A multi-physics ensemble over the CORDEX-Africa domain

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Thanks to:

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M.E.Magariño

Outline

1. Objectives
2. Data
3. Results
    - 3.1. Main differences among the ensemble members
    - 3.2. Seasonal cycle
    - 3.3. Interannual variability
4. Conclusions

Outline

Objectives

- To study the effect of different WRF schemes in Africa.

- To analize if WRF is able to reproduce the seasonal cycle and interannual variability.

Objectives

The area of study is the the African domain.

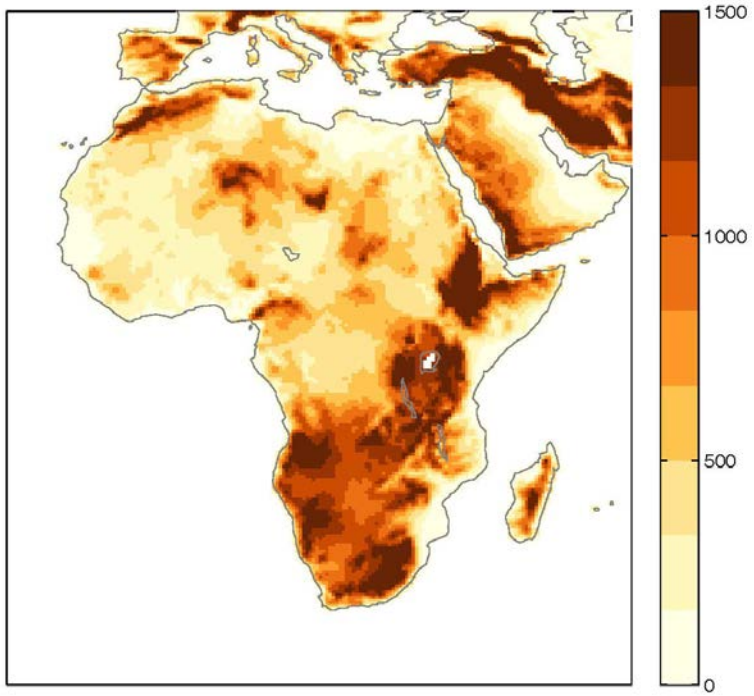


Fig.1: *Domain used for all the simulations. The altitude (m) is shown.*

Outline

Data

Observations:

CRU[1] 3.1:

Monthly gridded fields based on daily values.

0.5x0.5 degree.

It has been used for **maximum and minimum temperatures**.

TRMM[2] 3B43:

The Tropical Rainfall Measuring Mission (TRMM) is a joint U.S.-Japan satellite mission to monitor tropical and subtropical monthly precipitation.

0.25x0.25 resolution.

It has been used for **precipitation**.

[1]University of East Anglia Climatic Research Unit (CRU). [Phil Jones, Ian Harris]. CRU Time Series (TS) high resolution gridded datasets, [Internet]. NCAS British Atmospheric Data Centre, 2008, *Date of citation*. Available from http://badc.nerc.ac.uk/view/badc.nerc.ac.uk__ATOM__dataent_1256223773328276

[2]Huffman, G.J., R.F. Adler, D.T. Bolvin, G. Gu, E.J. Nelkin, K.P. Bowman, Y. Hong, E.F. Stocker, D.B. Wolff, 2007: The TRMM Multi-satellite Precipitation Analysis: Quasi-Global, Multi-Year, Combined-Sensor Precipitation Estimates at Fine Scale. J. Hydrometeor., **8**:38-55.

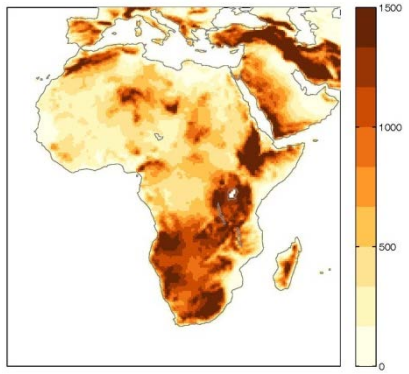
Data

Observations: CRU and TRMM

WRF Multiphysics experiments

8 different multiphysics experiments

WRF 3.3.1.
African CORDEX domain
Period: 2002-2006
Resolution: 50 km
Mercator Projection



	CU			BL		MP		LS		HIDR		LUSE	
	KF	BM	GD	YS	PX	W5	W3	NO	RU	NH	HR	MO	AV
CTRL	O			O		O		O		O		O	
CUBM	O			O		O		O		O		O	
CUGD	O			O		O		O		O		O	
BLAC	O			O		O		O		O		O	
MP3C	O			O		O		O		O		O	
AVNO	O			O		O		O		O		O	
AVRU	O			O		O		O		O		O	
HIDR	O			O		O		O		O		O	

Kain-Fritsch
Betts-Miller-Janjic
Grell-Devenyi
Yonsei University
Assymetric Convective Model 2 (Pleim)
WSM Single moment 5-class
WSM 3-class simple ice scheme
Noah Land Surface model
RUC Land Surface model
No hydrostatic
Hydrostatic
MODIS
AVHRR

