

# Storylines of future changes in precipitation regimes across the RECEIPT hotspots of remote agricultural risk affecting Europe

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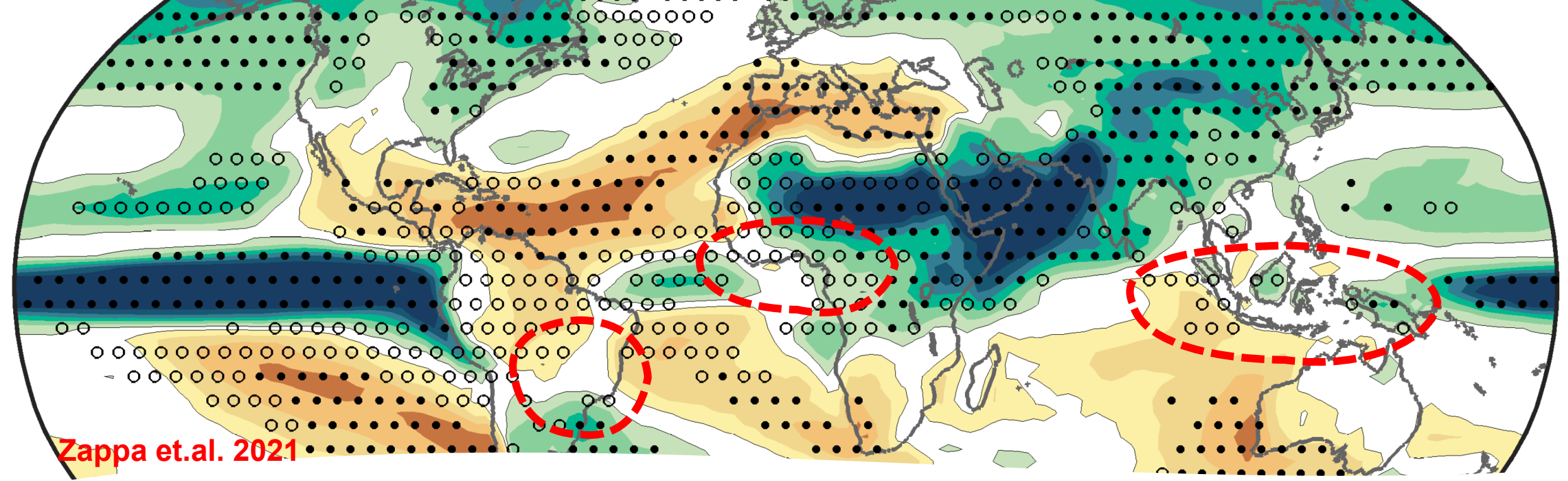
<sup>2</sup> Alfred-Wegener-Institute Helmholtz Centre for Polar and Marine Research

ReCeipt



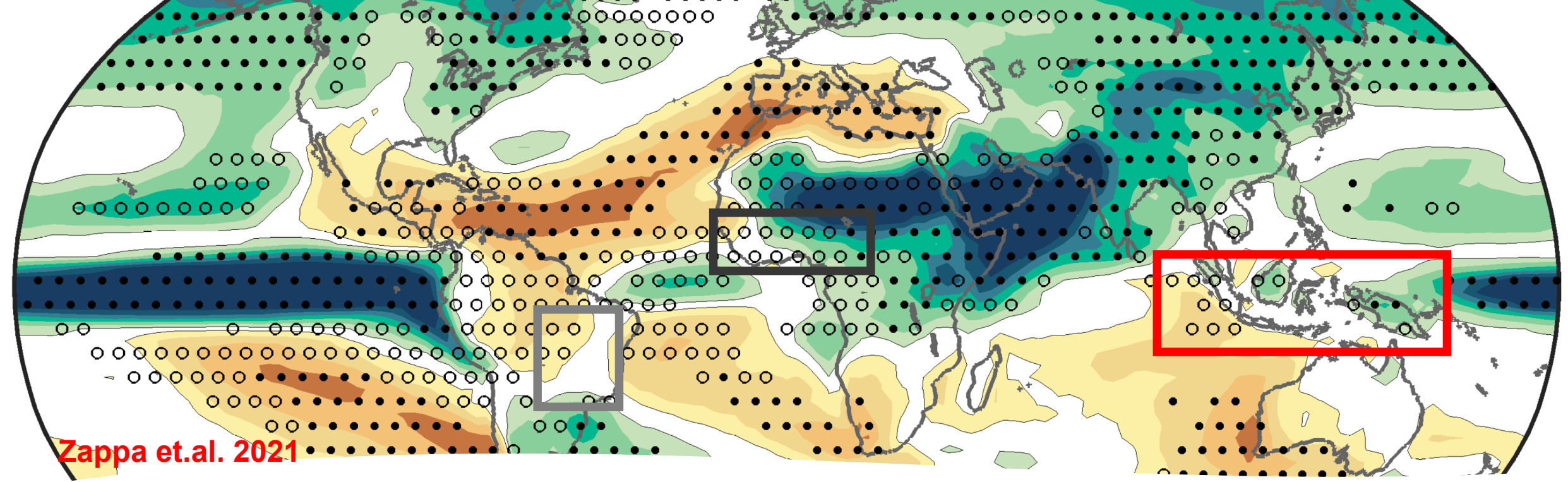
# Key Hotspots on agriculture are in the tropics





## Large uncertainty in future changes of tropical land rainfall

Open stipple : Large response but non-robust  
projections

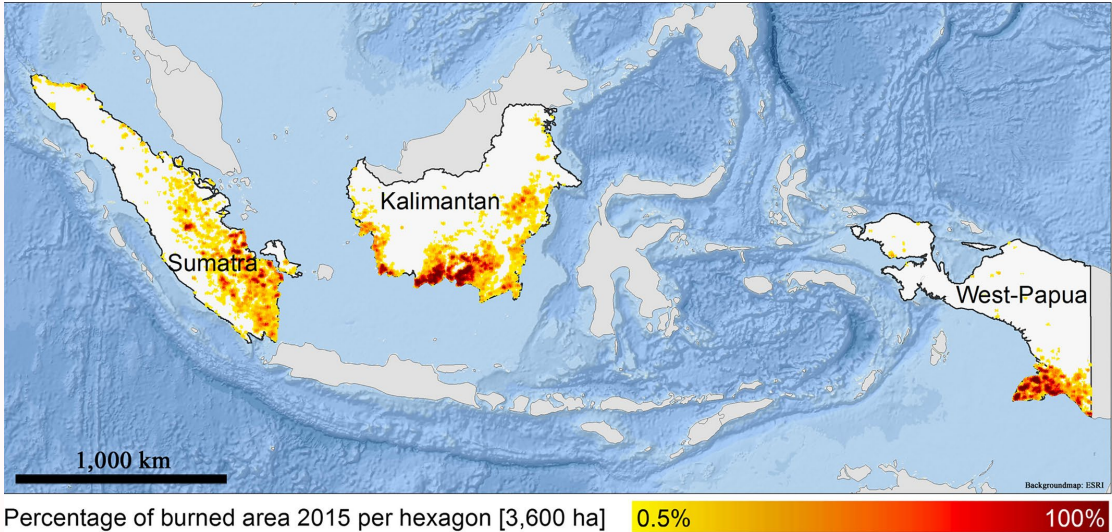
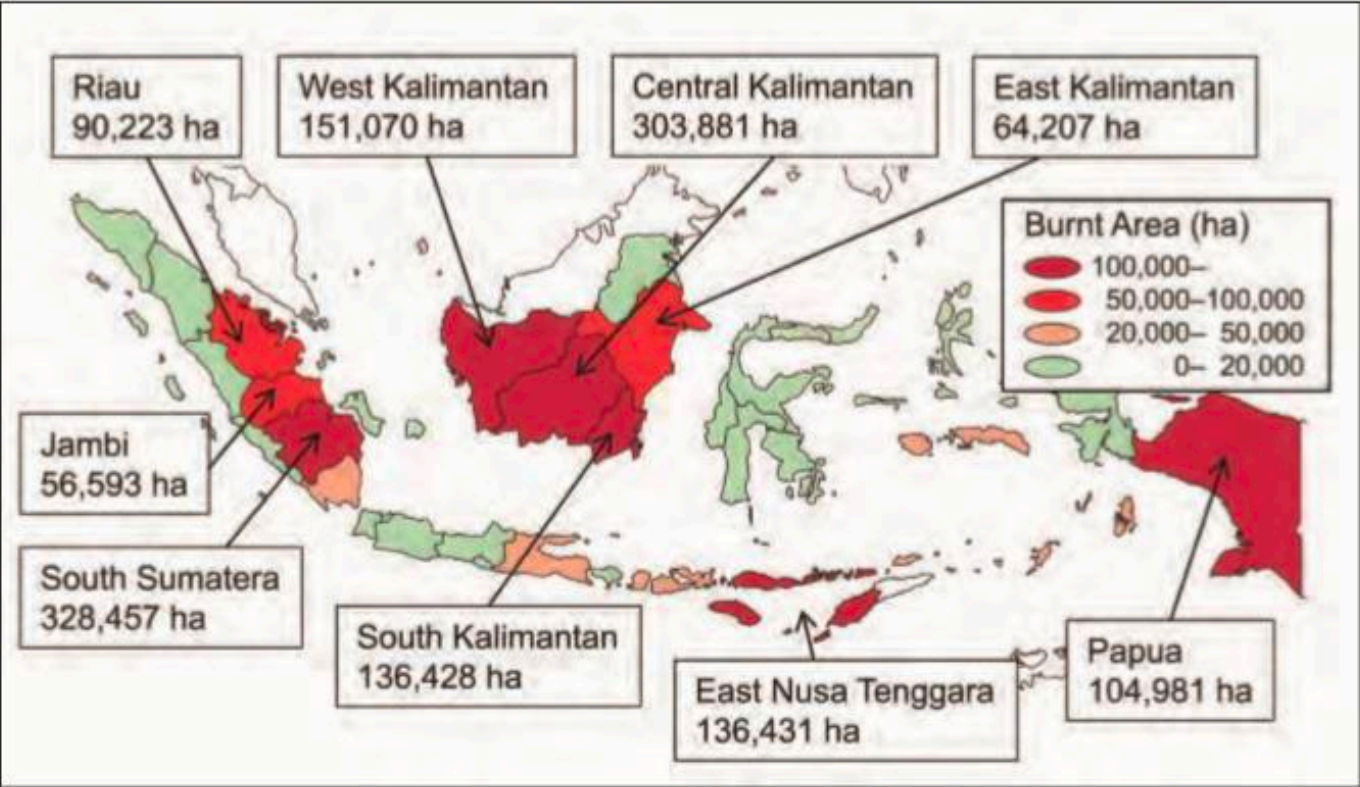


