LUMIP paper: Land Management

Danica Lombardozzi
National Center for Atmospheric Research

Some Relevant LUMIP Simulations

- Changes in **land surface characteristics**
  - No land use change, crops & pasture as grasses
- Changes in **management practices**
  - No irrigation, no fertilization, no grazing
- Changes in **forcings**
  - Constant CO_2, constant climate

CLM-Crop

Crop Types

Corn*

Wheat

Sugarcane

Soy*

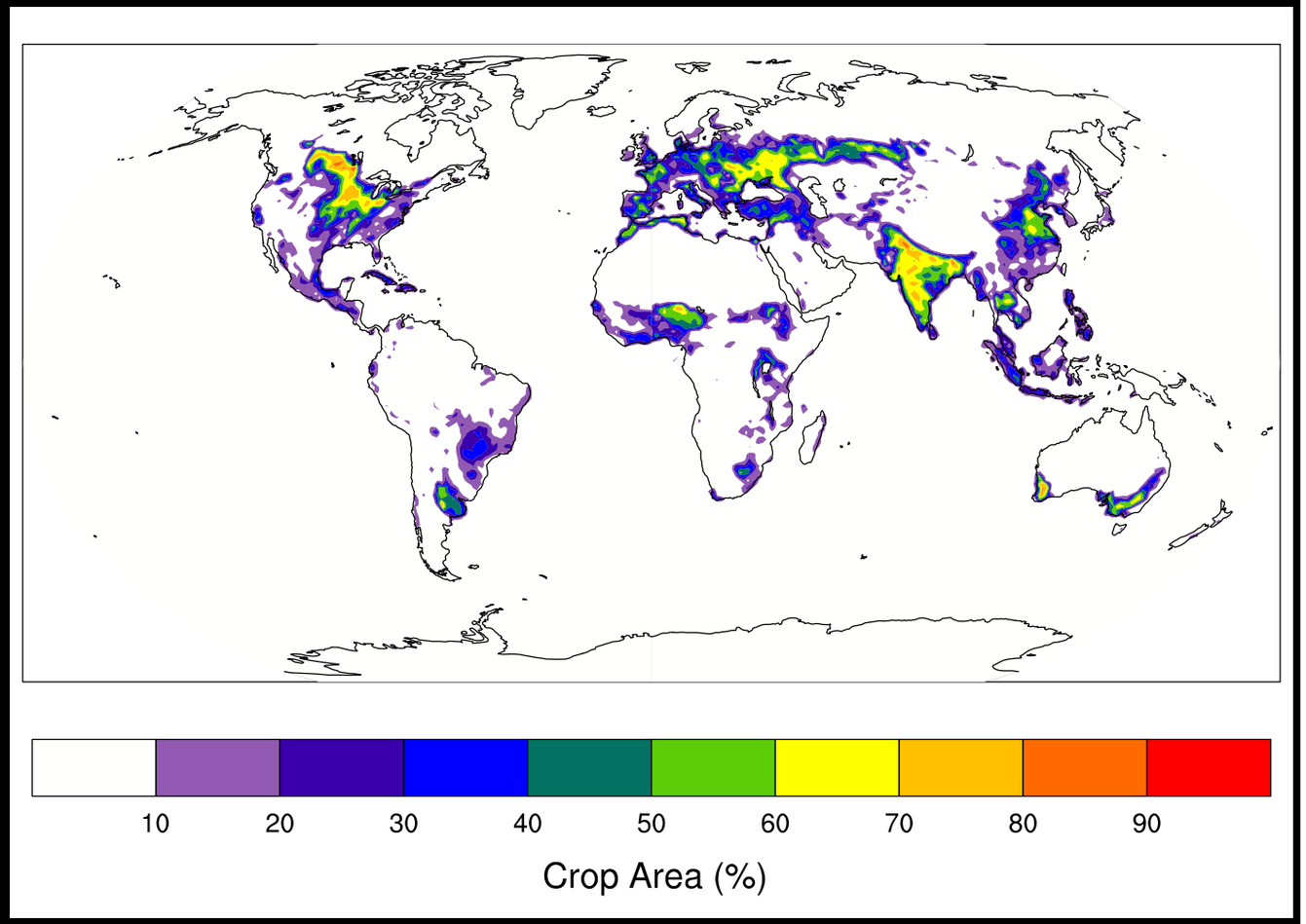
Cotton

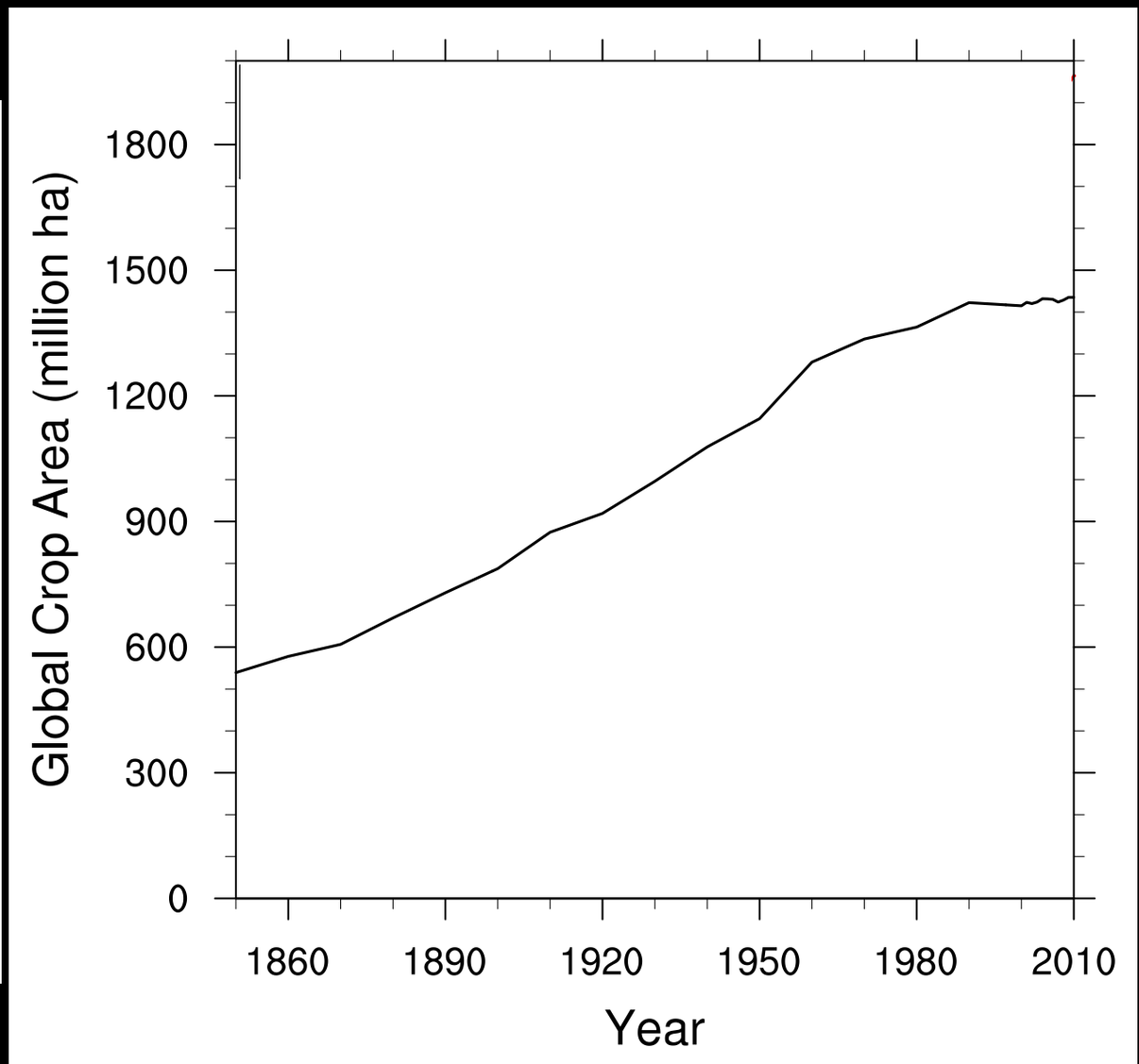
Rice

** Temperate and tropical varieties*

Crop Distributions

1991-2010 Crop Area





Simulated crops are different from natural vegetation

Plant

Fertilize (N only)

Harvest

Irrigate

A Couple Topics For Consideration

Note: Tomorrow's discussion is not limited to these topics

Crops as Grasses

Responses to Management

&

Crops as Grasses: What is the impact?