Outline

Results

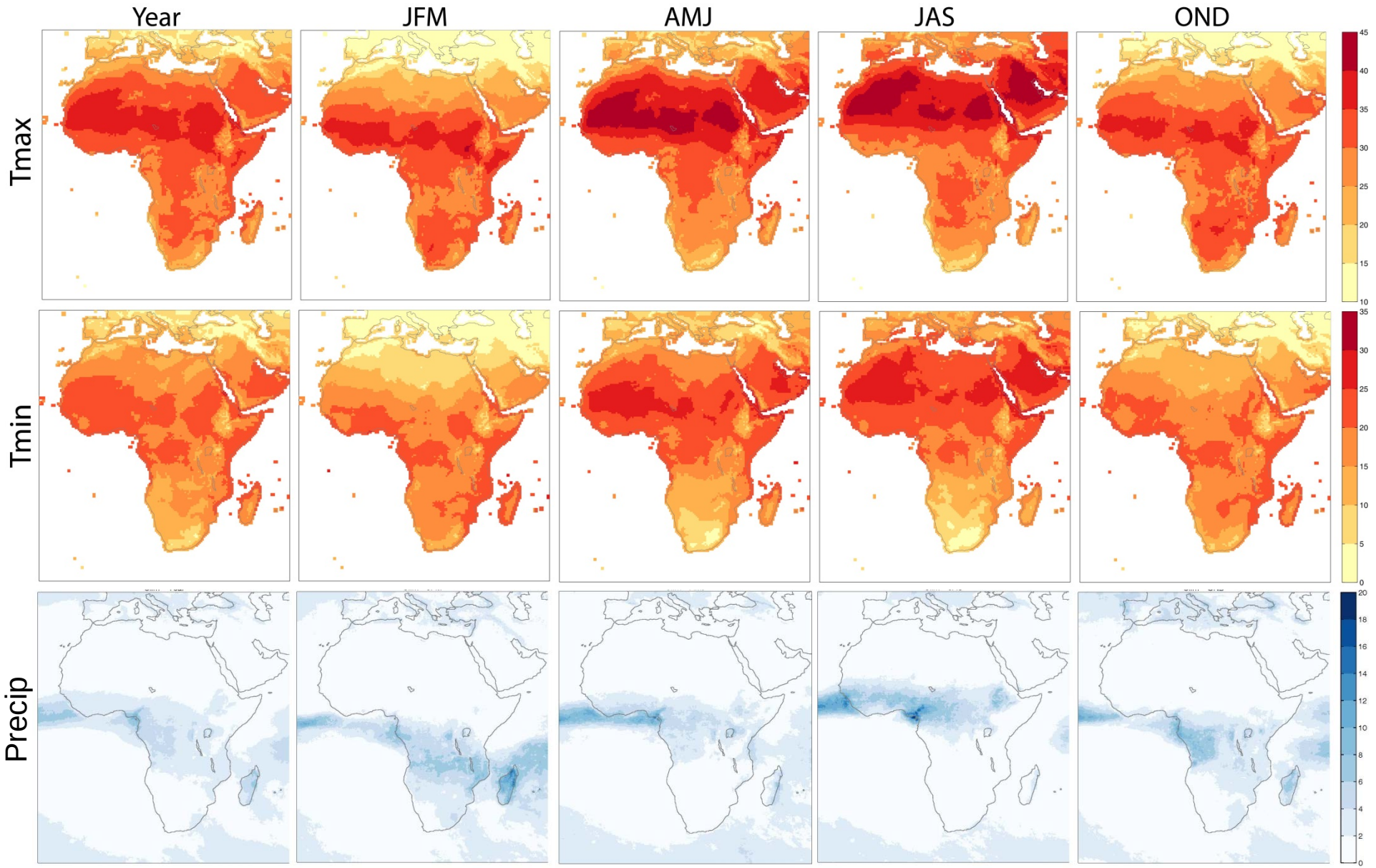


Fig 2: *Climatology for observed maximum temperature (up), minimum temperature (middle) and precipitation (low), considering CRU for temperatures and TRMM for precipitation.*