**Large  
uncertainty in  
future changes  
of tropical land  
rainfall**

- 1) Maritime continent**
- 2) West Africa**
- 3) South-east Brazil



# Forest fires are seen during Dry period over Maritime Continent (May-to-October, MJJASO)



Source: NASA

Source: Tropical Peatland Society Project, 2019.

Fachrie, 2020

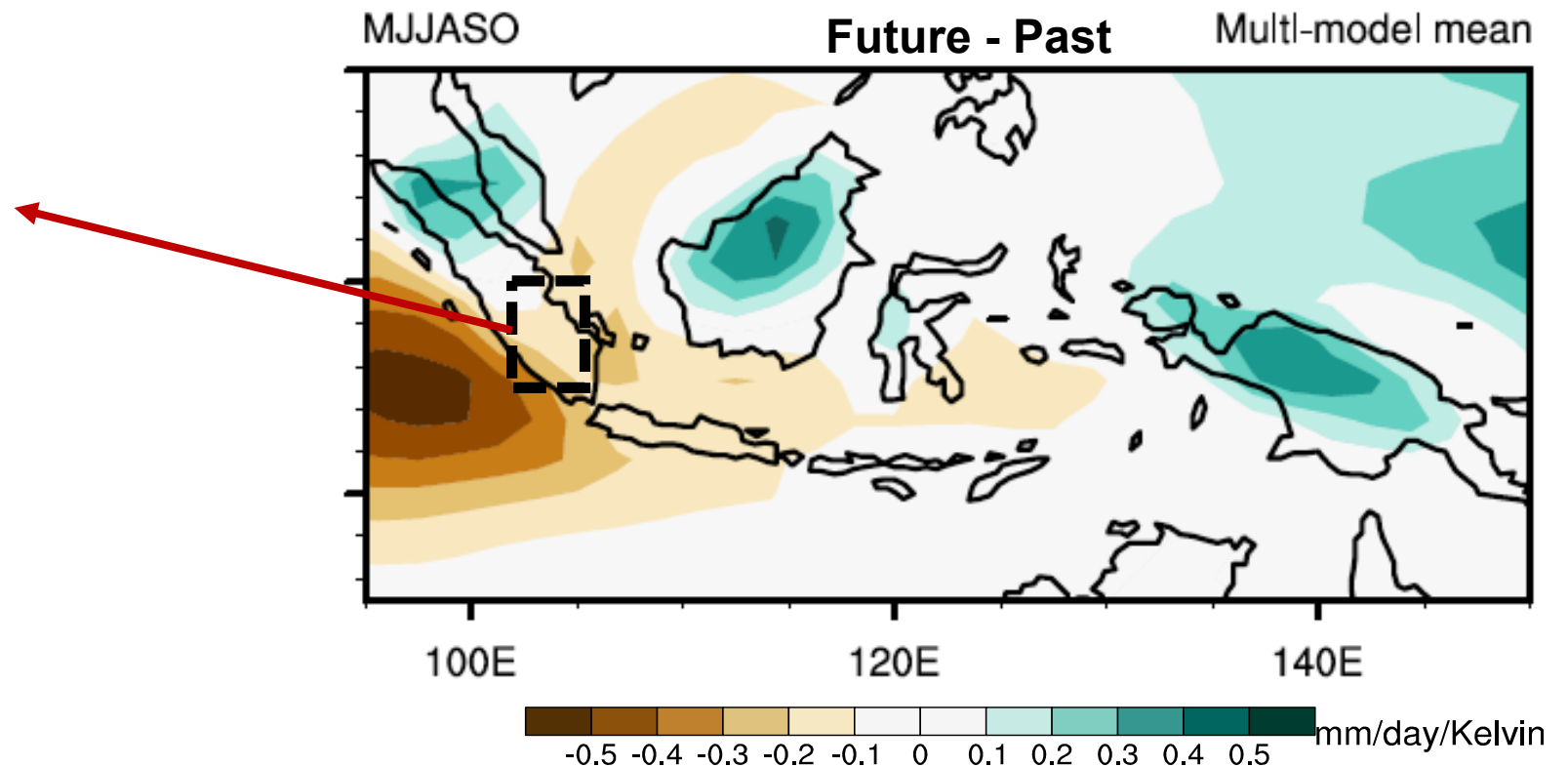
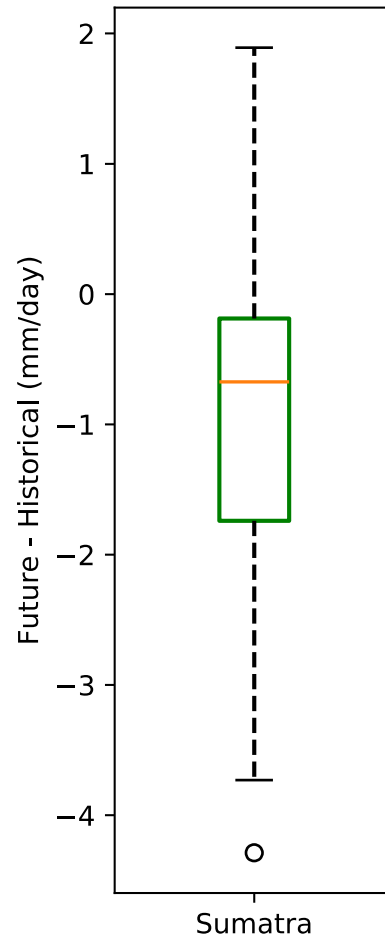
# Large uncertainty in future rainfall over Maritime continent under global warming