Managed Crops

Planted, Harvested, Irrigated, Fertilized

vs

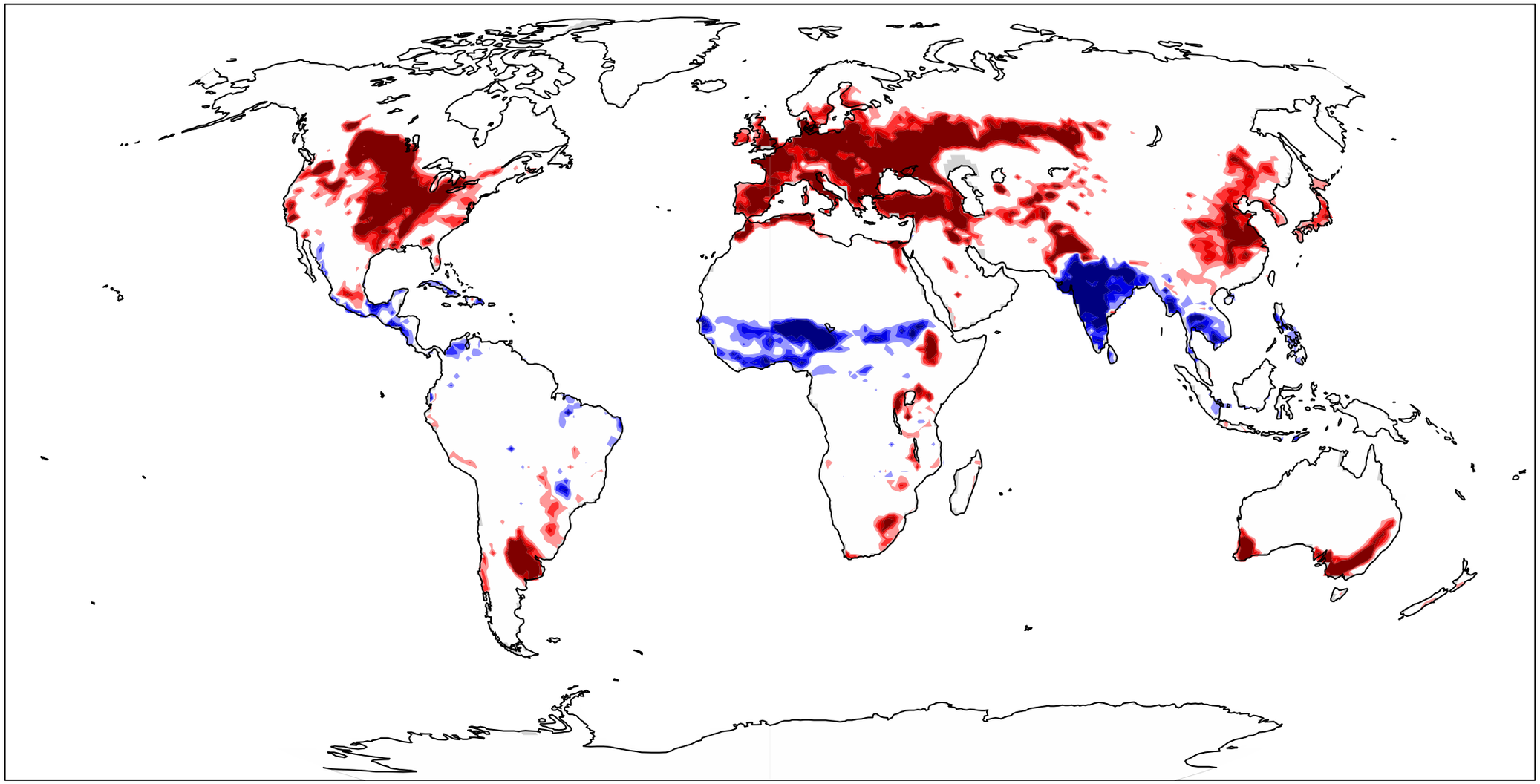
Generic Crops

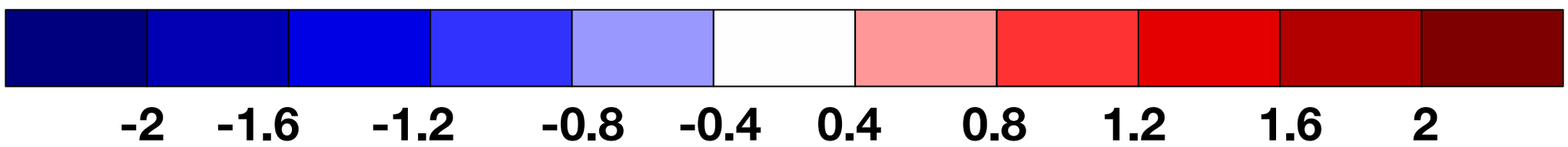
Function similar to C_3 grasses

1991-2010 Average

Impact of Simulated Managed Crops

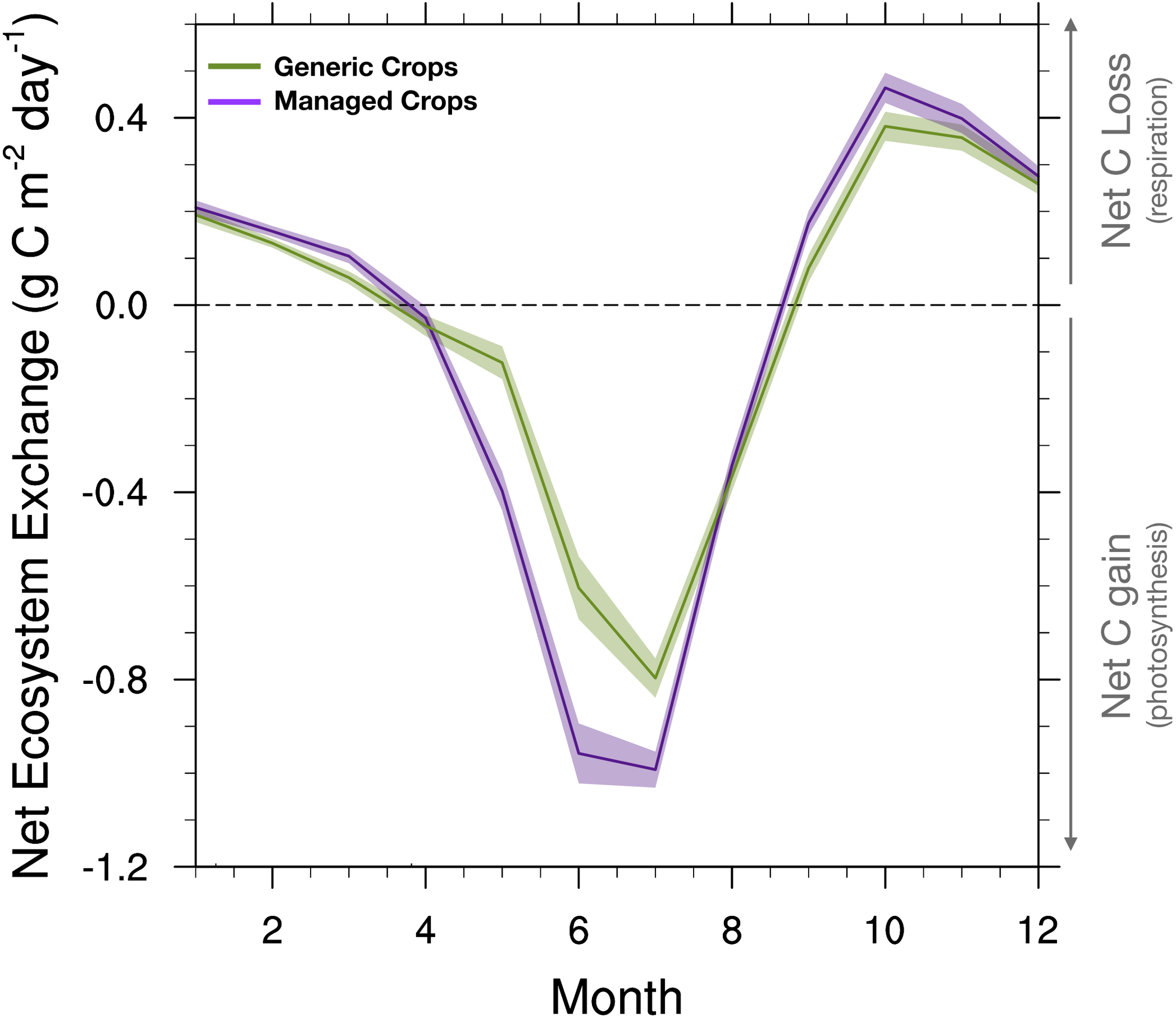
(relative to simulating generic crops)





Change in Annual Maximum Gross Primary Productivity (g C m^{-2} day^{-1})

Lombardozzi et al. in review



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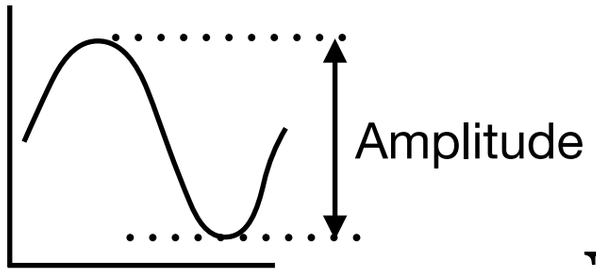
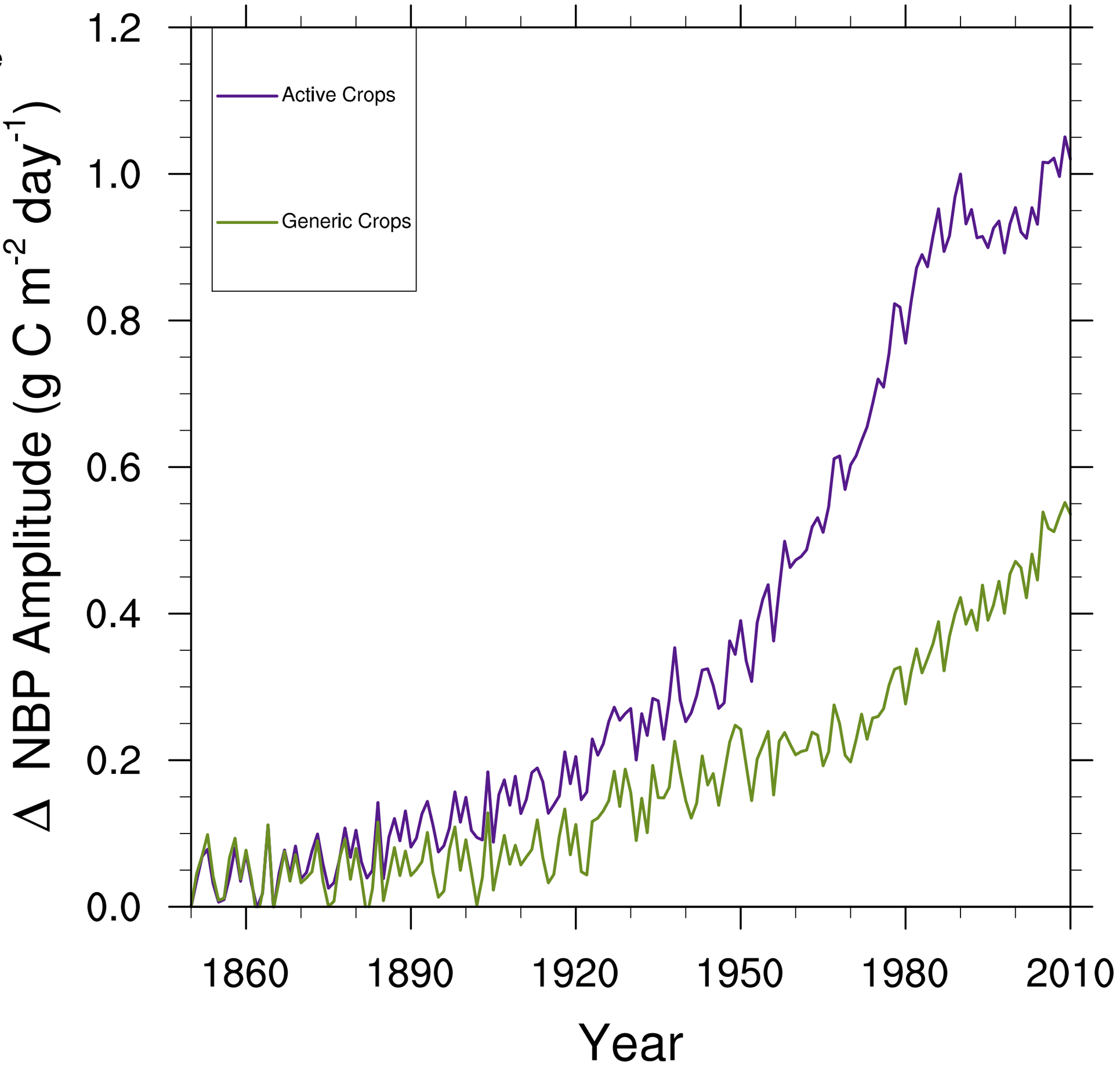




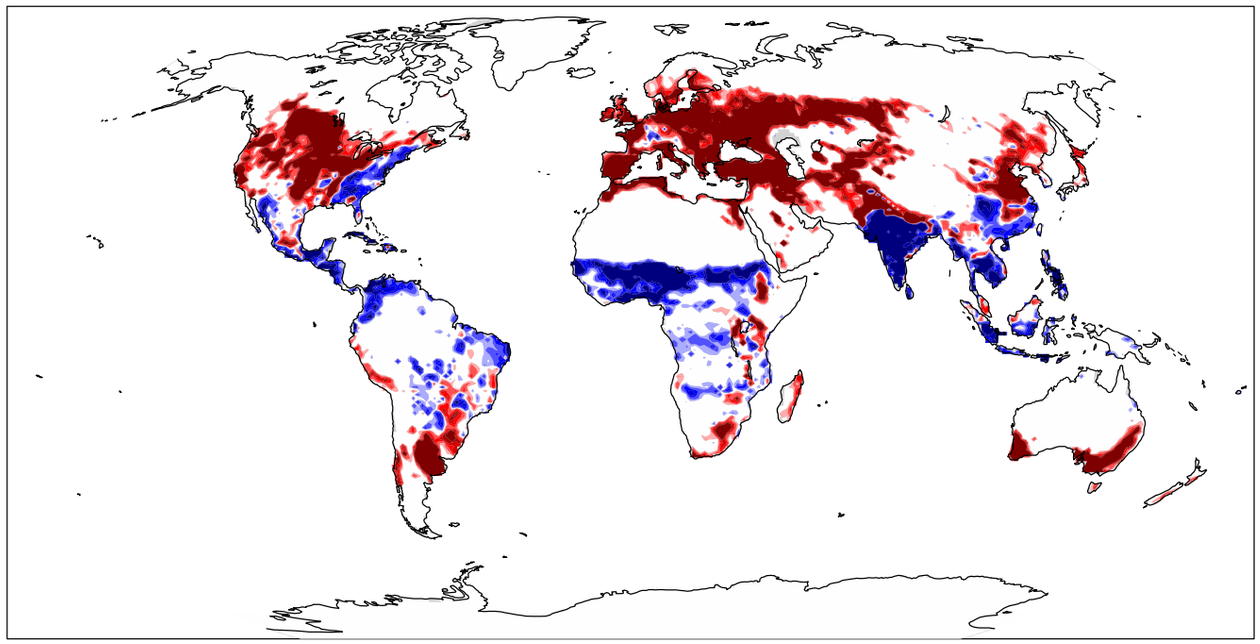
Lombardozzi et al. in prep

1991-2010 Average

Impact of Simulated Managed Crops

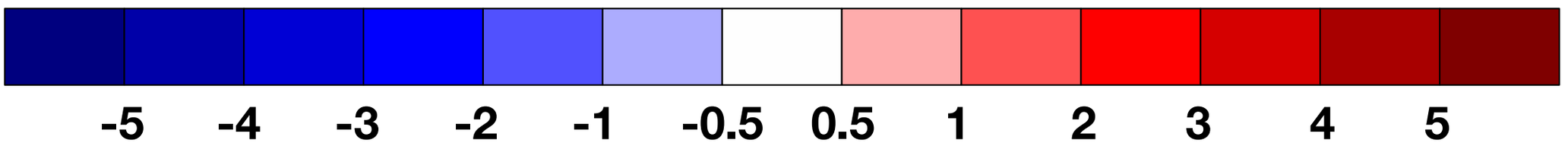
(relative to simulating generic crops)

Annual Monthly Maximum



Active crops decrease evaporative cooling

Active crops increase evaporative cooling



Change in Latent Heat Flux (W m^{-2})

Lombardozzi et al. in review

1991-2010 Average

Impact of Simulated Managed Crops

(relative to simulating generic crops)

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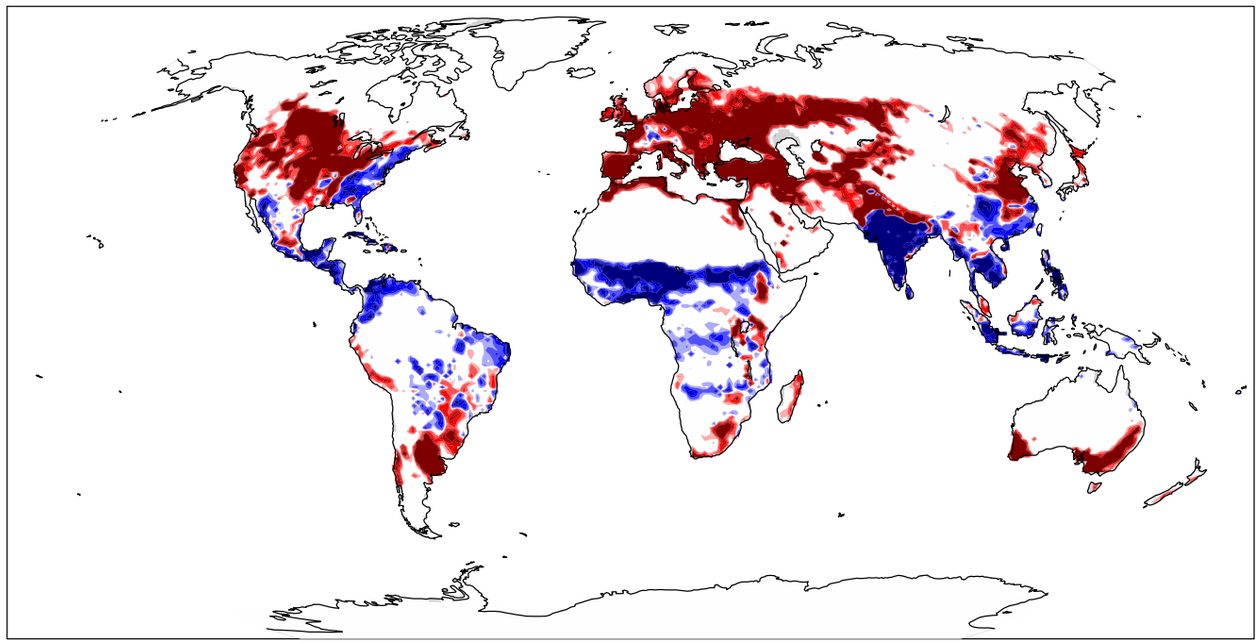
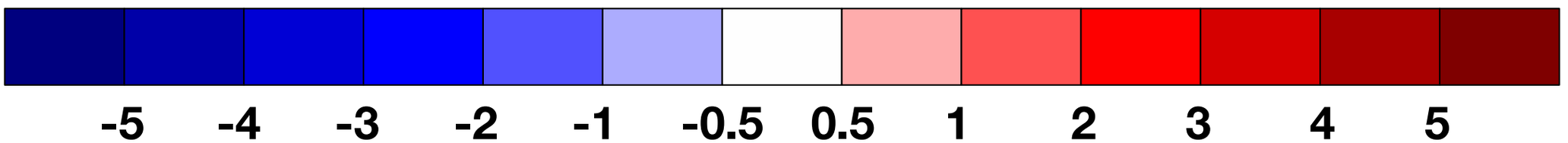