Results

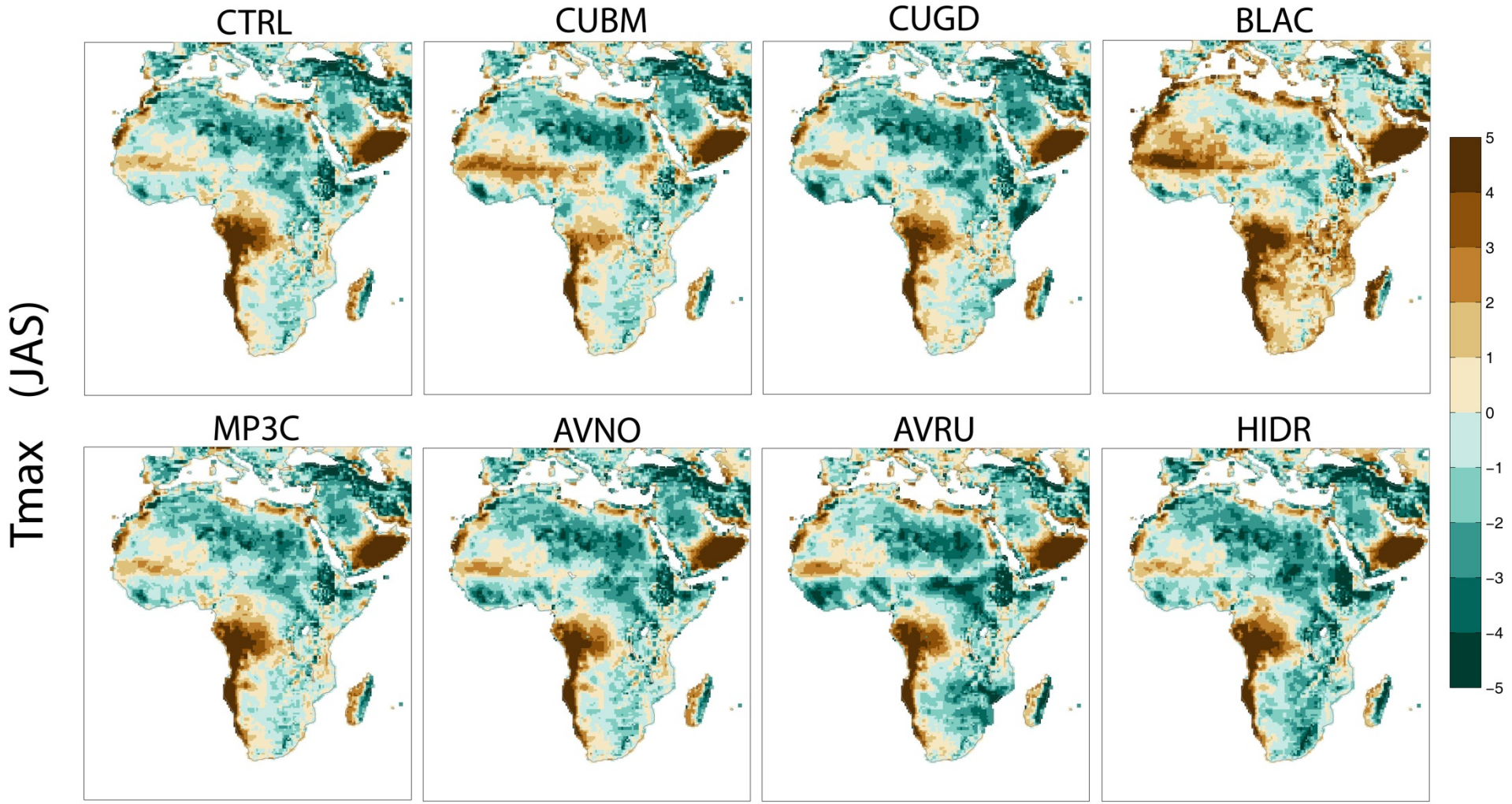


***Fig. 3**: Spatial bias distribution for maximum temperature (ºC) in boreal summer with respect to CRU (3.1) for the period 2002-2006.*