**Future:** 2070-2100 (SSP585)

**Past:** 1930-1960

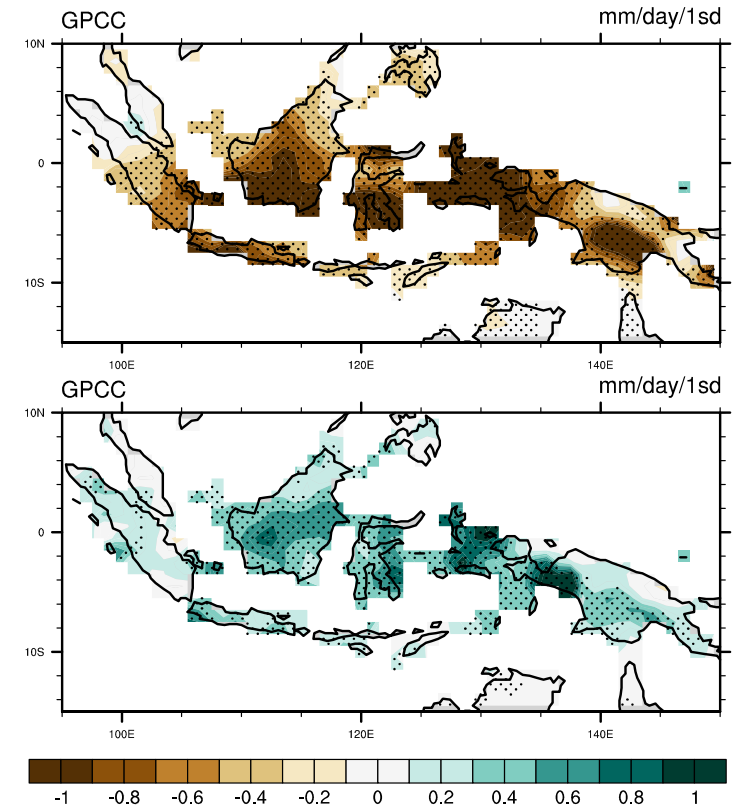
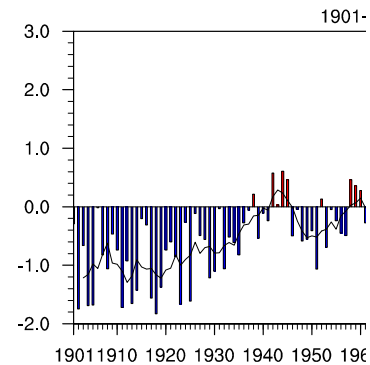
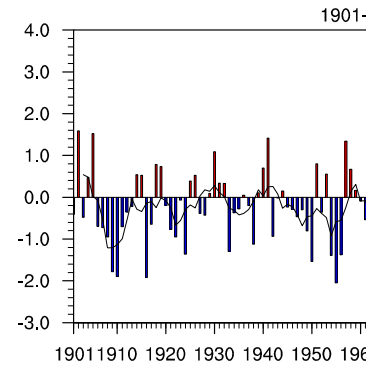
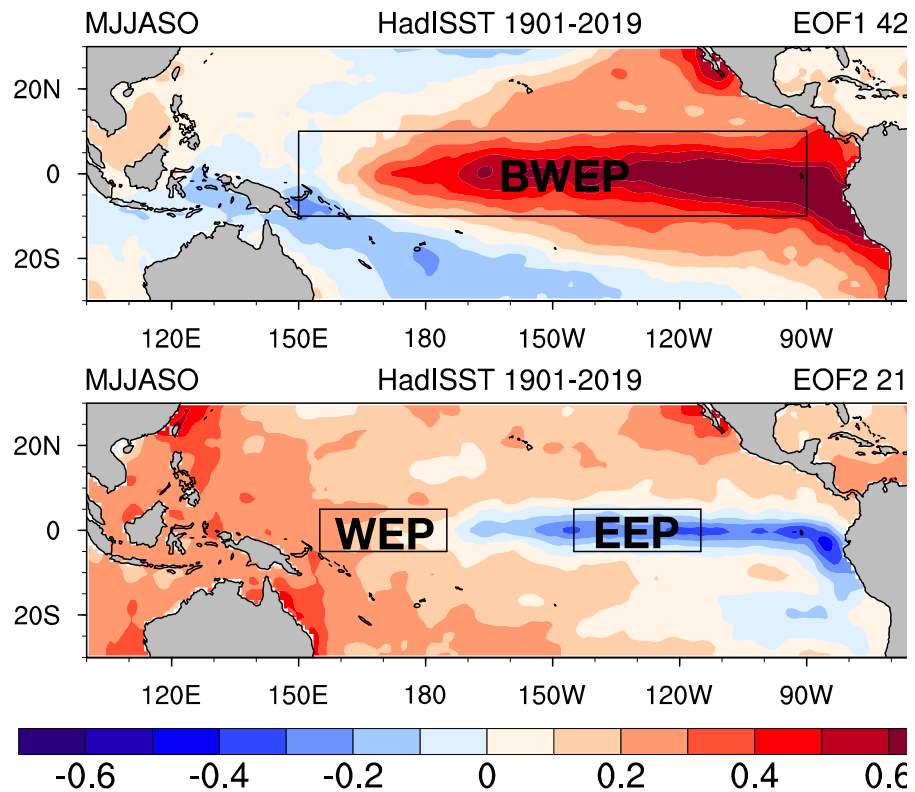
38 CMIP6 models

**Sumatra**



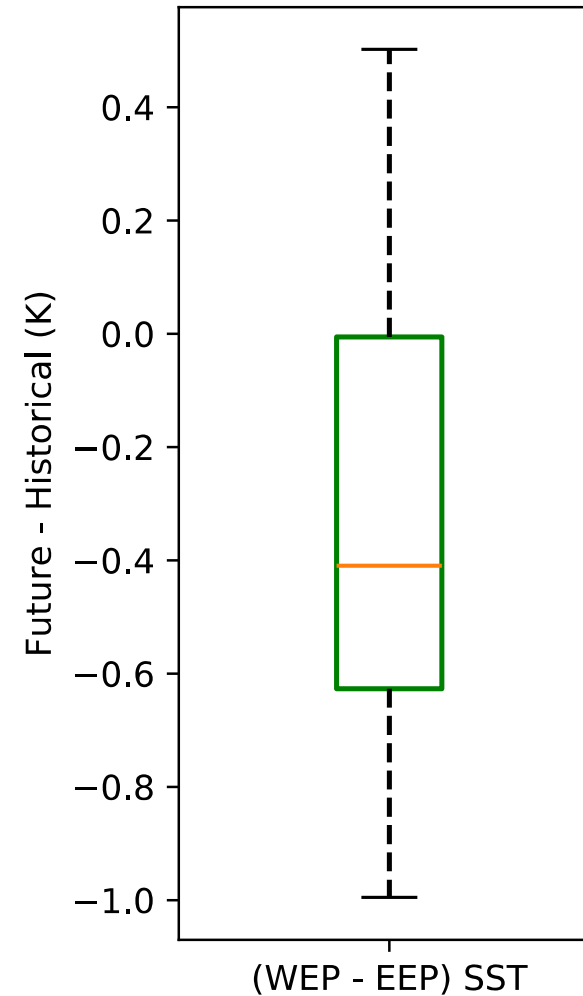
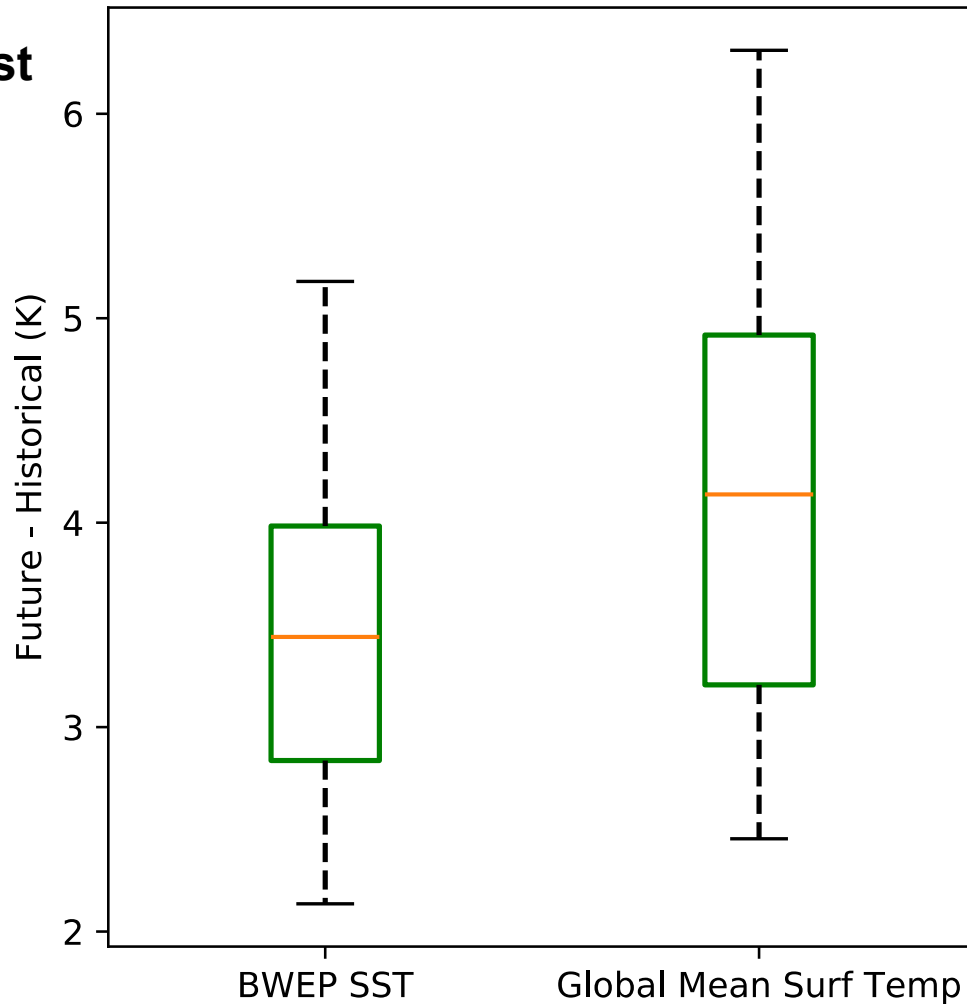
# Tropical Pacific Sea Surface Temperature (SST) drive Maritime Continent dry period rainfall