- Added irrigation
- Increased transpiration

Active crops decrease evaporative cooling

Active crops increase evaporative cooling



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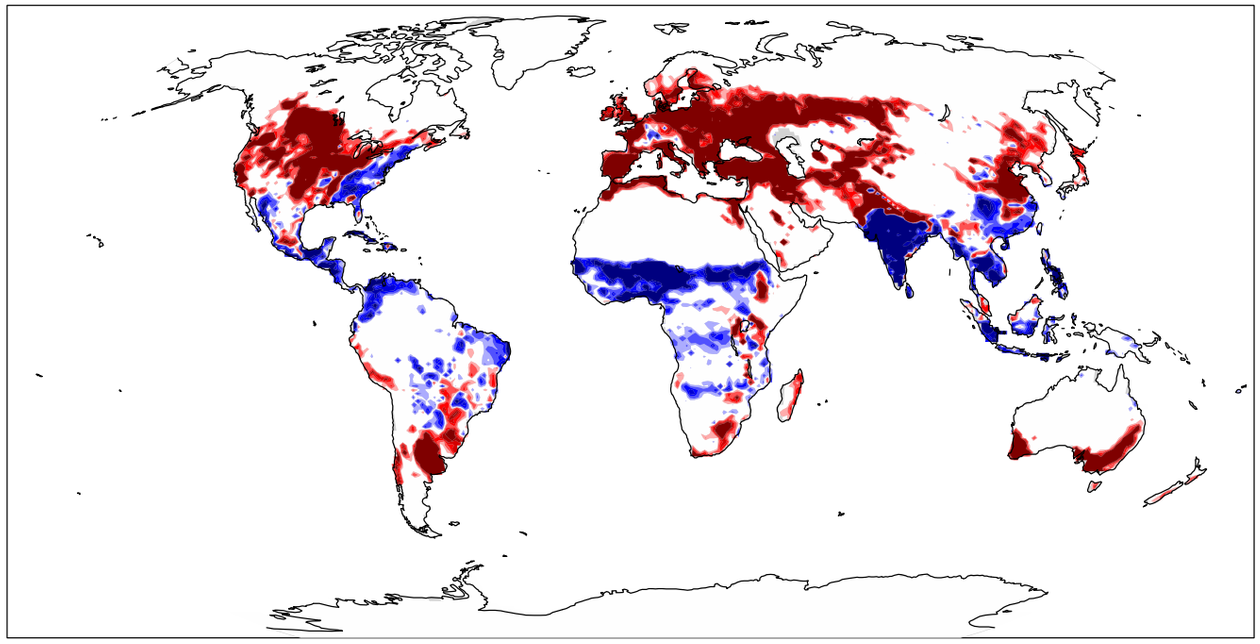
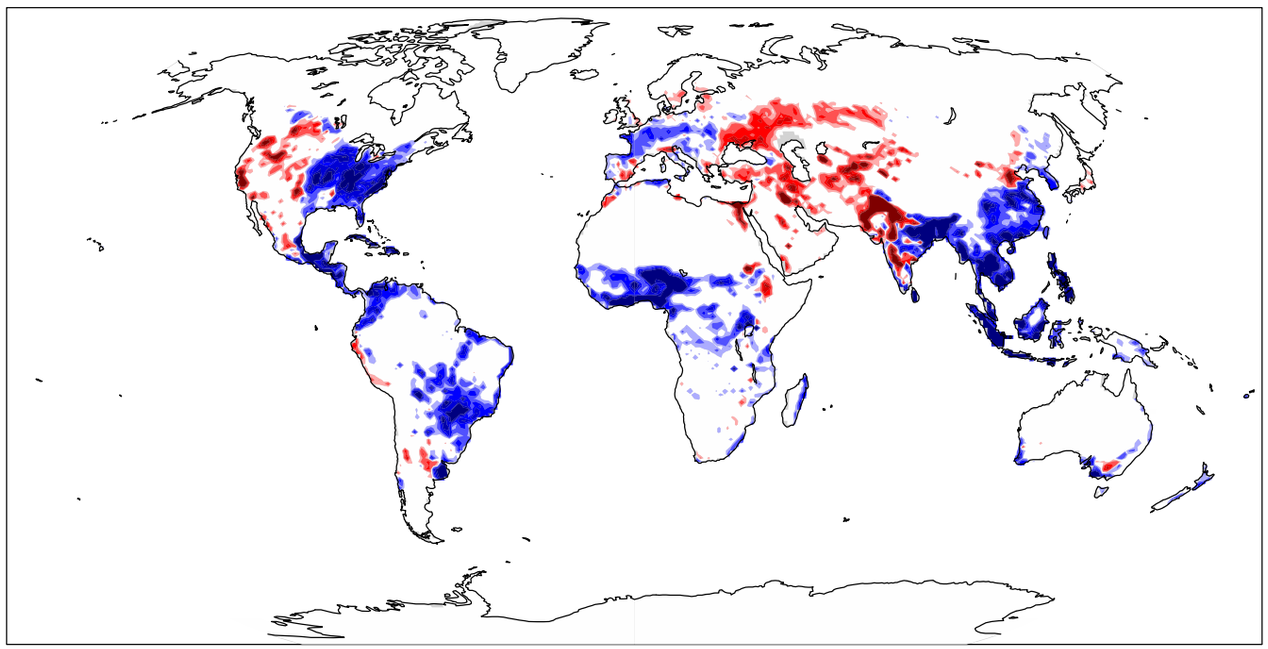


Annual Average



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Change in Latent Heat Flux (W m^{-2})

Lombardozzi et al. in review

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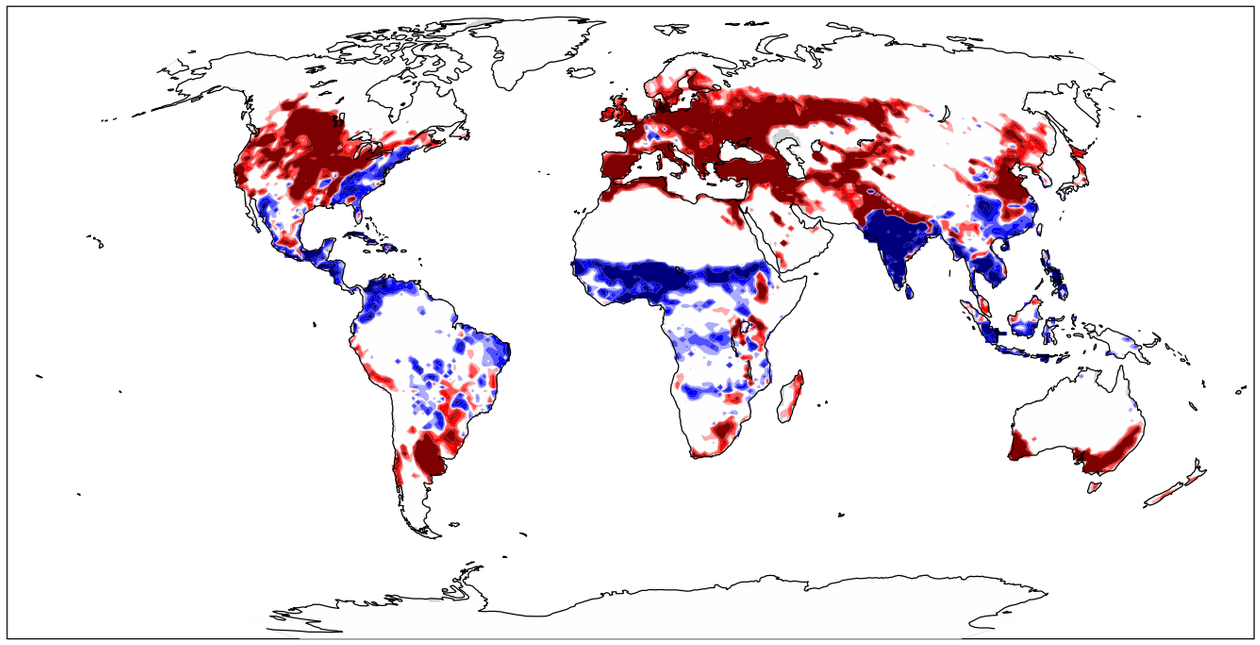

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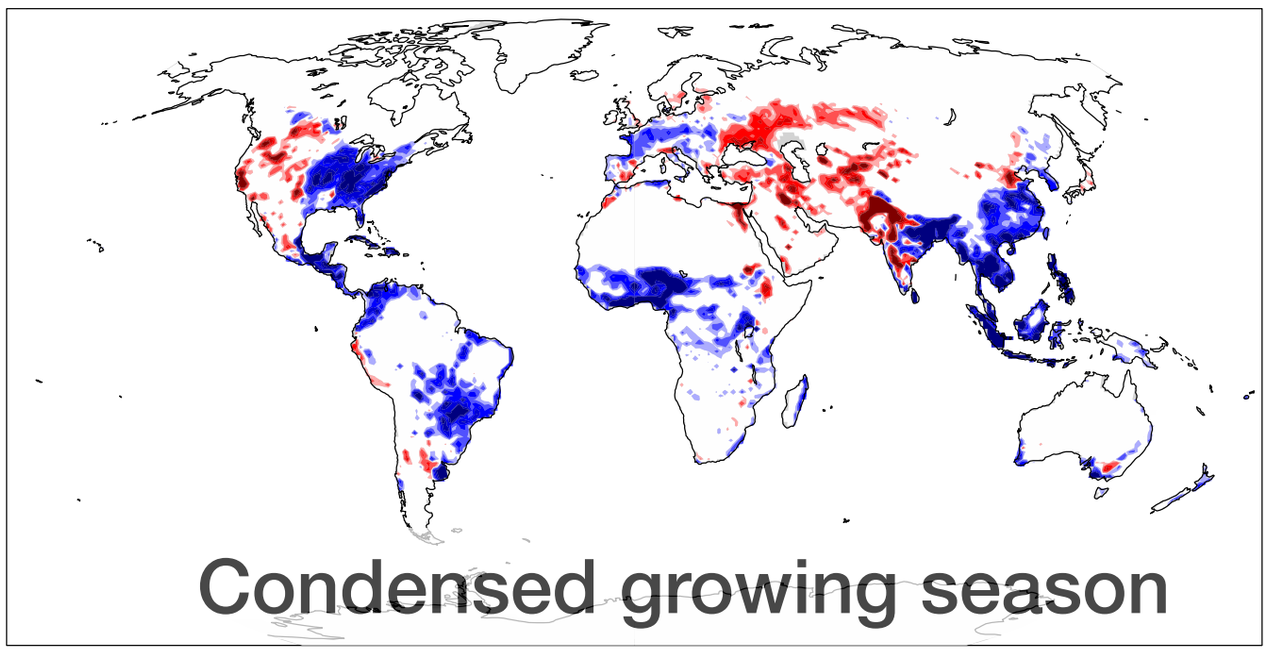

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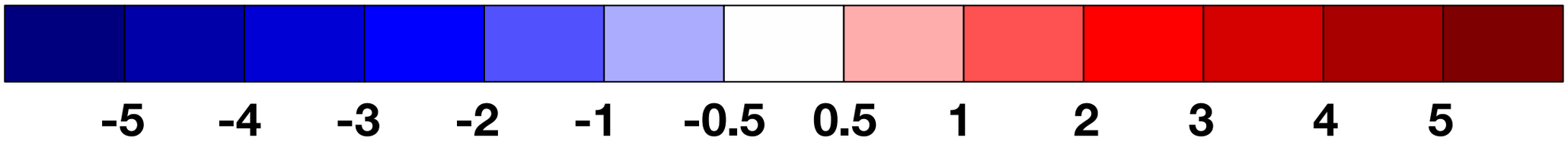


Change in Latent Heat Flux (W m^{-2})

Lombardozzi et al. in review

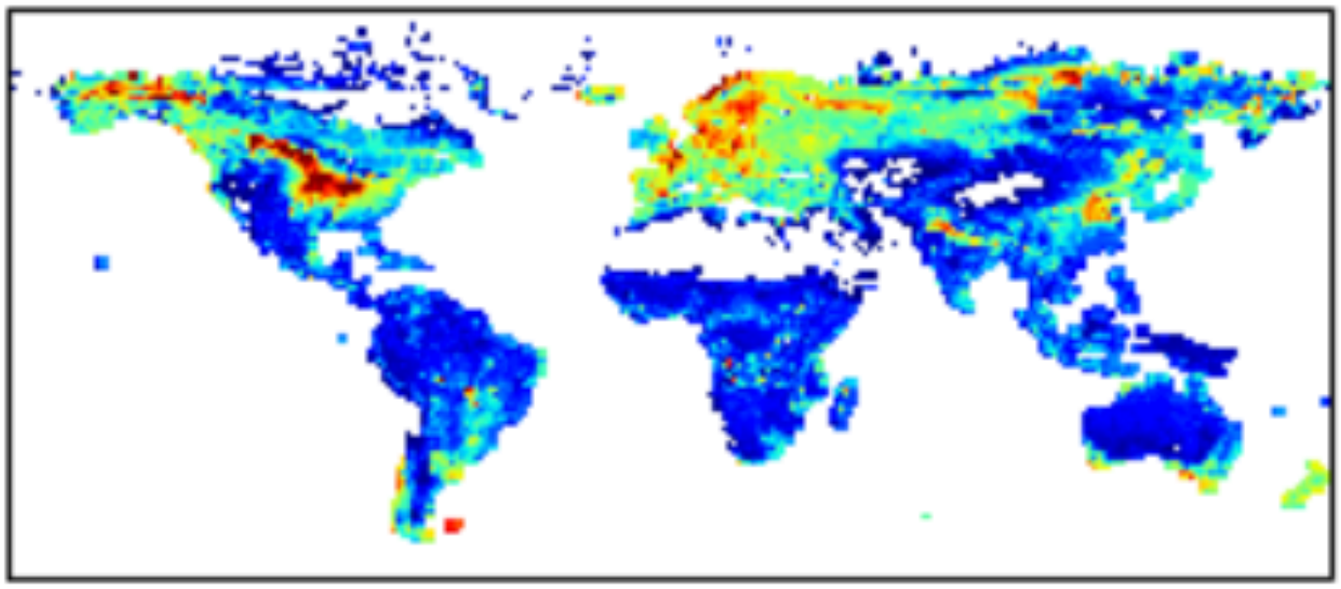
Responses to Management*

* Irrigation & fertilization

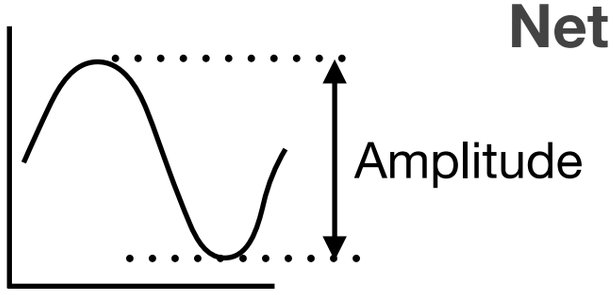
NBP Amplitude

1990-2010

CLM5-Crop



Net Biome Production (NBP) Amplitude (g C m^{-2} day^{-1})