Results

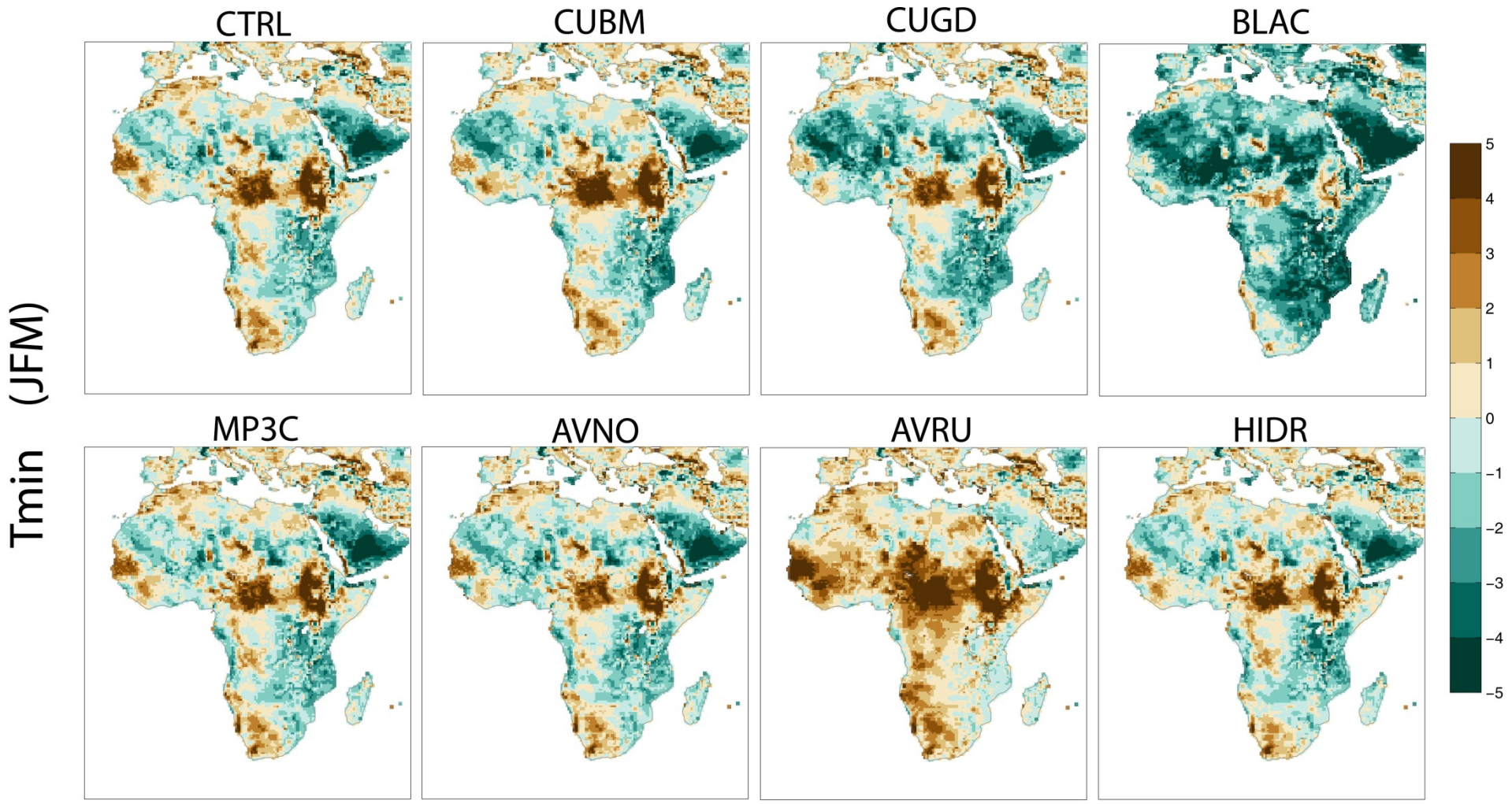


Fig. 4: *Spatial bias distribution for minimum temperature (ºC) in boreal winter with respect to CRU (3.1) for the period 2002-2006.*

Results

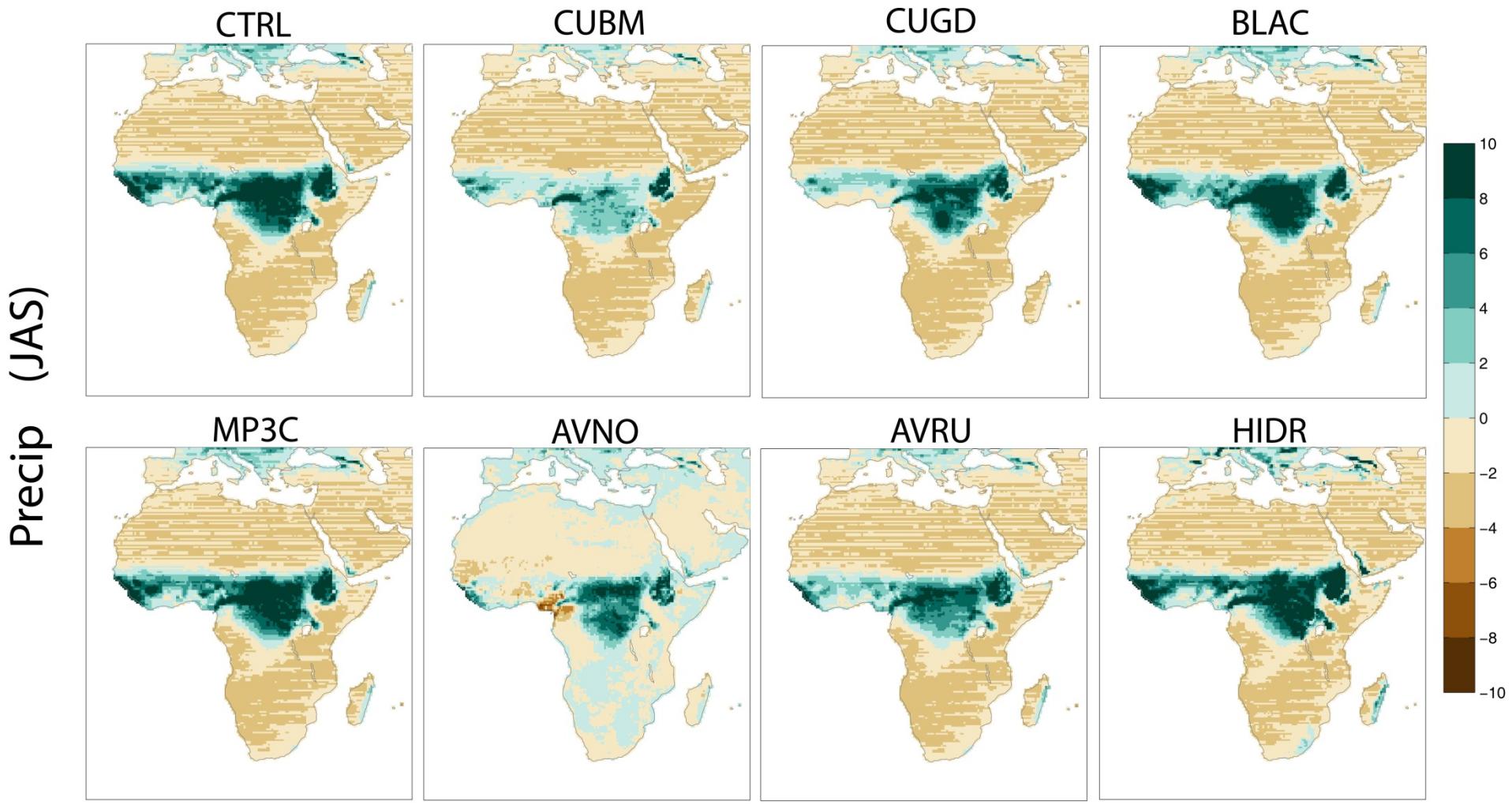


Fig. 5: *Spatial bias distribution for precipitation (mm/day) in boreal summer with respect to TRMM for the period 2002-2006.*