## Observed Relation



# Uncertain Evolution of Tropical Pacific SST in the climate models

**Future - Past**  
MJJASO



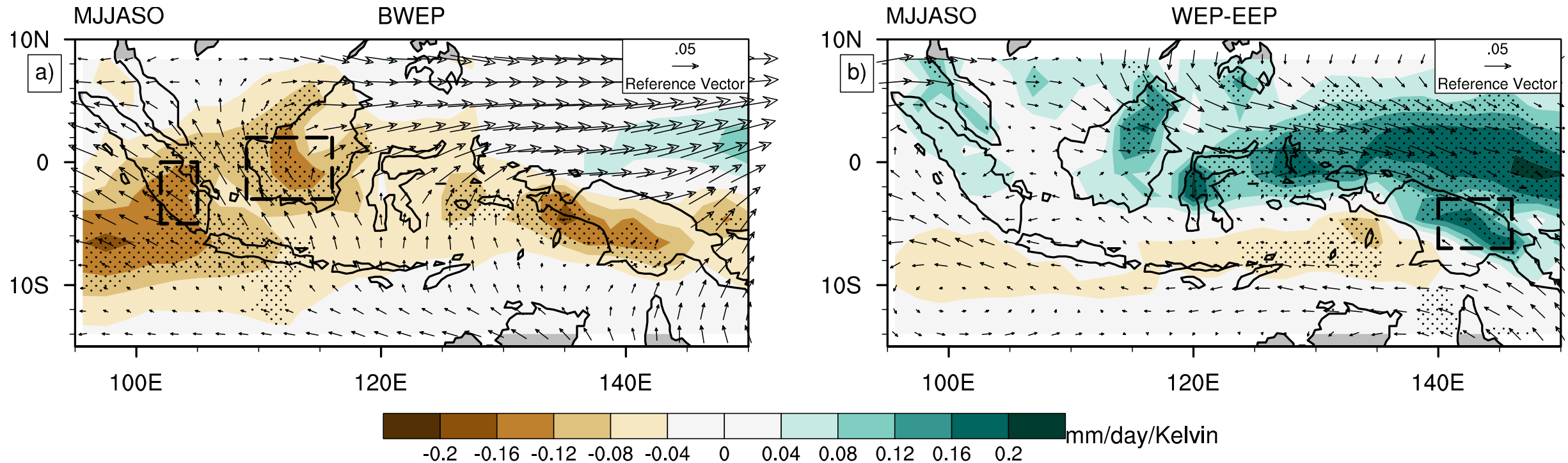


# Multiple Linear Regression (MLR) model

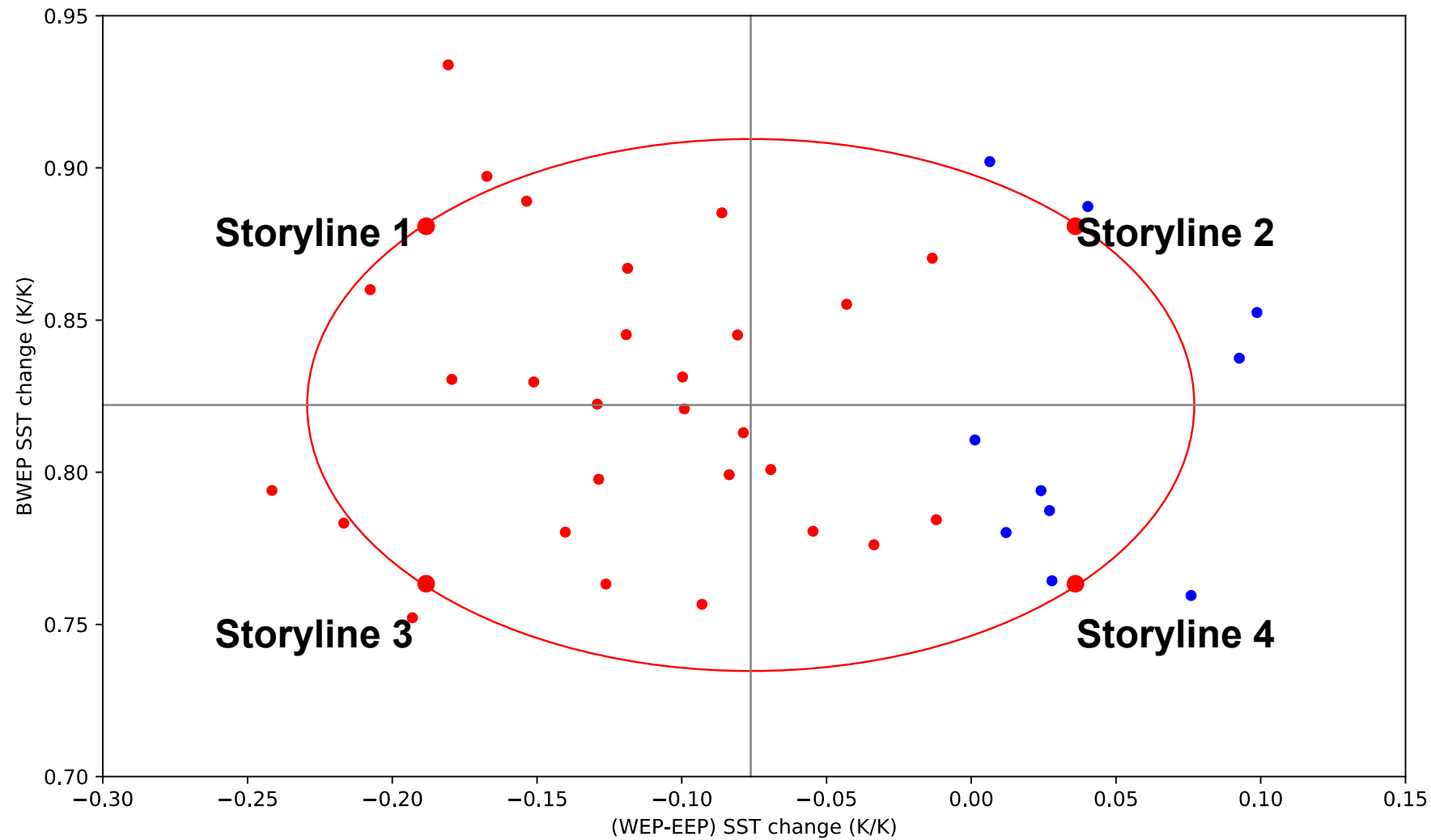
following Zappa & Shepherd, 2017

$$(\Delta P / \Delta T_{\text{GMST}})_m = a + b (\Delta T_{\text{BWEp}} / \Delta T_{\text{GMST}})'_m + c (\Delta T_{\text{WEP-Ep}} / \Delta T_{\text{GMST}})'_m + e_m$$