NBP Amplitude

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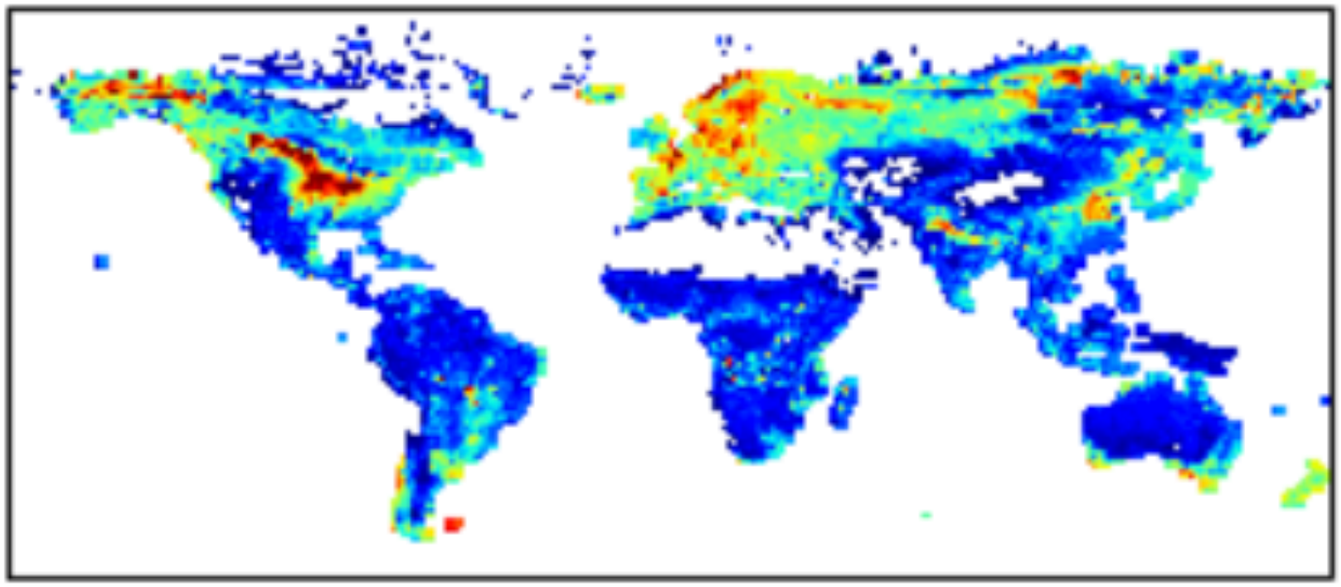
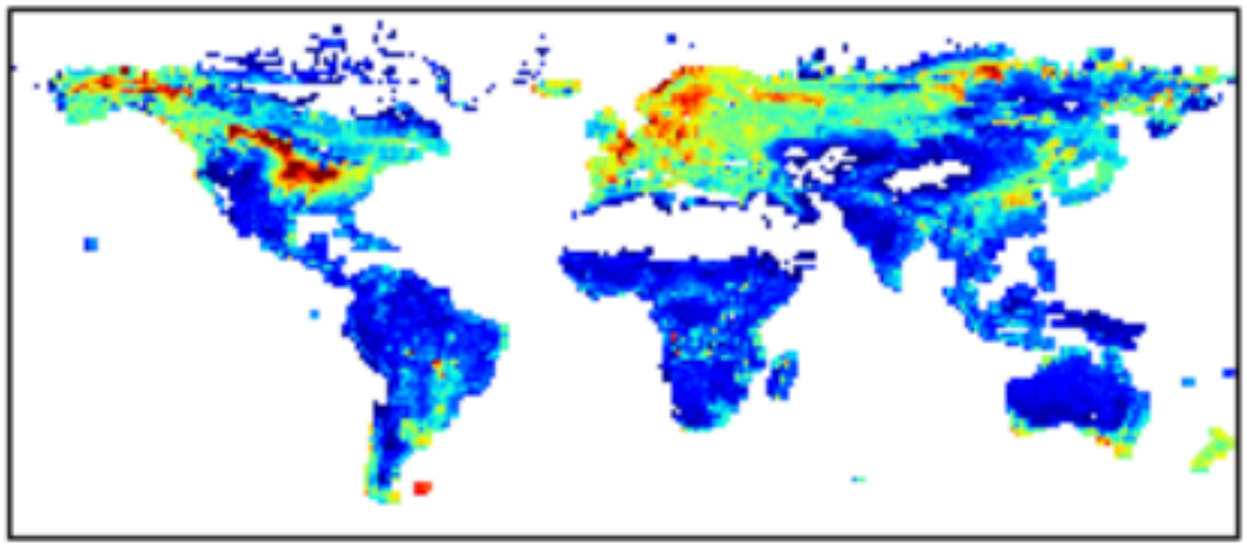
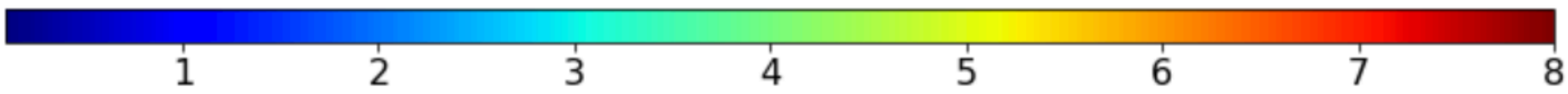


No Irrigation





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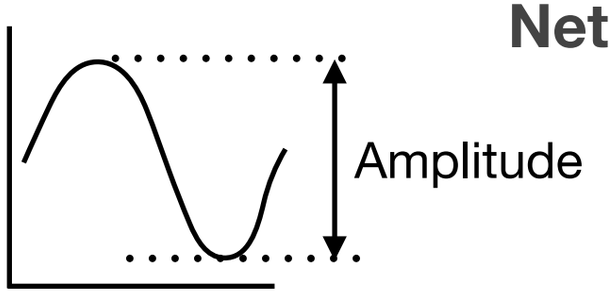

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1990-2010

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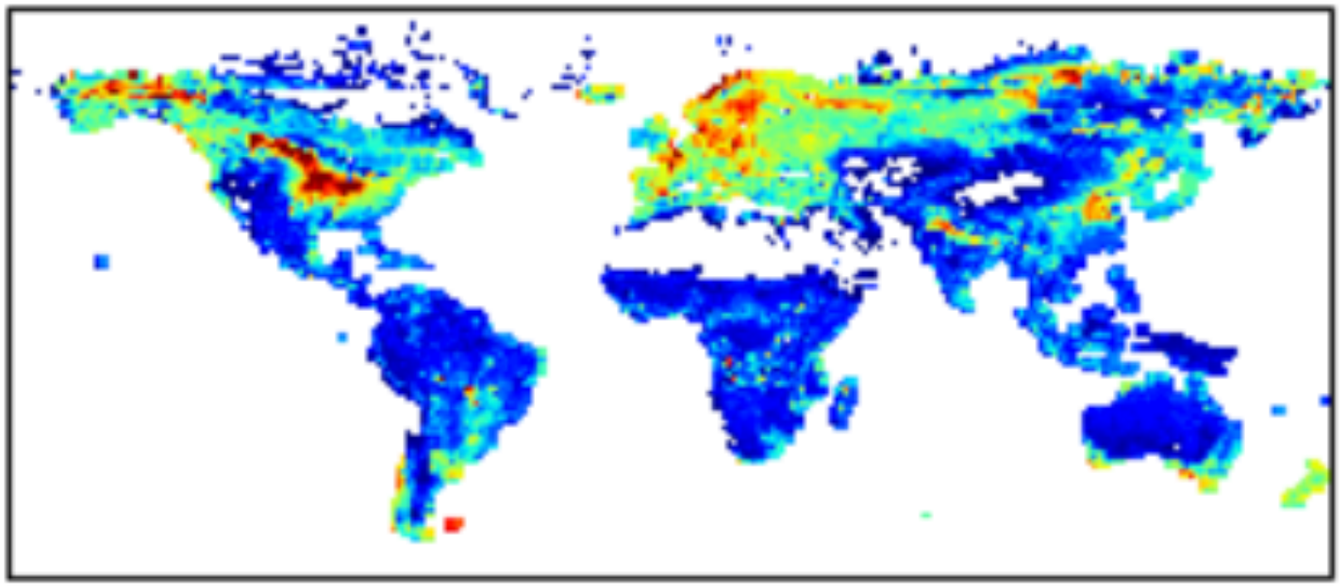

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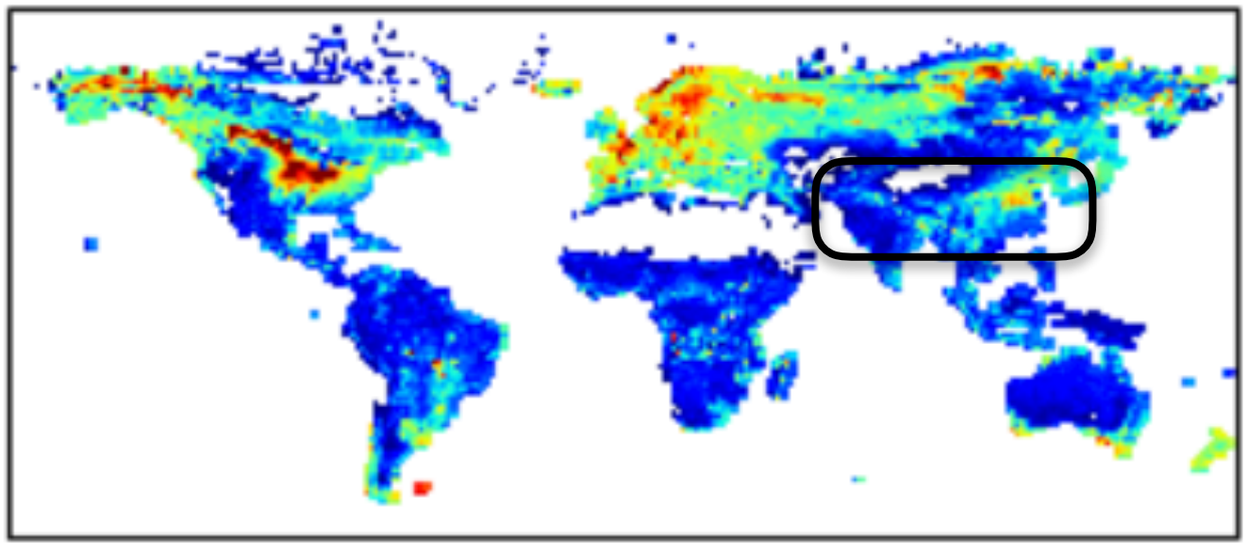

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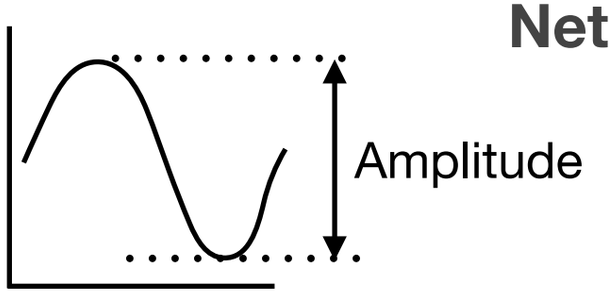