Outline

Results

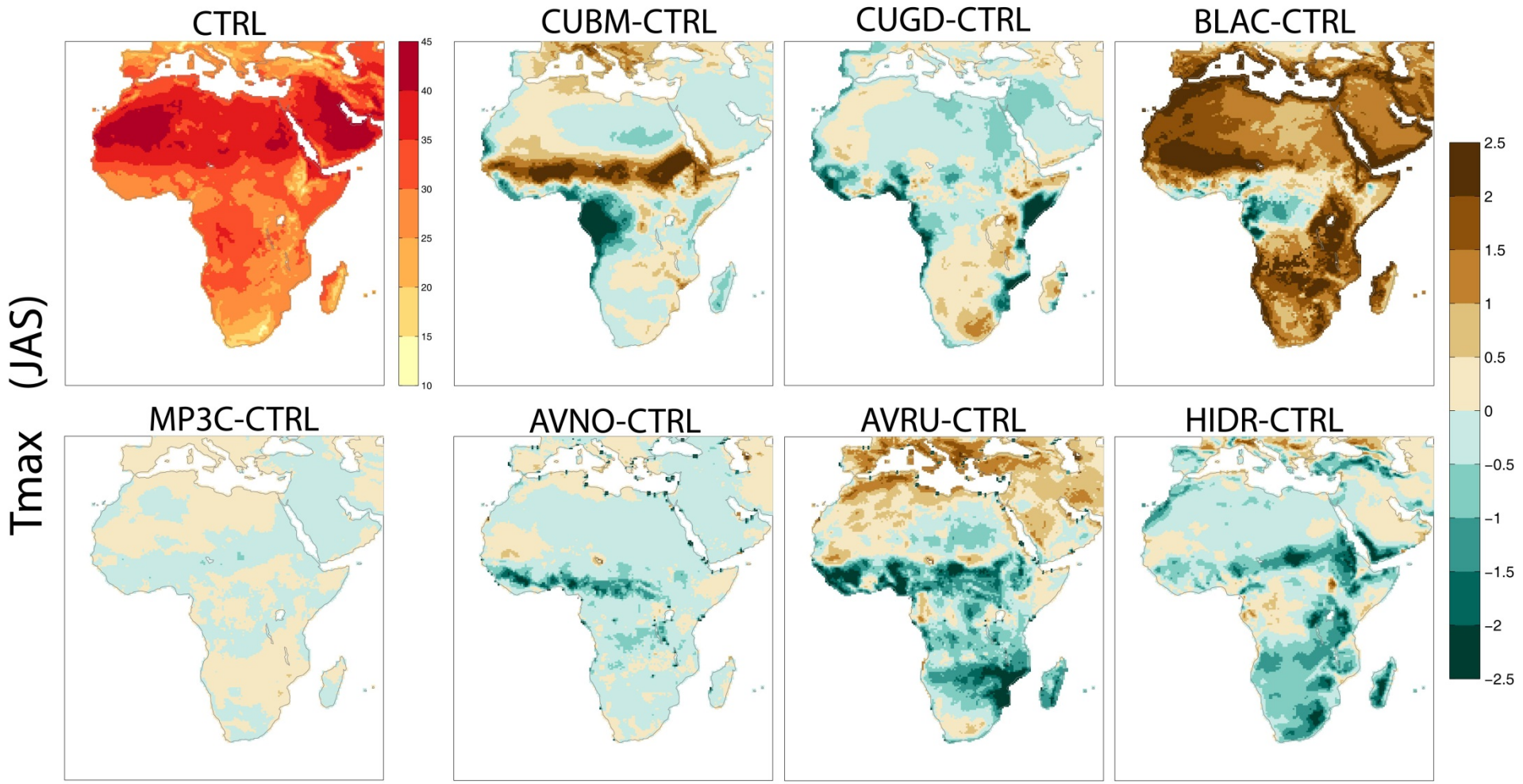


Fig. 6: *Maximum temperature (ºC) in boreal summer for the control simulation (upper left corner) and the differences with the other simulations for the period 2002-2006.*