# MC precipitation response to the uncertainty in tropical Pacific SST drivers

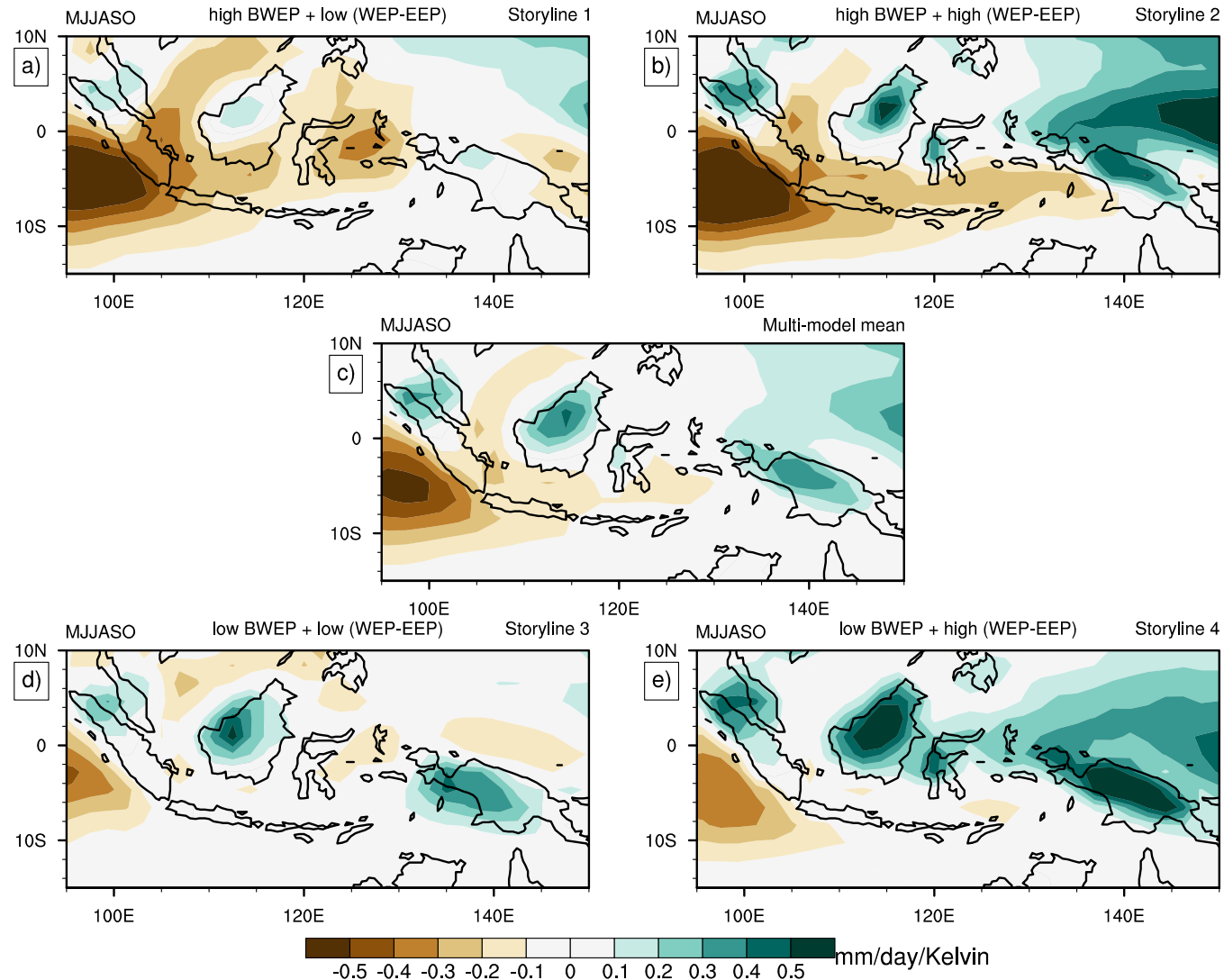


# Choosing the state of the drivers for Storylines

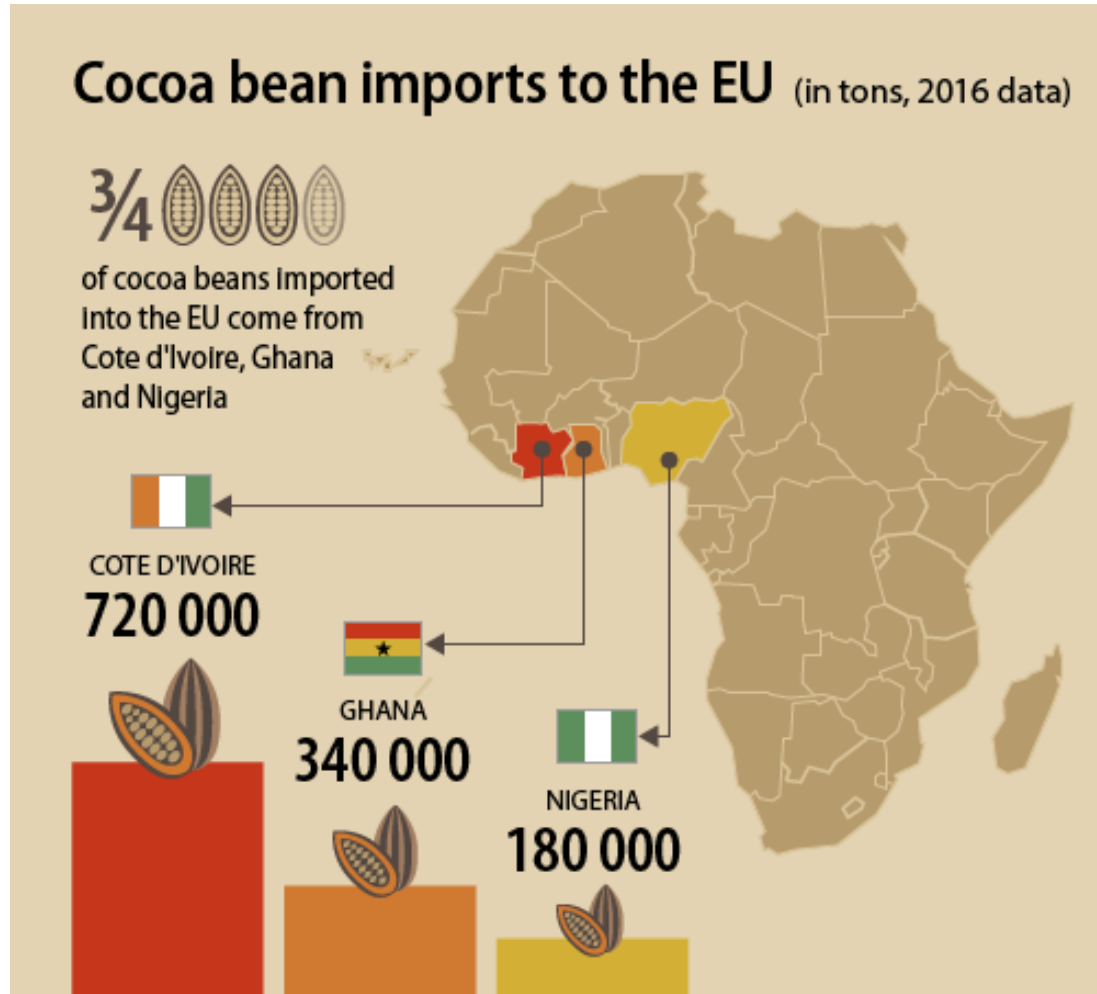




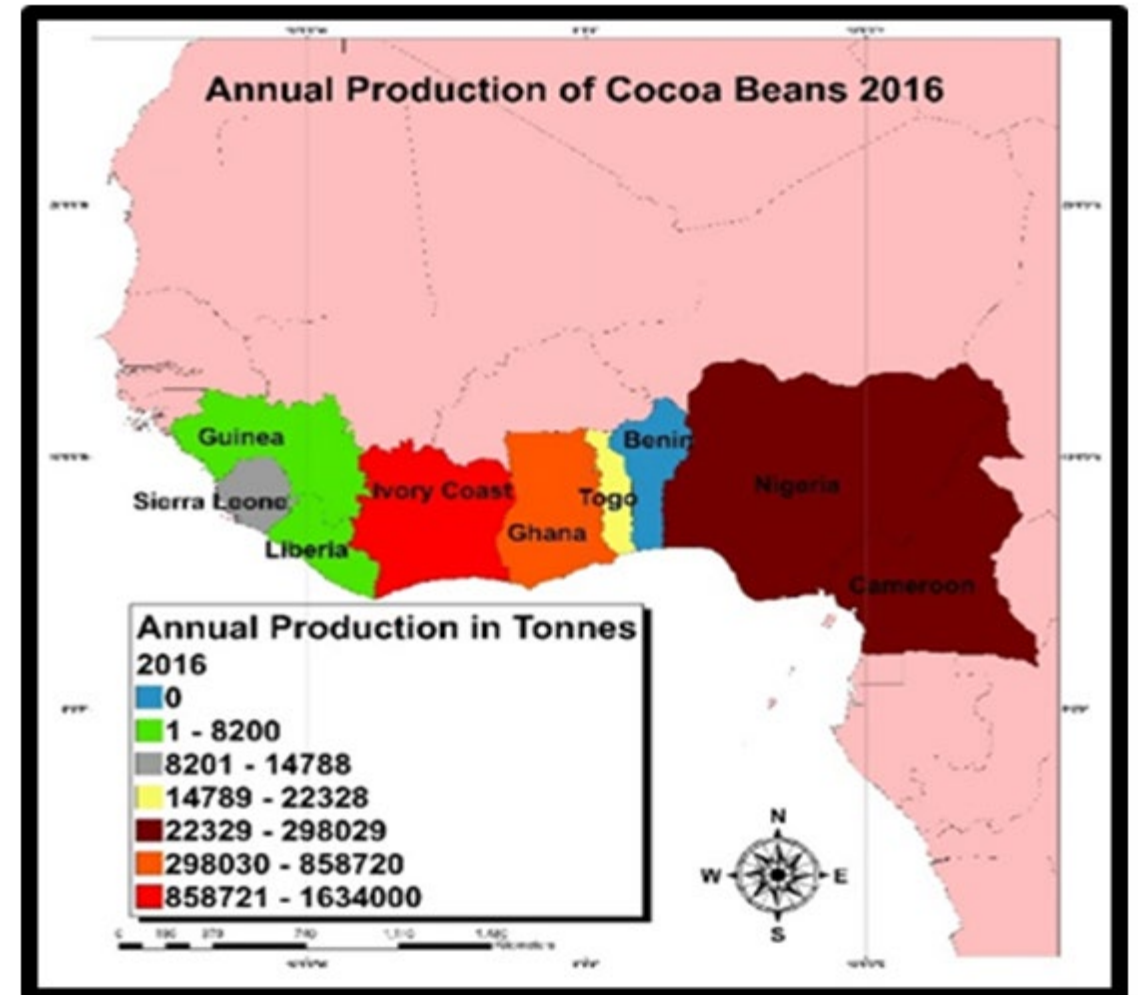
# Future storylines of Maritime continent dry period precipitation changes



