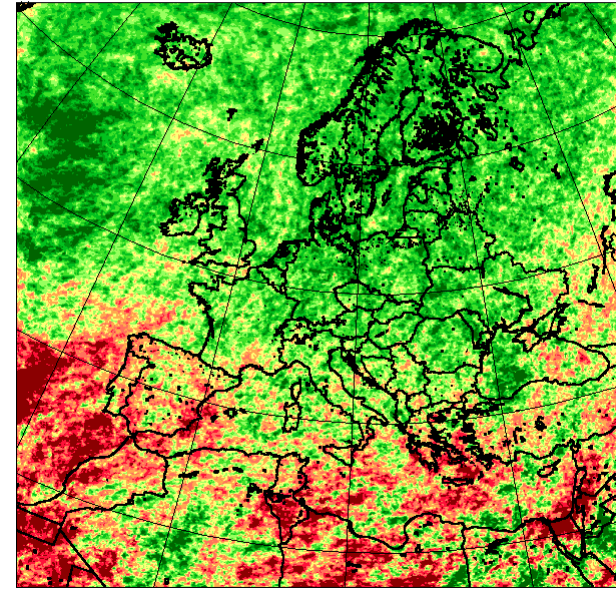
Pr 5 yrv RCP8.5 JJA 2085 vs. 1985



Pr 10 yrv RCP8.5 JJA 2085 vs. 1985



Pr 30 yrv RCP8.5 JJA 2085 vs. 1985



Andre ekstremnedbørsparametre, estimeret fra modelresultater

Indeks	2041-2070 RCP8.5	2070-2099 A1B	2071-2100 RCP8.5
	Sandsynligt interval	Sandsynligt interval	Sandsynligt interval
Største døgnsum	1,05 - 1,17	1,05 - 1,2	1,11 - 1,29
Største 5-døgnssum	1,05 - 1,23	1,06 - 1,26	1,09 - 1,31
Hændelser over 10mm	1,1 - 1,3	1,1 - 1,5	1,2 - 1,4
Hændelser over 20mm	1,1 - 1,5	1,3 - 1,7	1,4 - 1,8
Hyppeghed af skybrud	1,1 - 1,9	1,1 - 2,1	1,5 - 2,7



Konklusioner generelt

- Atmosfærens indhold af drivhusgasser er steget markant som følge af menneskets aktiviteter
- Dette er skyld i den største del af den allerede observerede temperaturstigning på ca. 1°C
- Global temperaturstigning indtil 2100 bliver 2-5°C, alt efter model og scenario. Største ændringer i Arktis: op til 10°C varmere, mindre og yngre havis, indskrænkning af indlandsisen og stigende havniveau, optøning af permafrost med mulig frigivelse af yderlige drivhusgasser
- Mere nedbør i våde, mindre nedbør i tørre områder. Ekstreme nedbørshændelser bliver mere ekstreme
- Opvarmning og dermed vandstandsstigninger vil fortsætte i århundreder, selv hvis koncentrationerne af drivhusgasser blev stabiliseret i dag



Konklusioner for Danmark

- Det bliver varmere i Danmark pga. drivhuseffekten, ca. lige så meget som den globale opvarmning, lille forskel i effekt på årstiderne
- Det vil regne mere om vinteren; ingen signifikant ændring om sommeren
- Ekstrem nedbør vokser både vinter og sommer. Jo højere nedbørsfraktil, jo mere positive klimaændringer
- Der vil komme problemer pga. vandstandsstigninger og forøget ekstremregn. Det kan blive dyrt at ignorere klimaændringer for konstruktioner, der skal holde længe
- Tegn på mere ekstremvind, men ingen endelig og robust konklusion
- Der arbejdes stadig på at opnå en systematisk kvantitativ bestemmelse af usikkerheder