Results

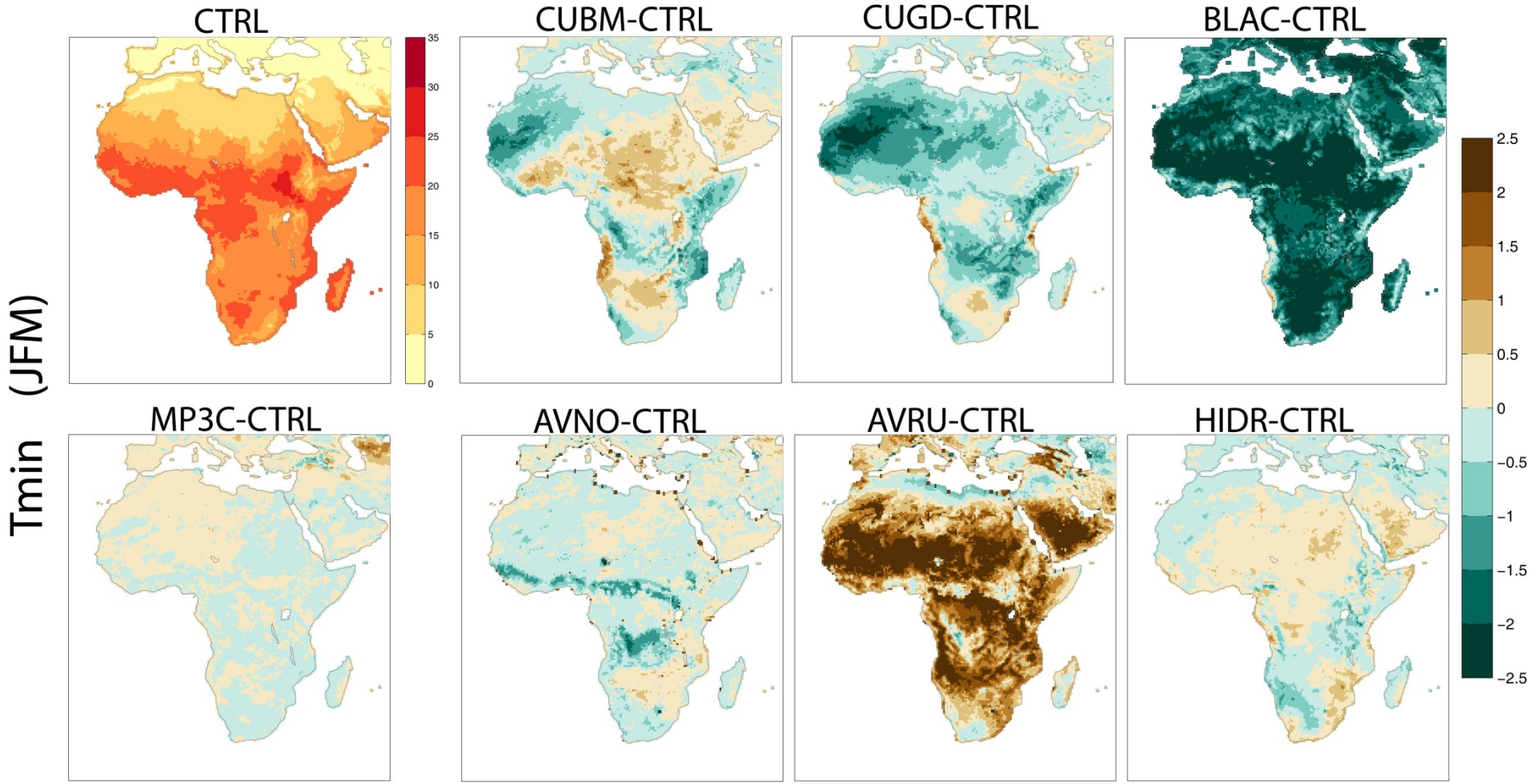


Fig 7: *Minimum temperature (ºC) in boreal winter for the control simulation (upper left corner) and the differences with the other simulations for the period 2002-2006.*