NBP Amplitude

1990-2010

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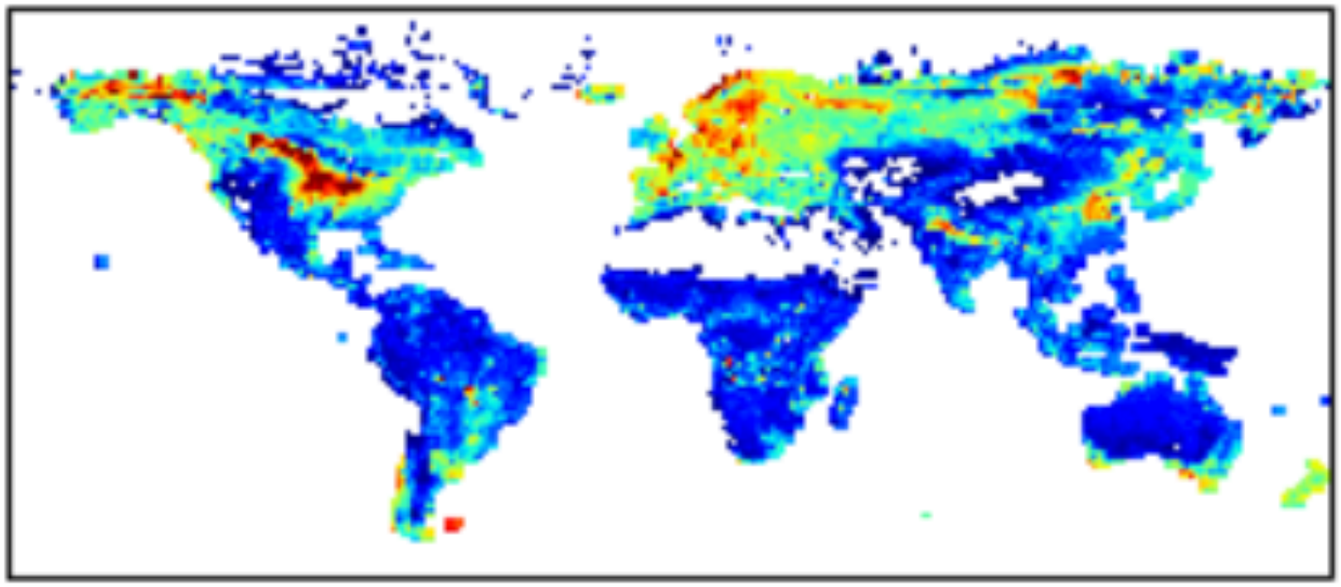

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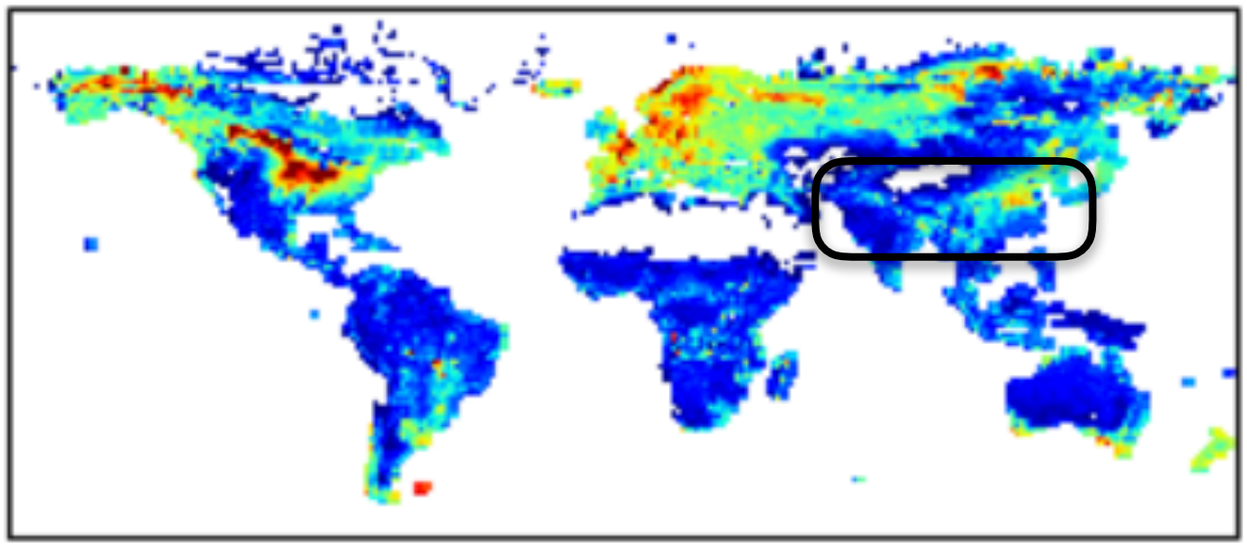
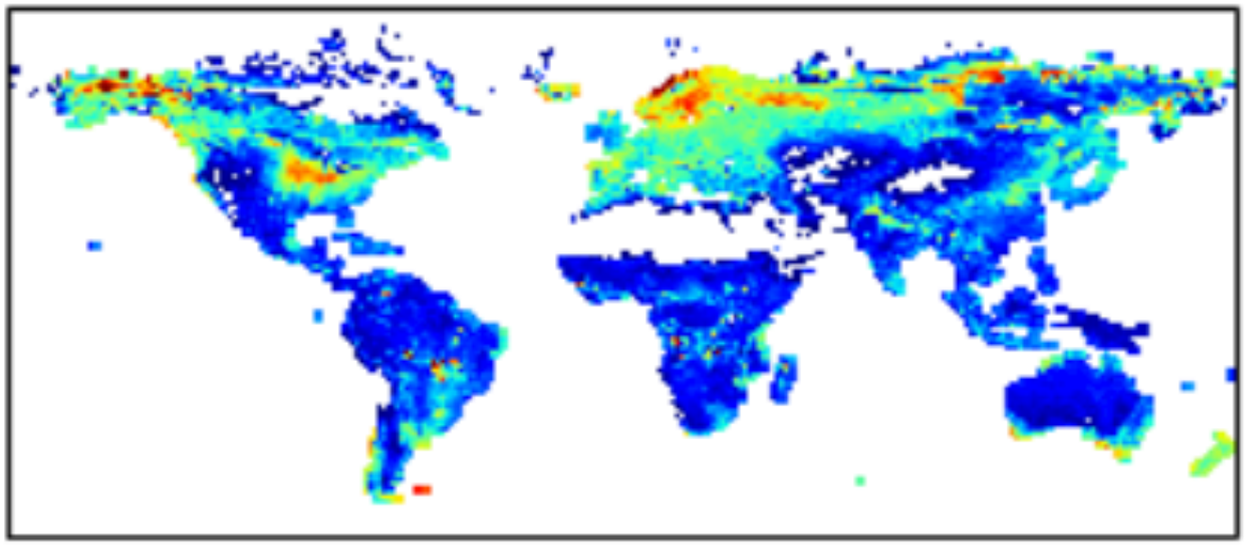


No Fertilization



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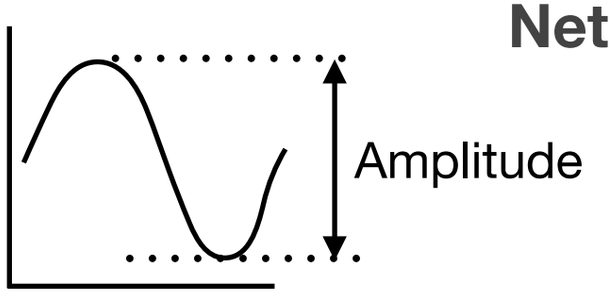

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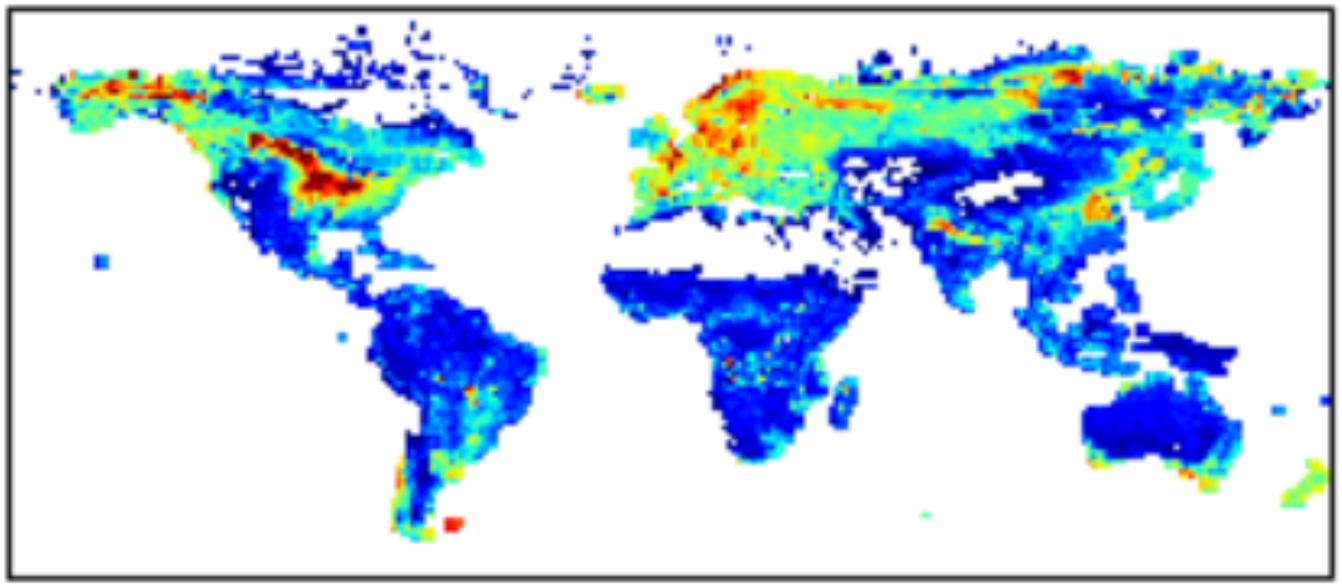

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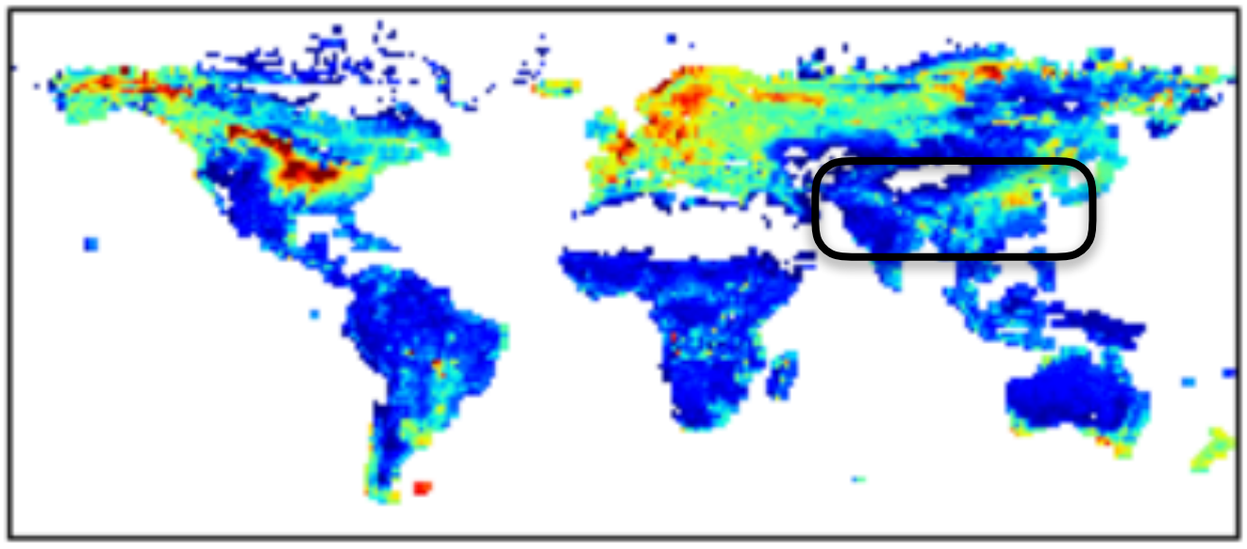

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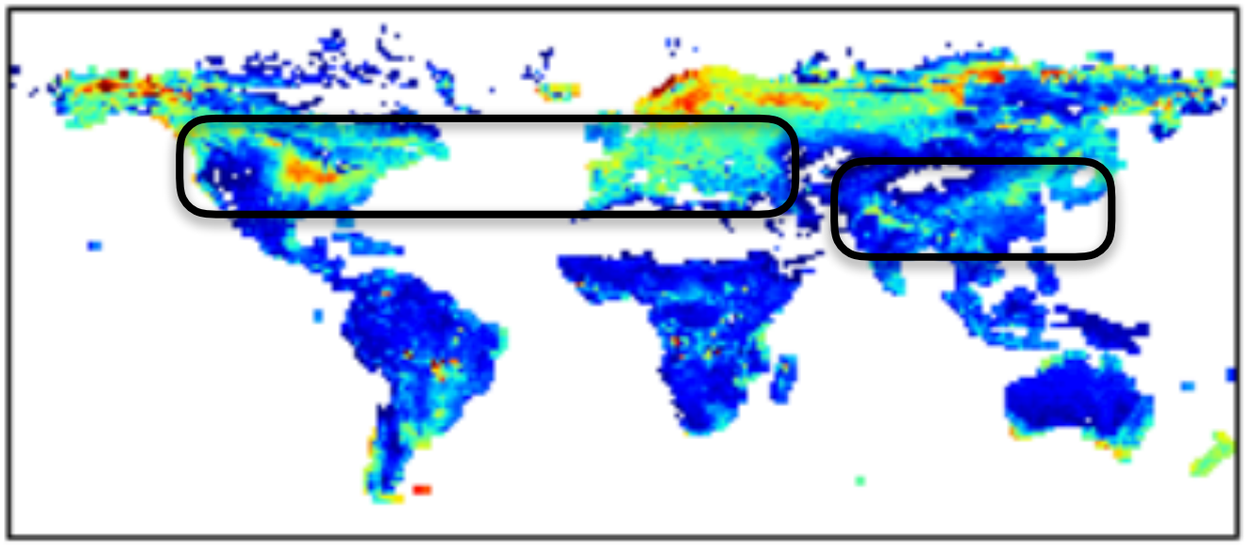