# EU's Cocoa dependence on West Africa



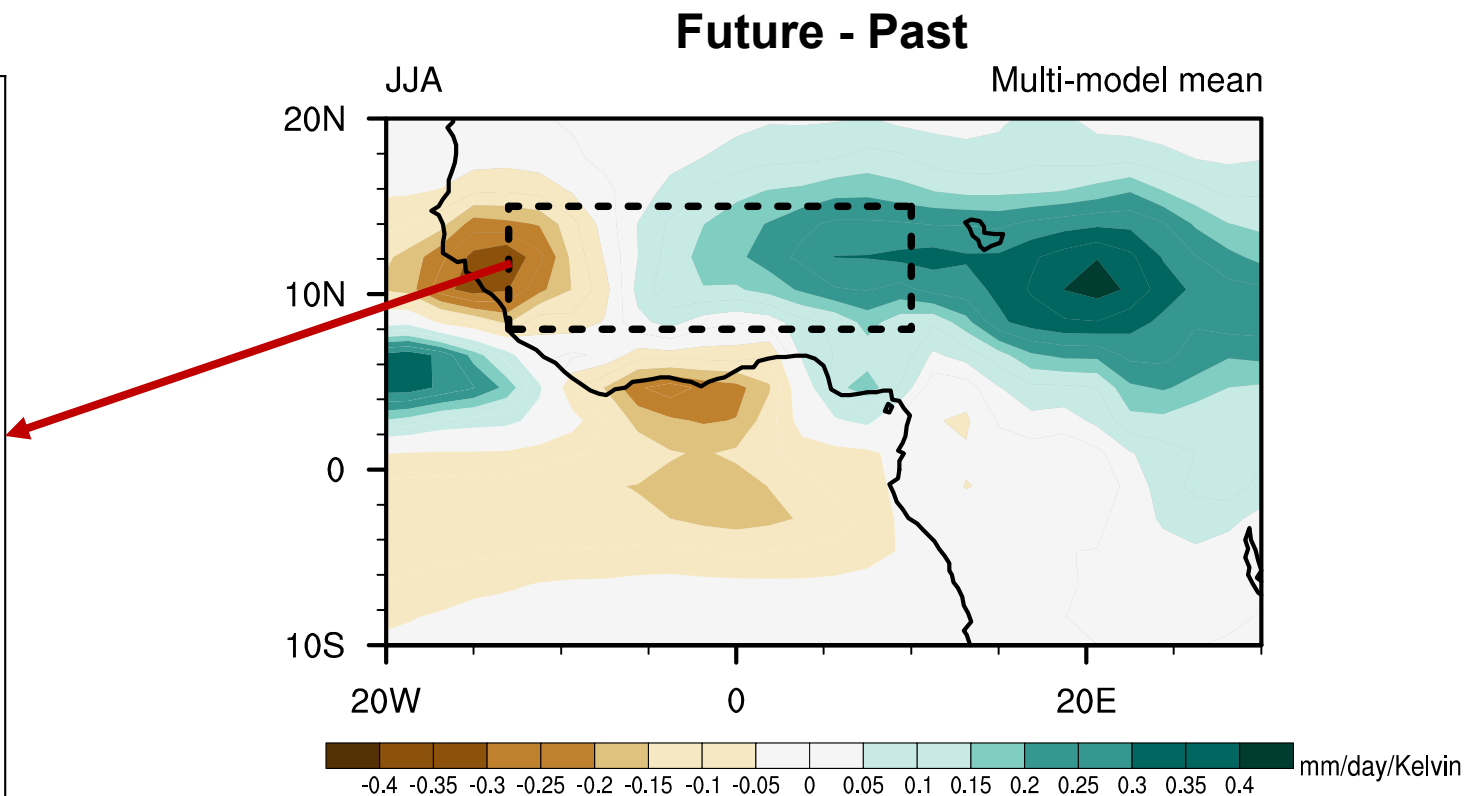
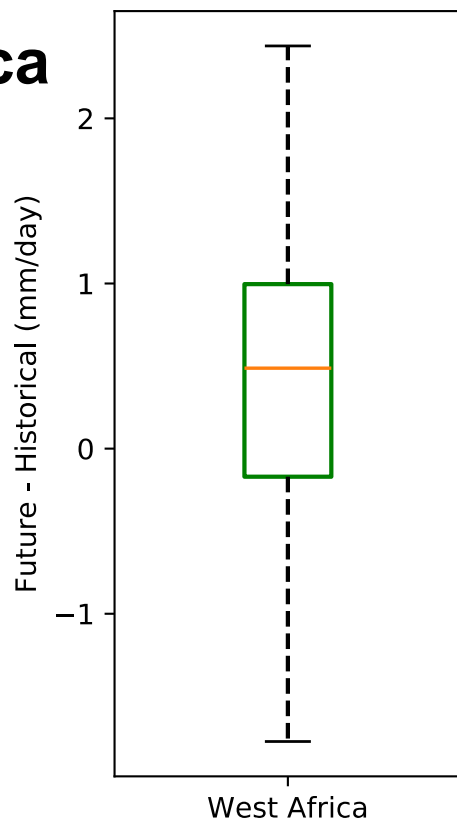
[ec.europa.eu/eurostat](http://ec.europa.eu/eurostat)



Merem et.al., 2020

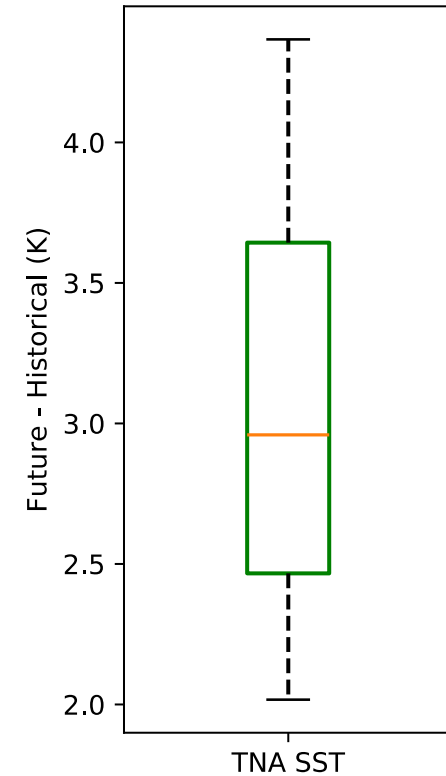
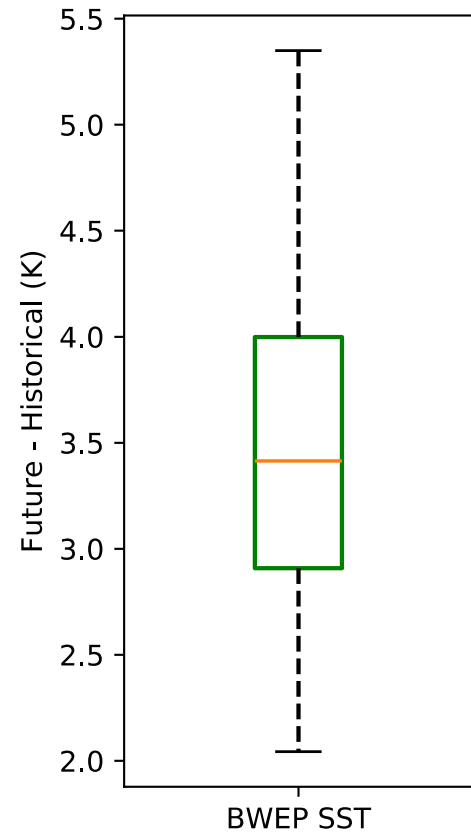
# Large uncertainty in future Western Africa summer rainfall under global warming