Results

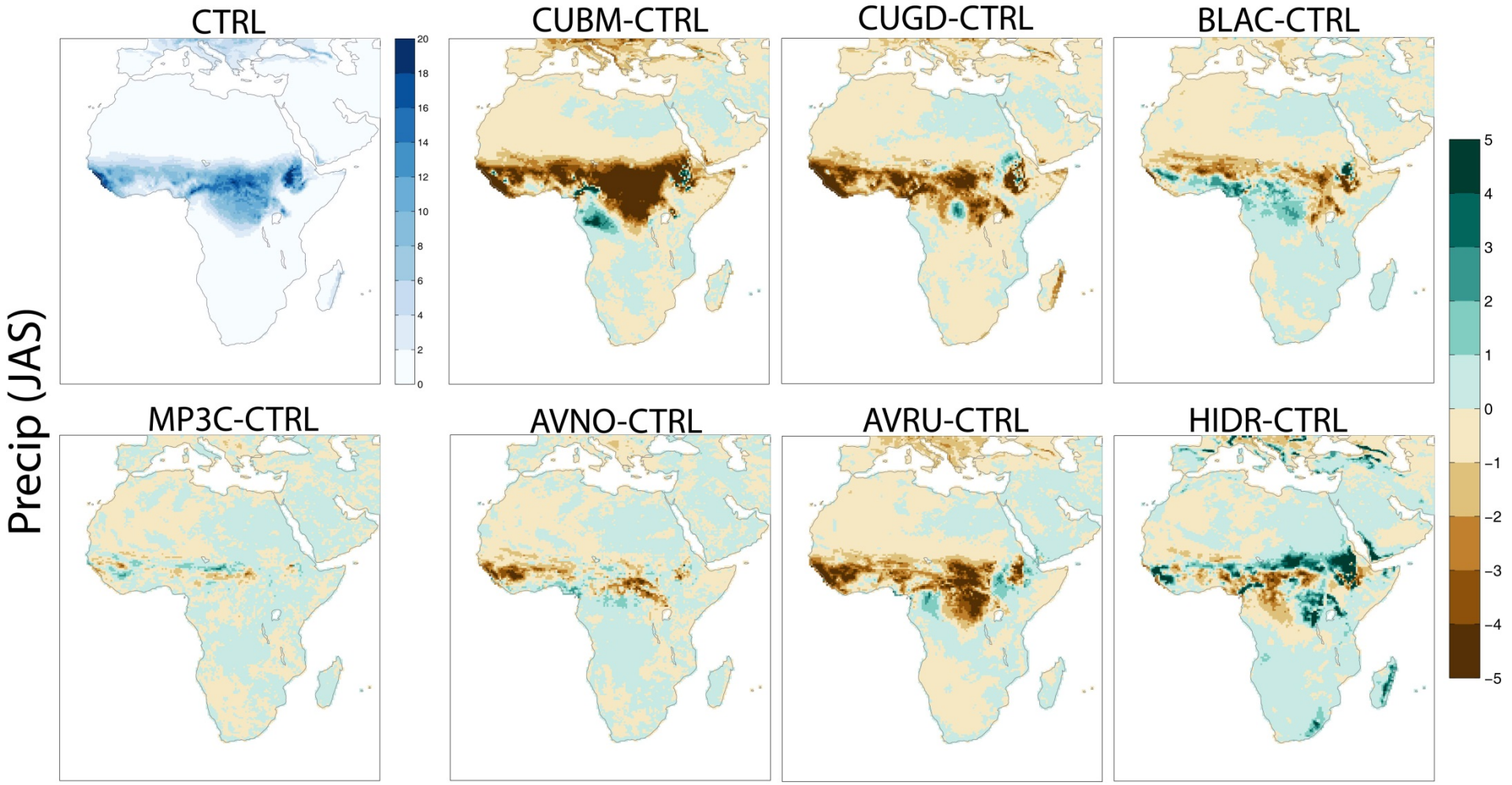
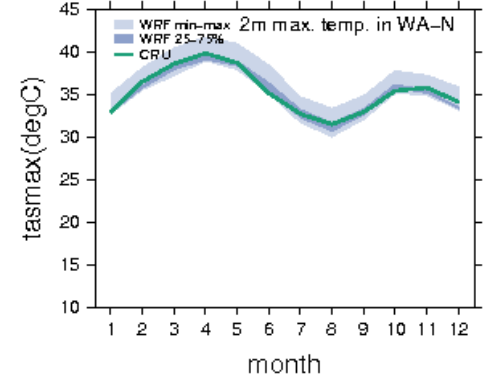
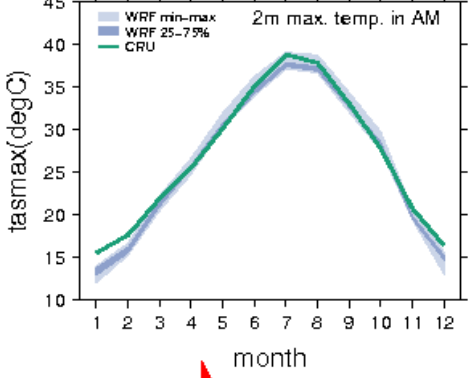


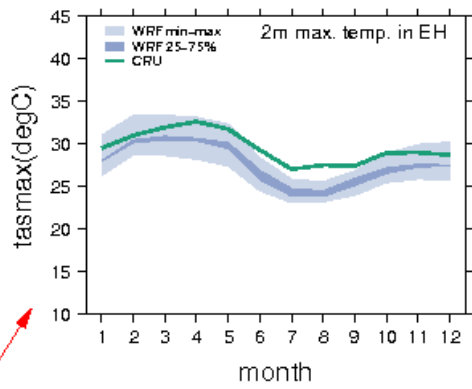
Fig. 8: *Precipitation (mm/day) in boreal summer for the control simulation (upper left corner) and the differences with the other simulations for the period 2002-2006.*