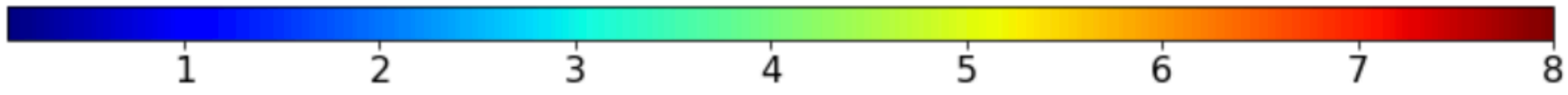

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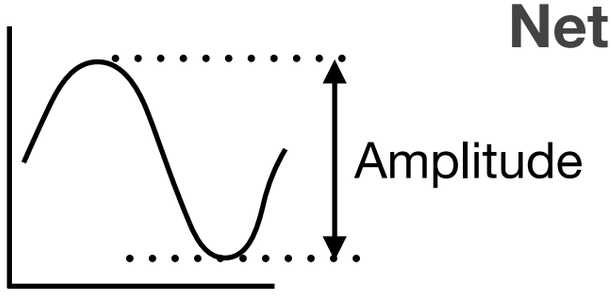
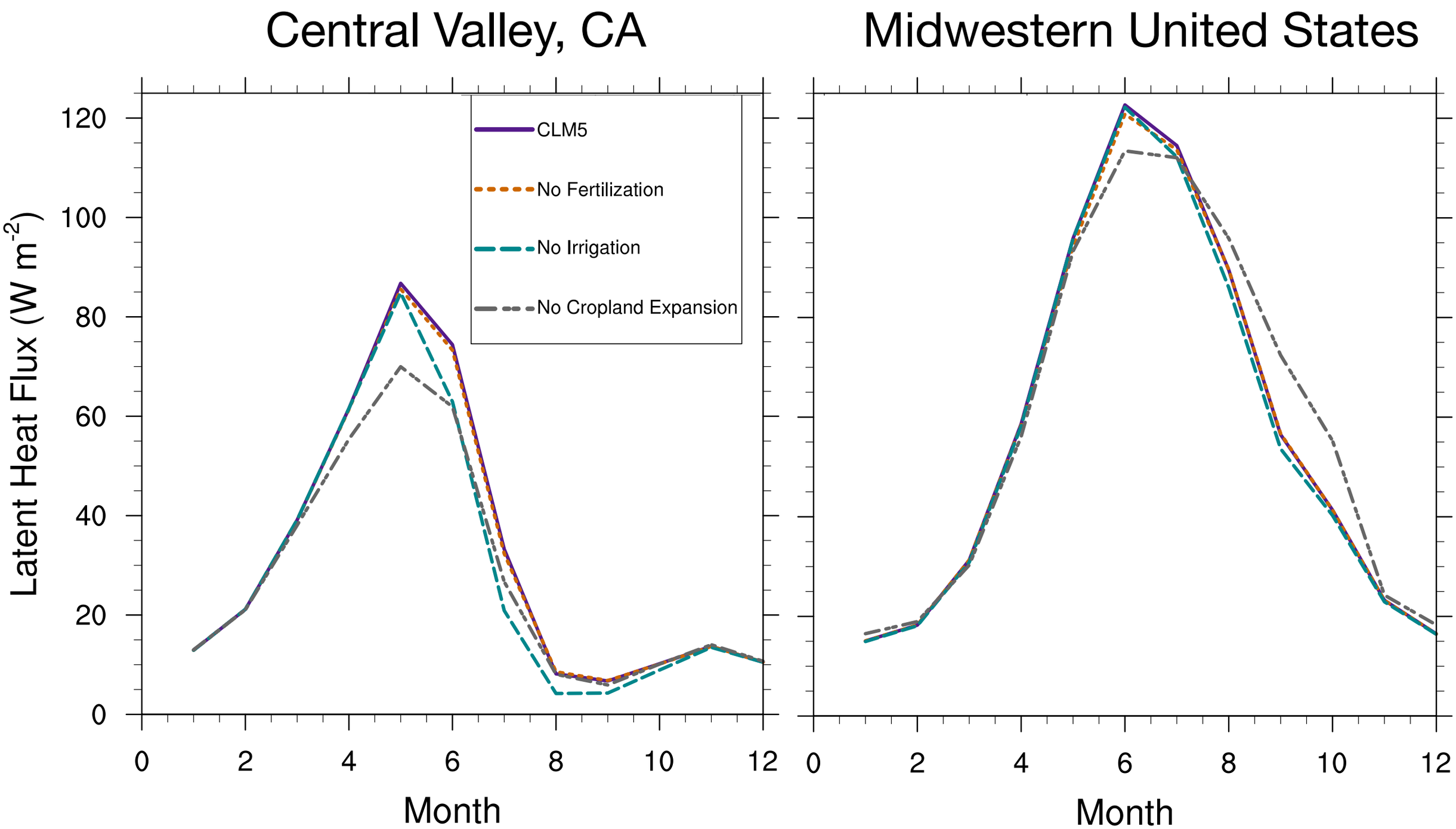




Lombardozzi et al. in review

Some Topics for Discussion:

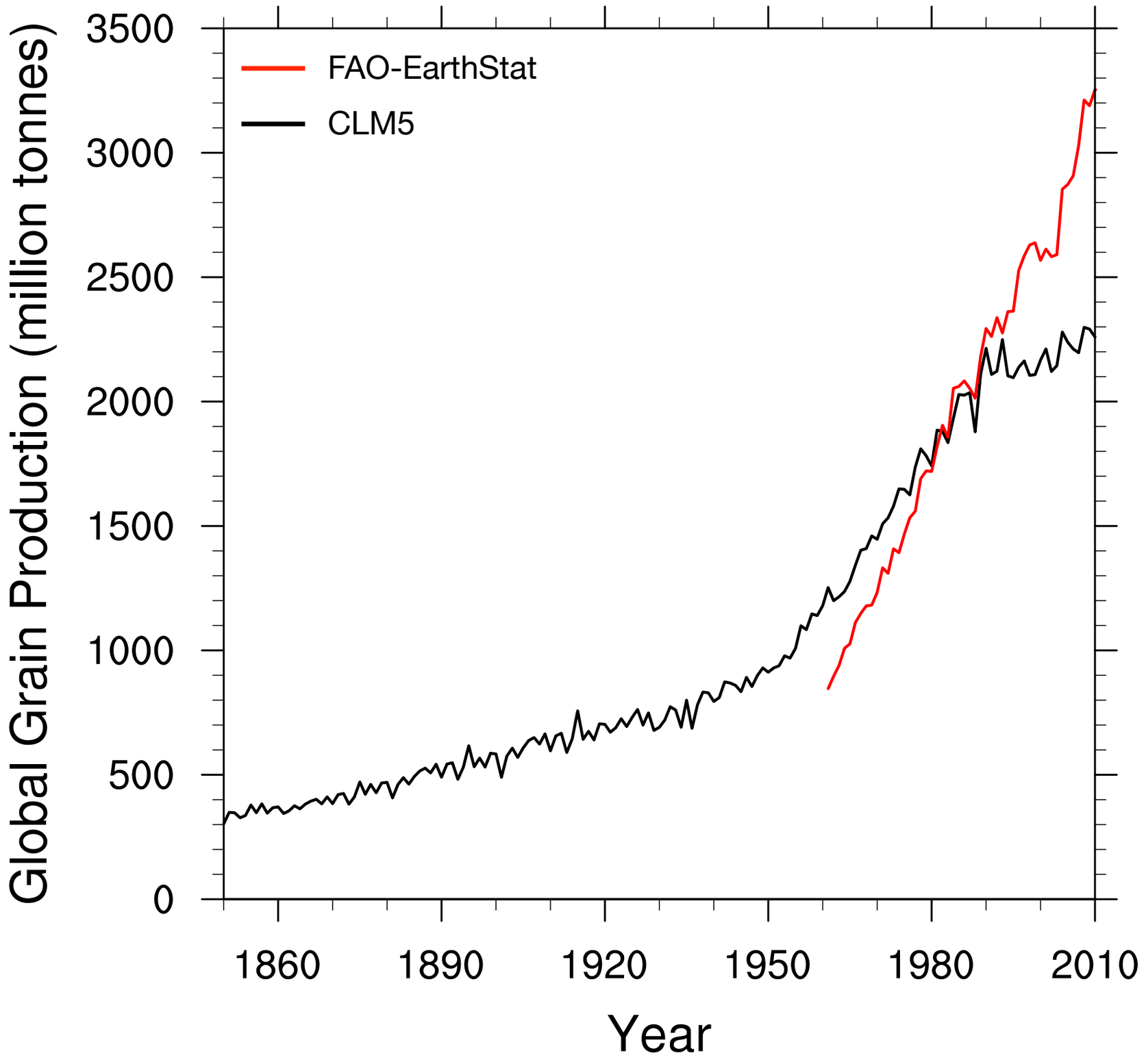
How do carbon, water, and energy fluxes change in response to:

- Management practices?
- Explicit crop representation?

Do changes in forcing (climate, CO_2) and surface characteristics (no land use change, no pasture) interact with land management?

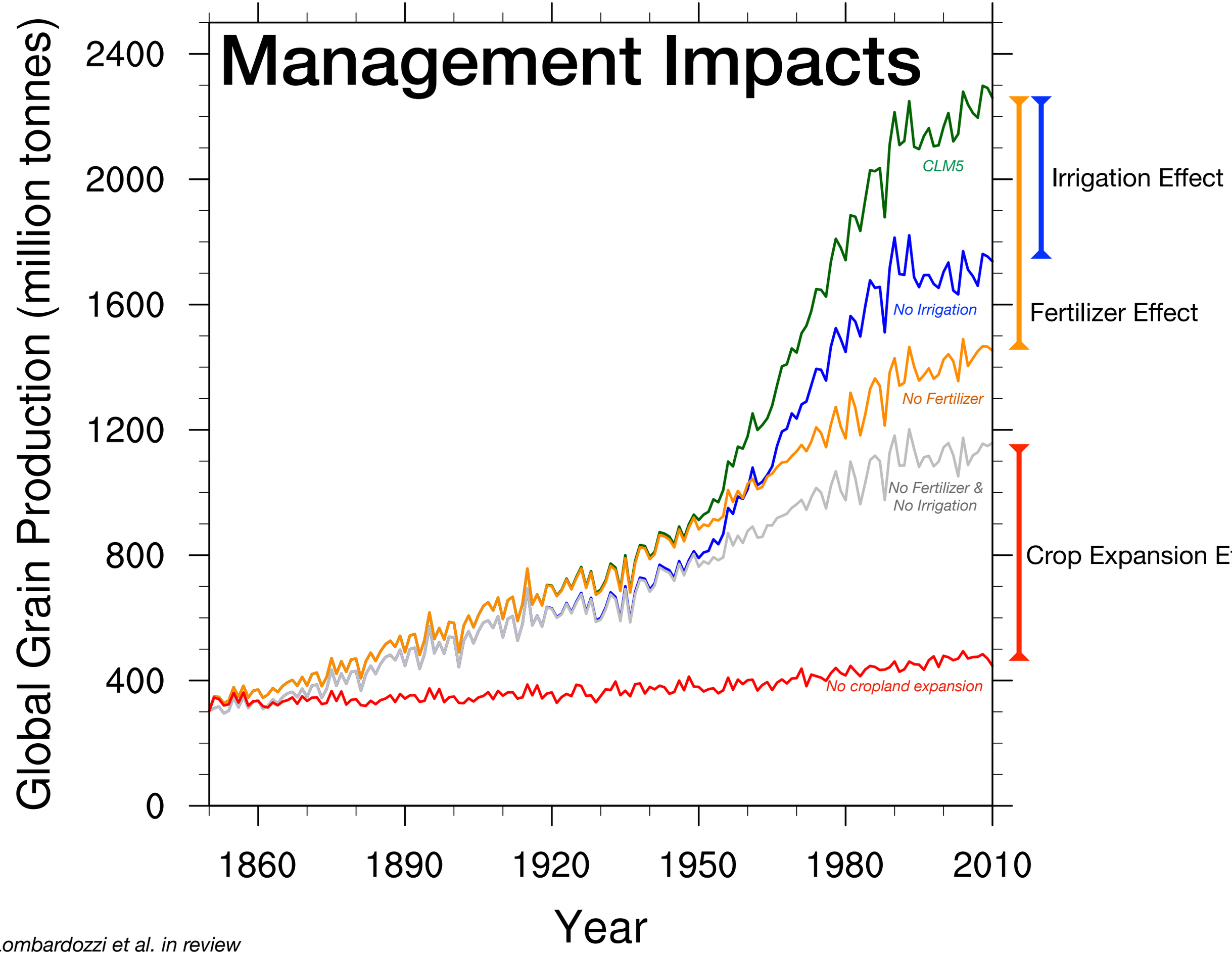
What is the uncertainty across model responses? What is the primary driver of uncertainty?