## West Africa

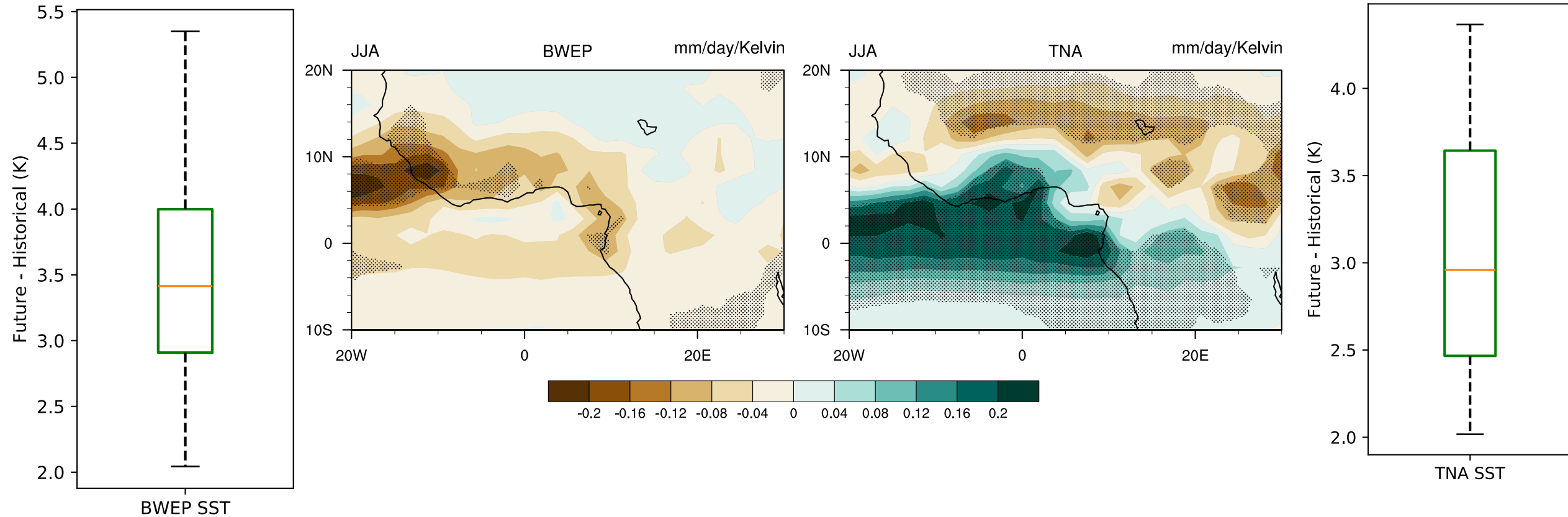




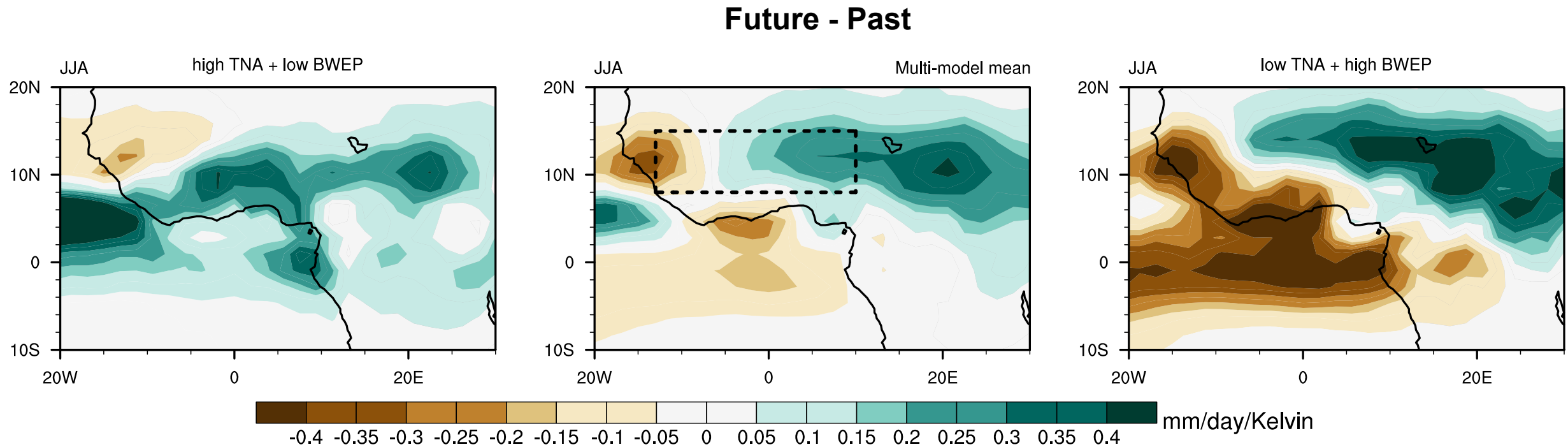
# Uncertainty in the potential SST drivers of the Western Africa summer rainfall



# Uncertainty in the potential SST drivers of the Western Africa summer rainfall

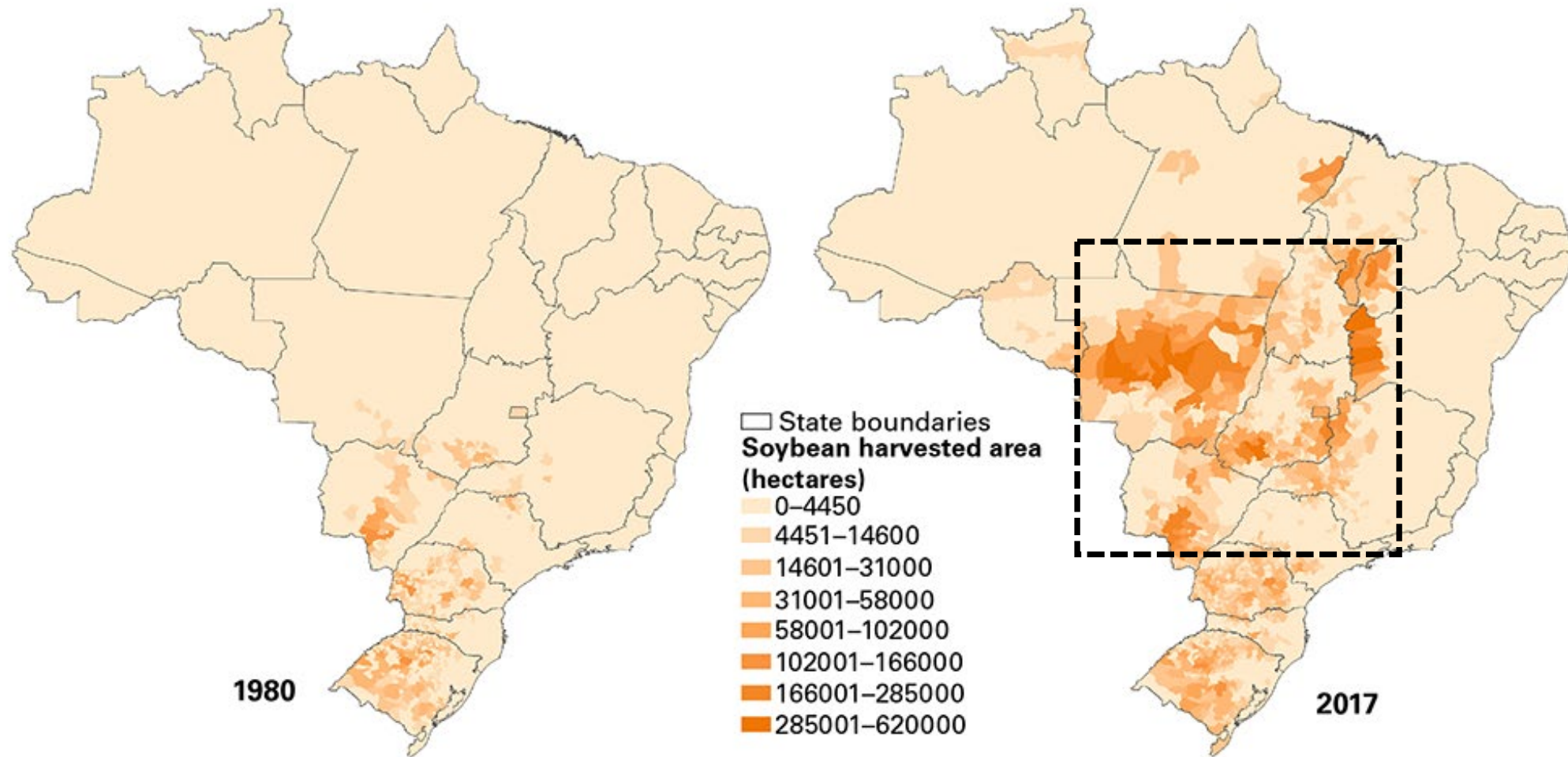


# Two extreme storylines of West African summer rainfall



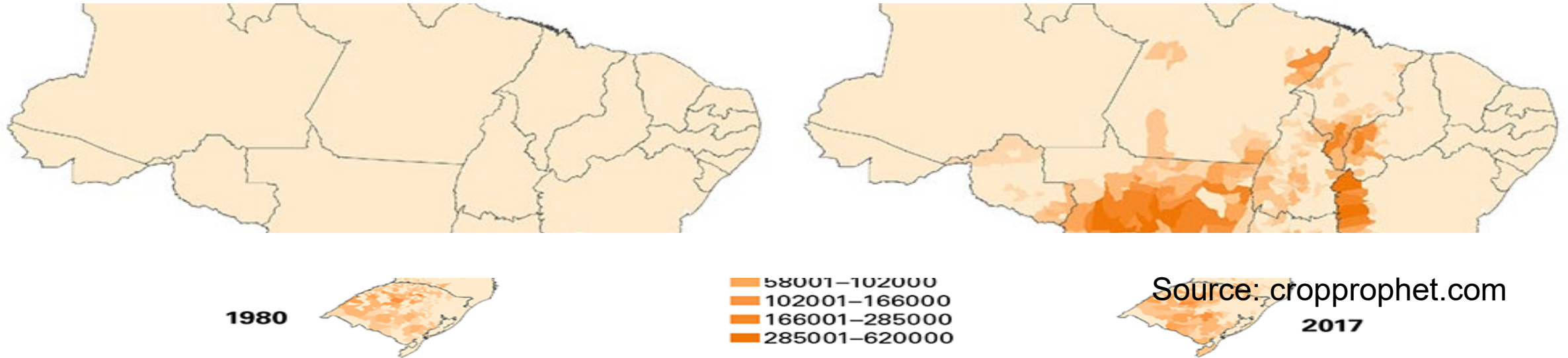


# Soy producing region in Brazil



Source: Brazilian Institute of Geography and Statistics (IBGE)

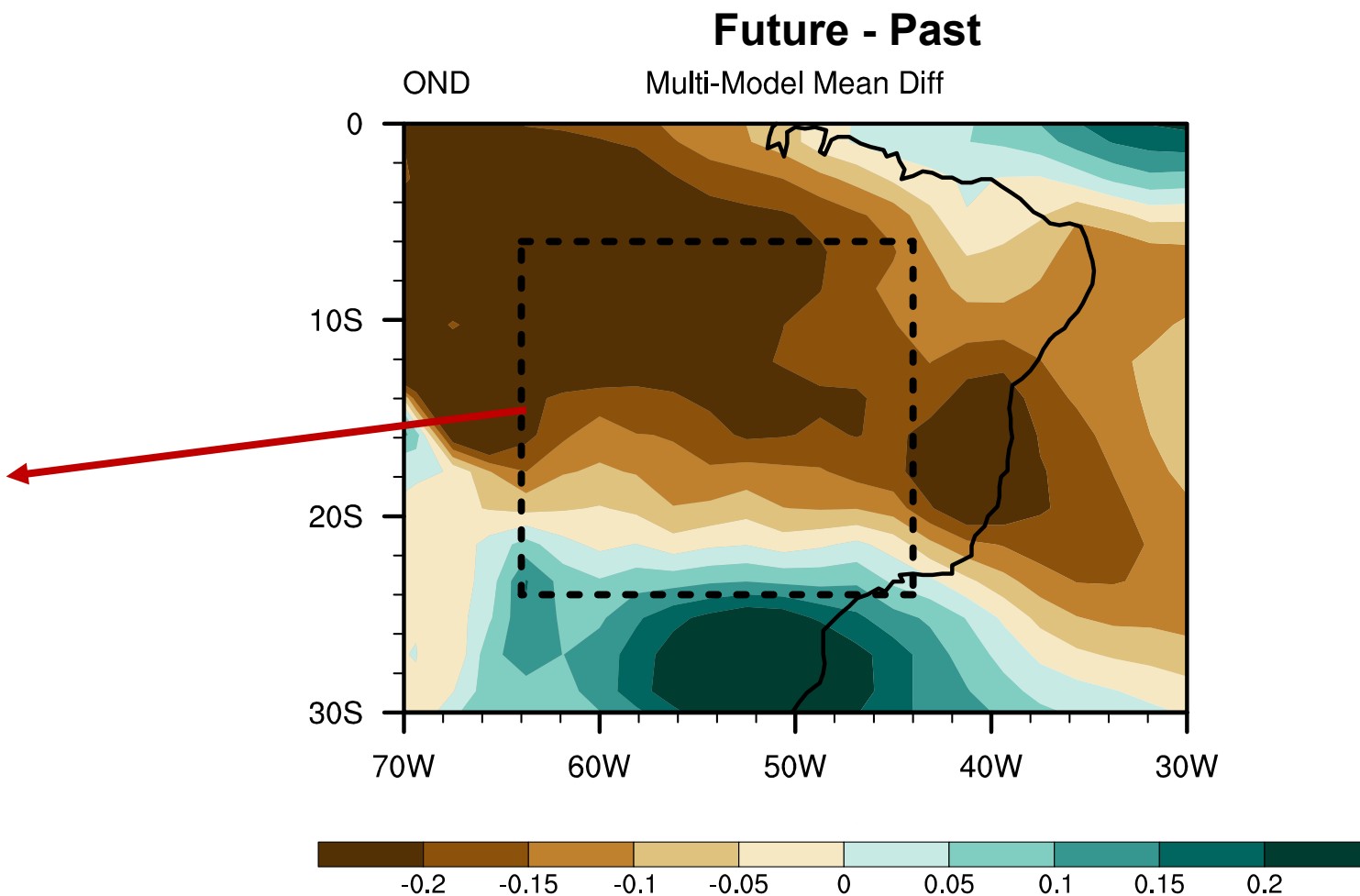
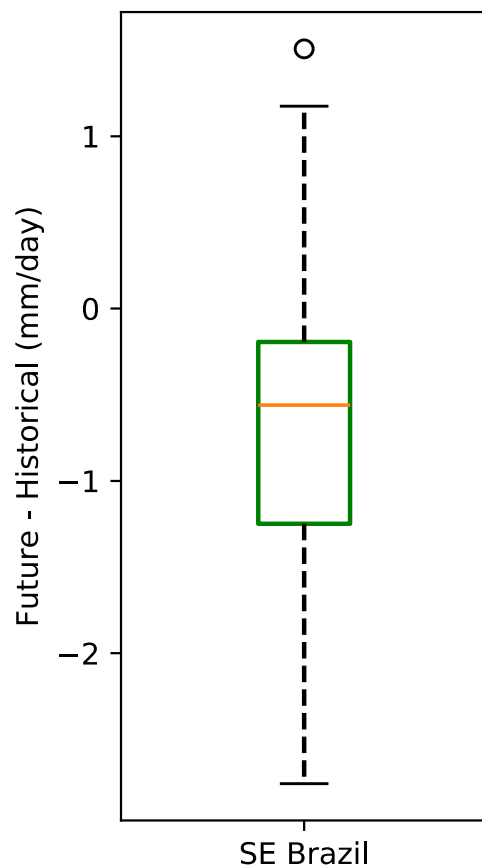
# Crop Calendar of Brazil



# Large uncertainty in future South-east Brazil spring rainfall under global warming

OND – Soy Plantation

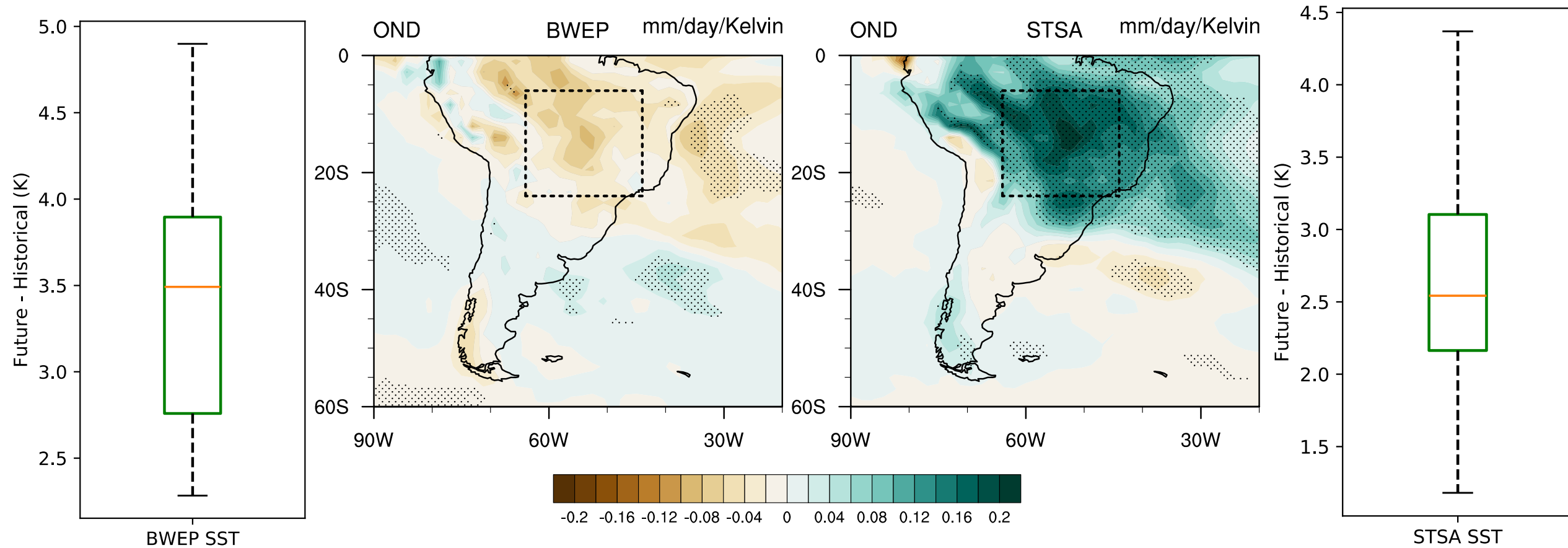
South-east  
(SE) Brazil





# Uncertainty in the potential SST drivers of the SE Brazil spring rainfall

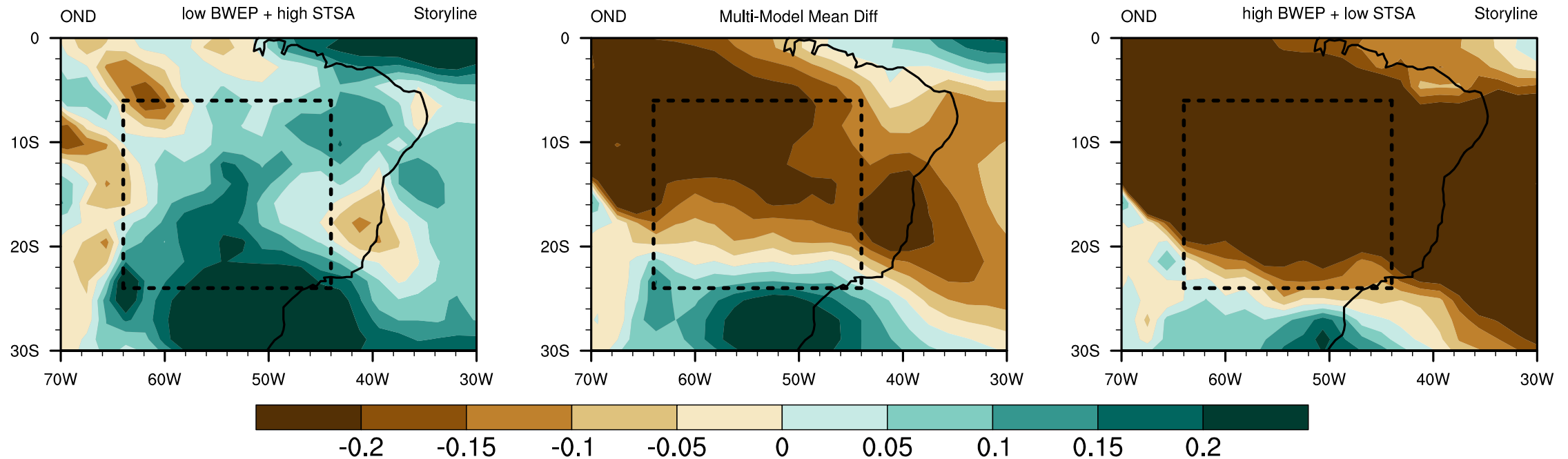
OND – Soy Plantation



# Two extreme storylines of south-east Brazil spring rainfall

OND – Soy Plantation

**Future - Past**



# Conclusions

- 1) Different possible evolutions in the oceanic drivers (uncertainty) lead to different potential changes in the tropical precipitation regimes (Storylines).
- 2) Potential socio-economic risks associated with each evolution Storylines could be different.
- 3) Looking at the multi-model-mean changes could lead to underestimation of physically plausible future risk.

Rohit Ghosh and Theodore G Shepherd 2023 Storylines of Maritime Continent dry period precipitation changes under global warming *Environ. Res. Lett.* 18 034017

Thank you

Receipt