Global Crop Production



Lombardozzi et al. in review

Management Impacts



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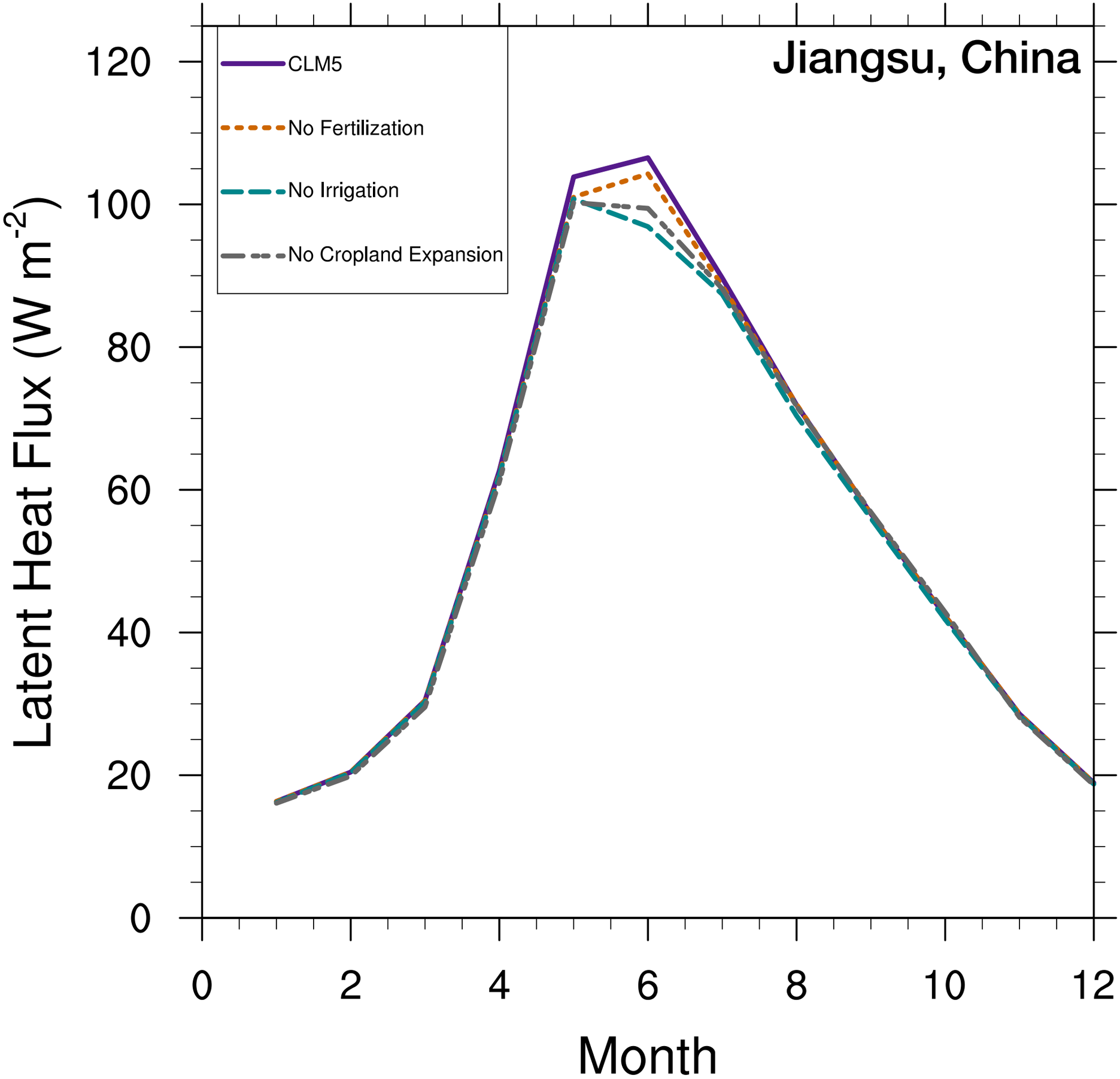
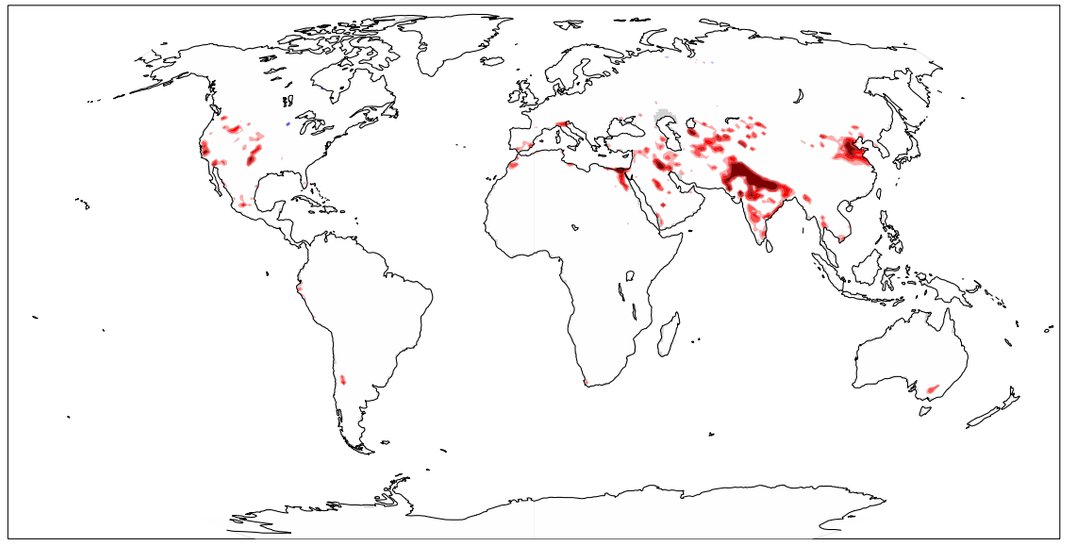


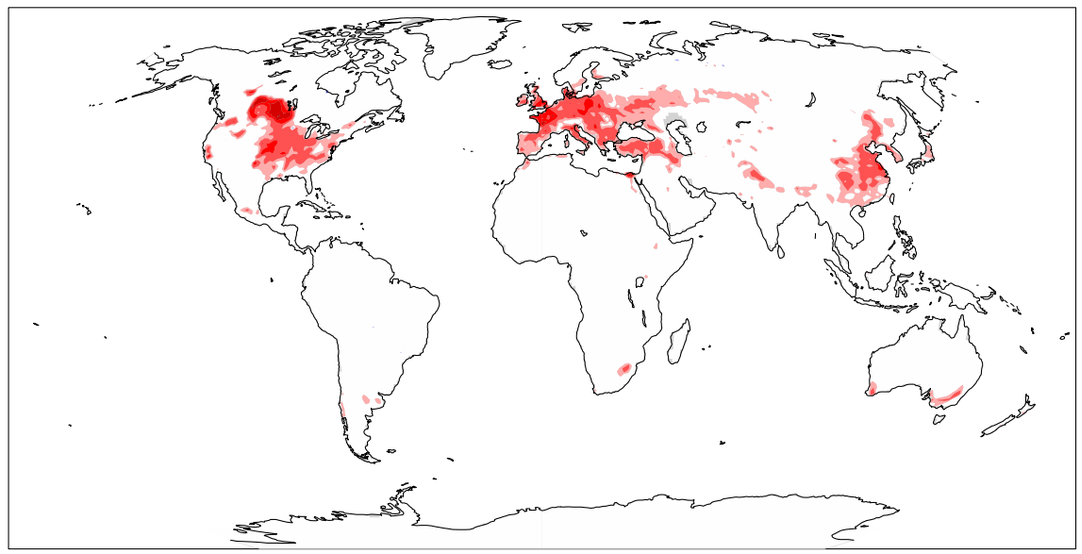
Lombardozzi et al. in review

Change in Maximum **GPP**

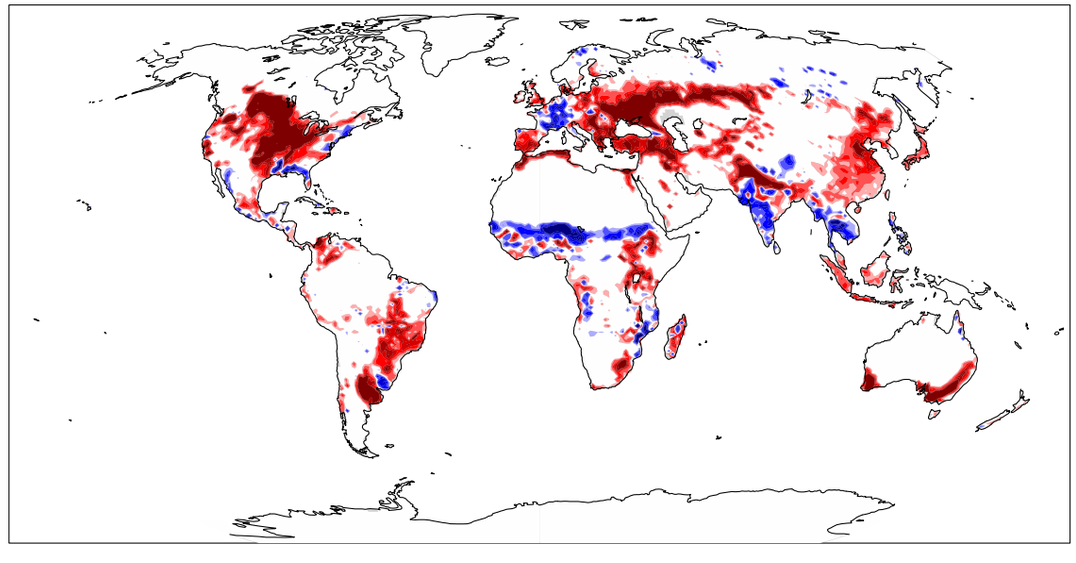
Irrigation

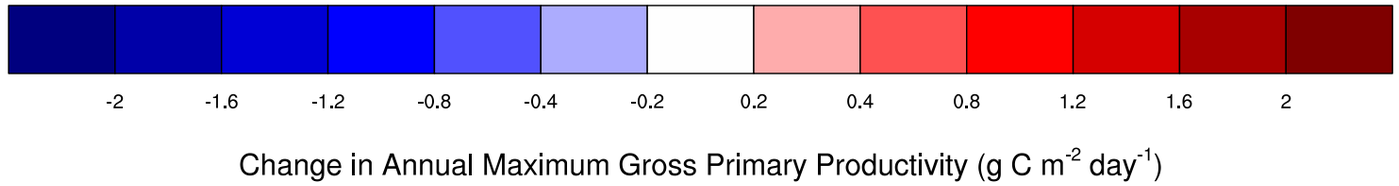


Fertilizer



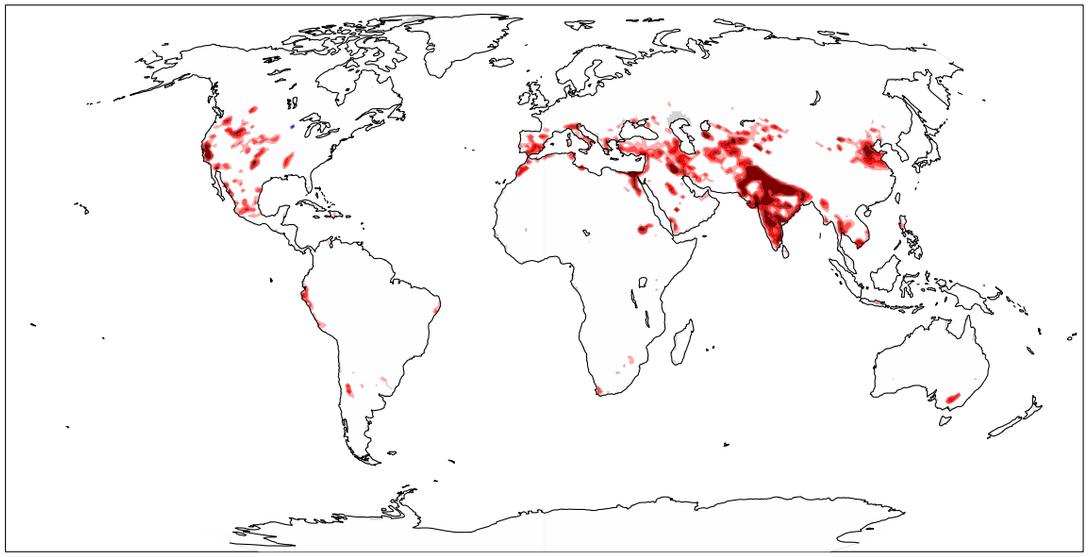
Cropland Expansion
(with irrigation & fertilization)



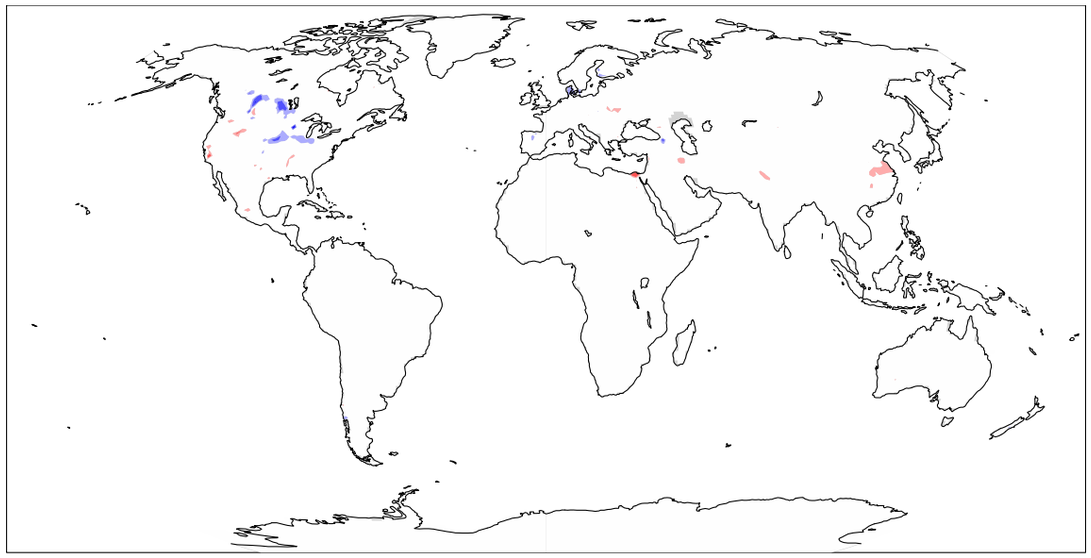


Change in Annual Average
Latent Heat Flux

Irrigation



Fertilizer



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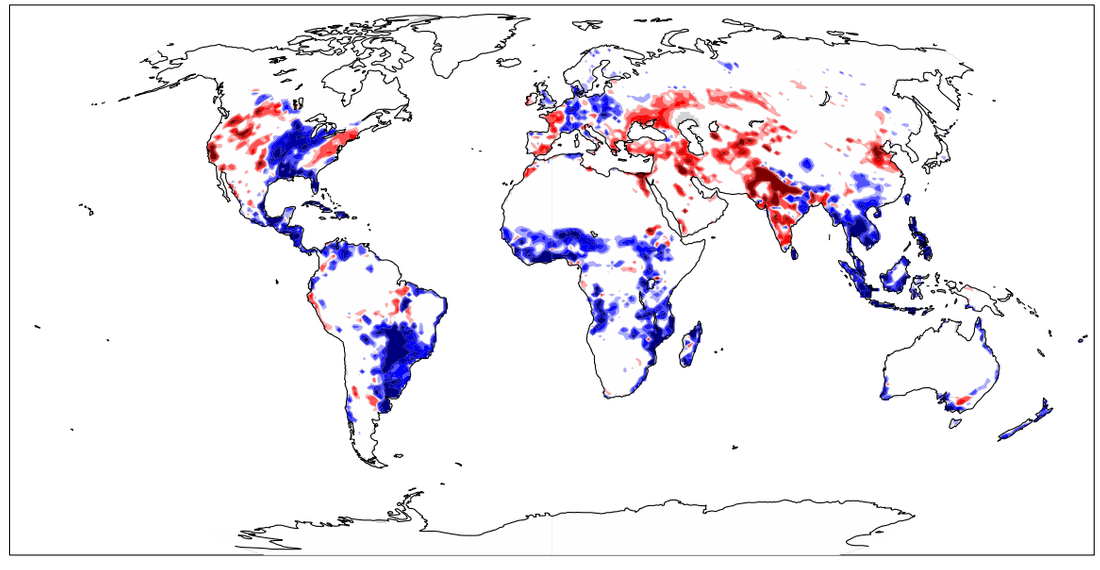
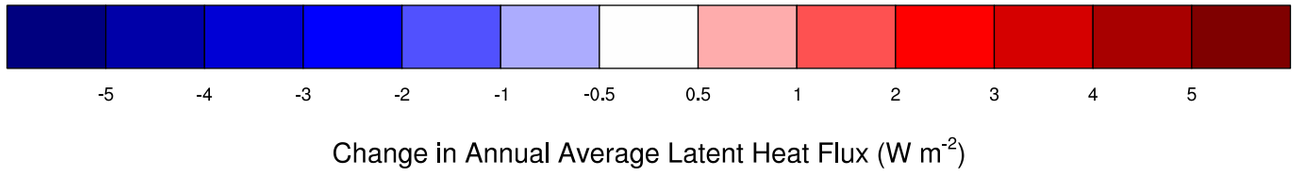
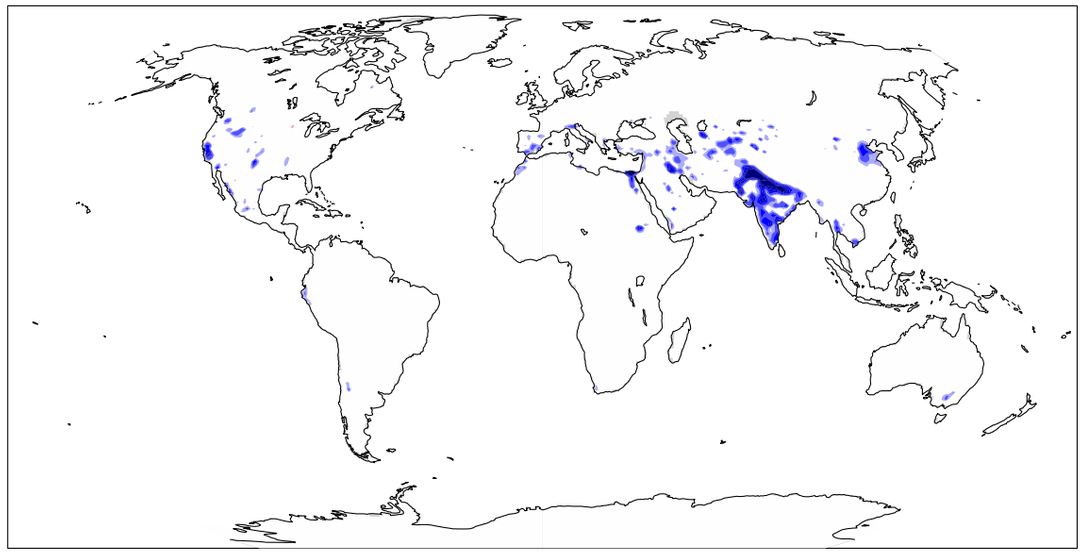


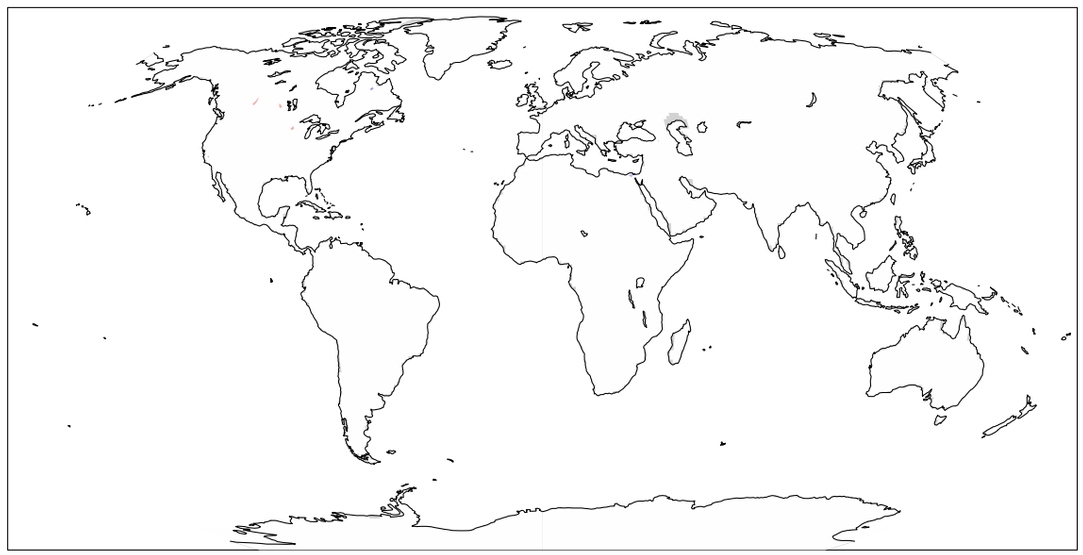


Change in Average **Runoff**

Irrigation



Fertilizer



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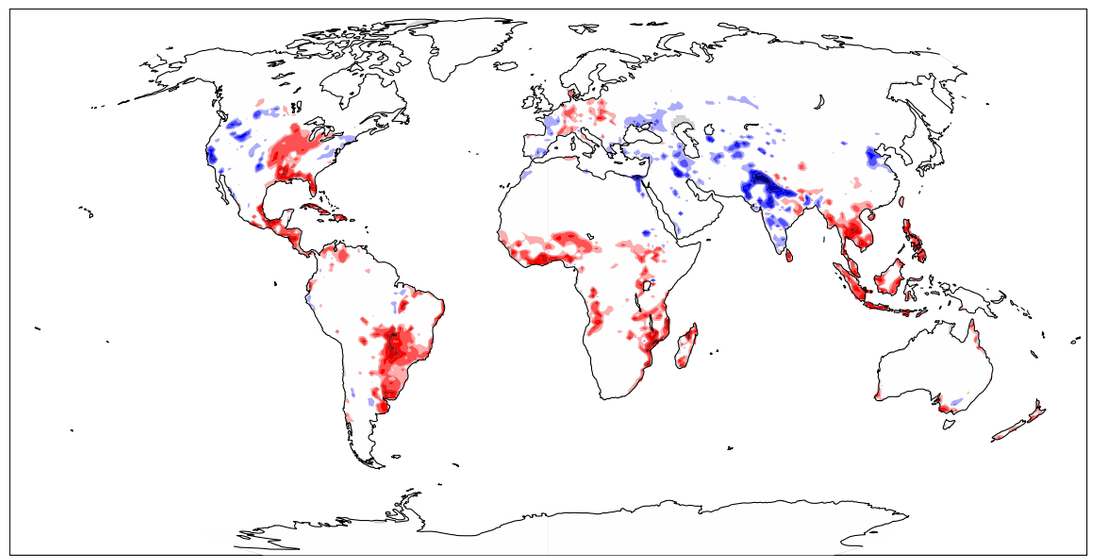
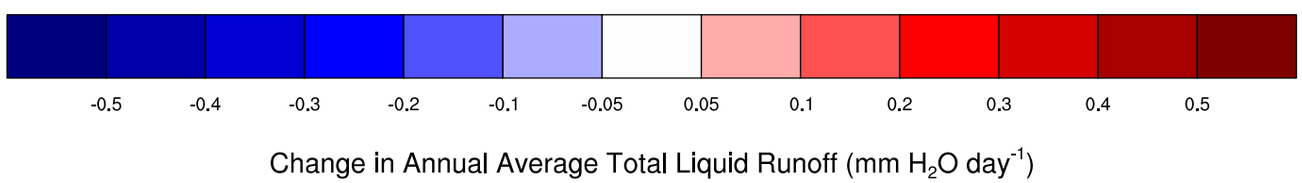
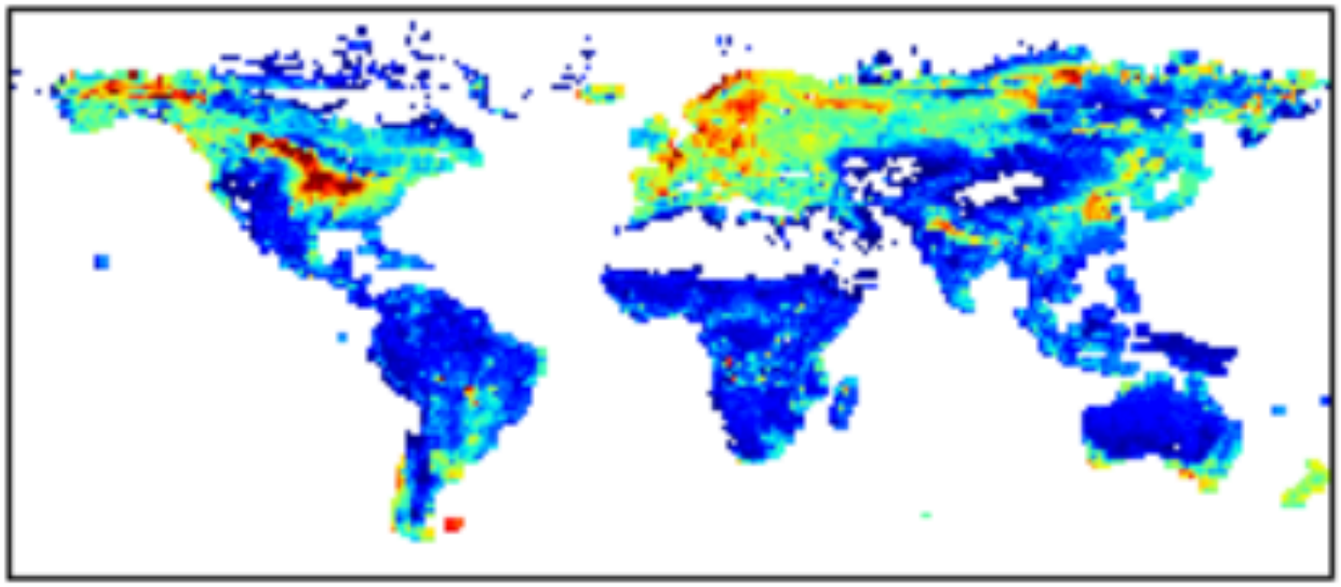


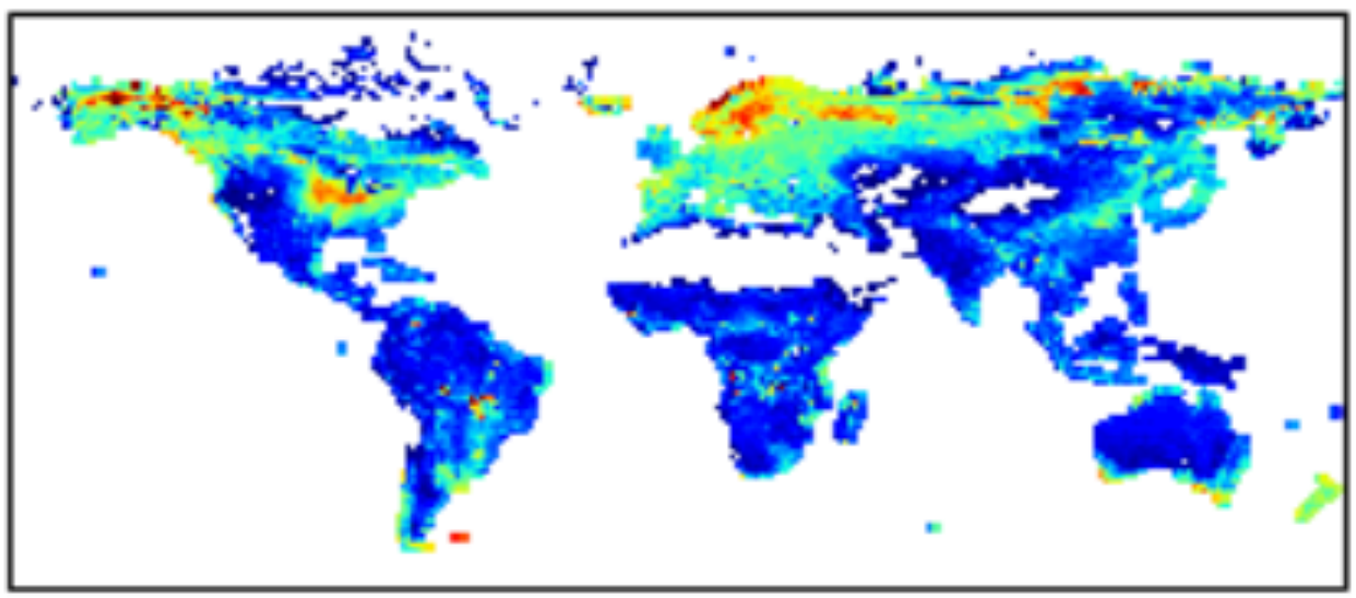


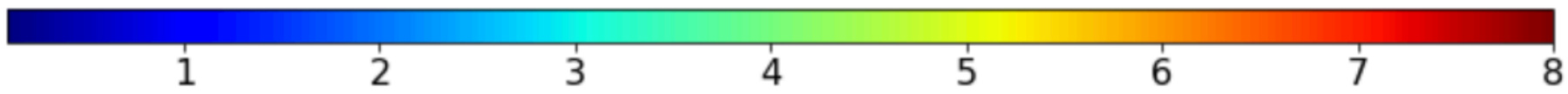
NBP Amplitude

CLM5-Crop



Constant CO_2





Net Biome Production (NBP) Amplitude (g C m^{-2} day^{-1})