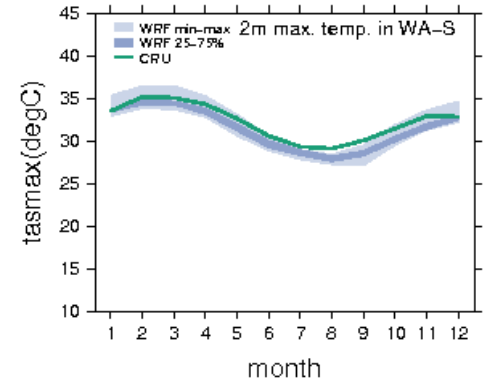
Outline

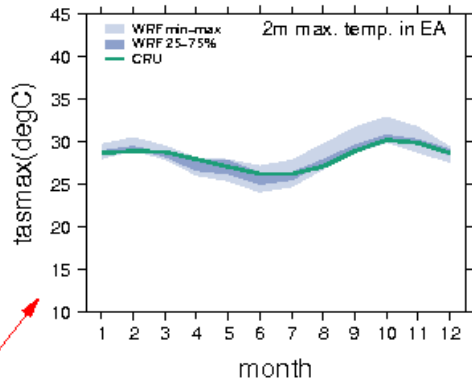
Monthly annual cycle
2m max temperature

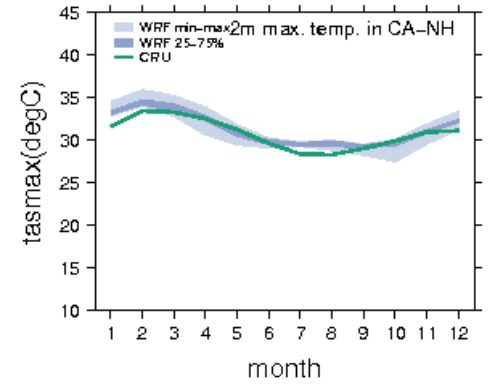


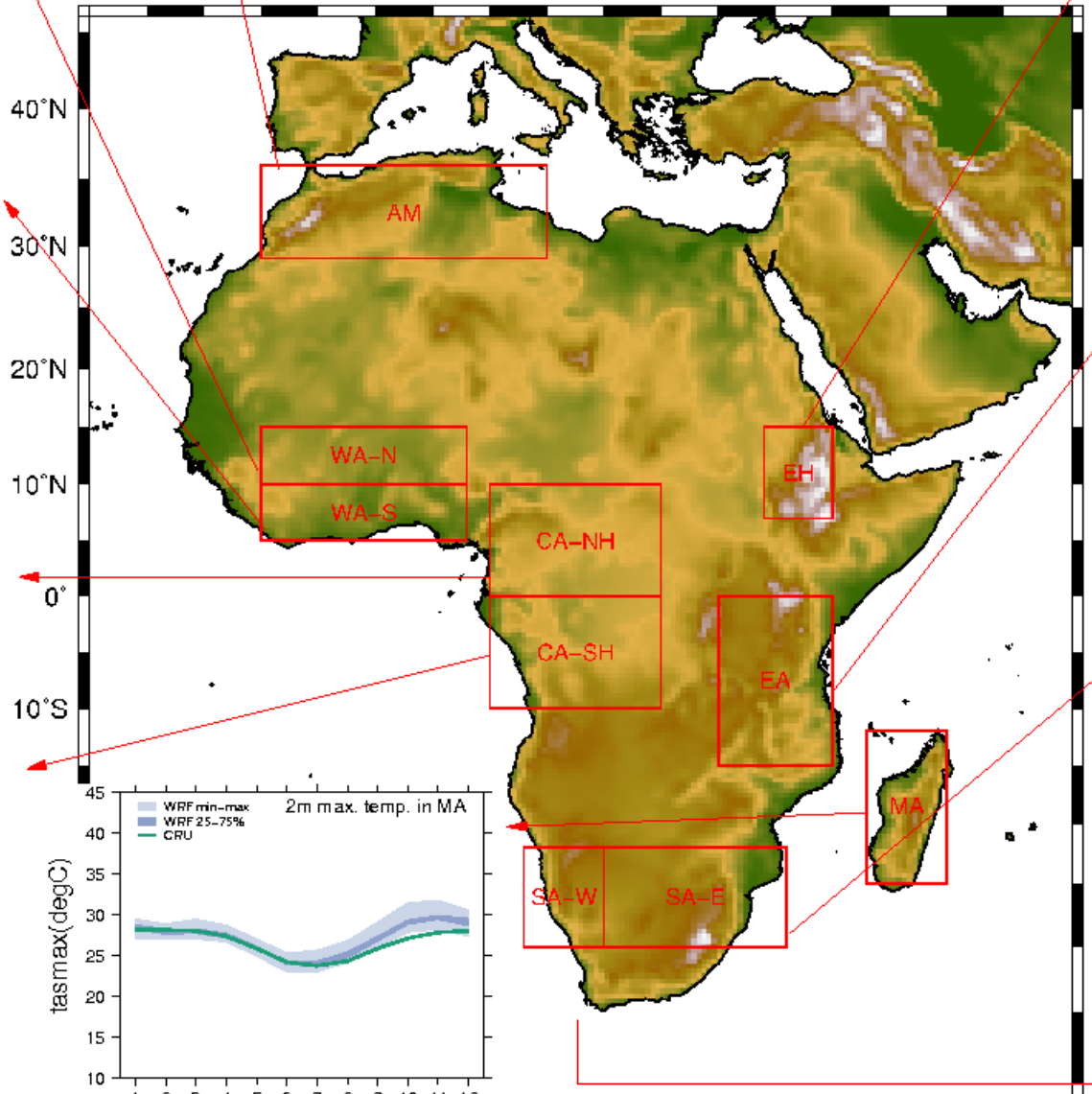


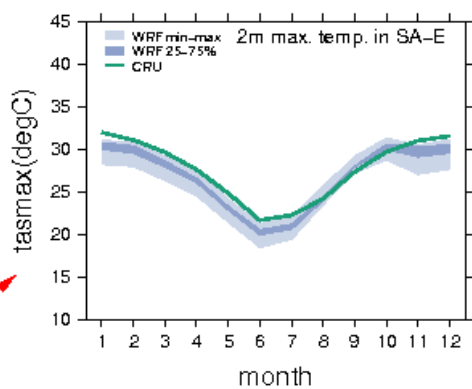


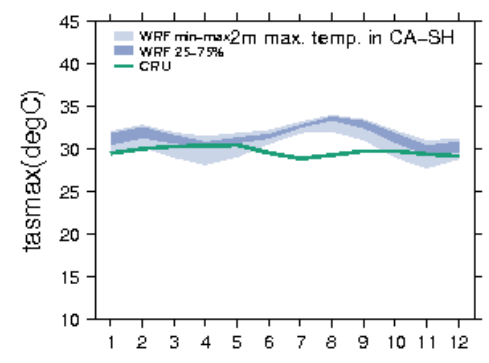


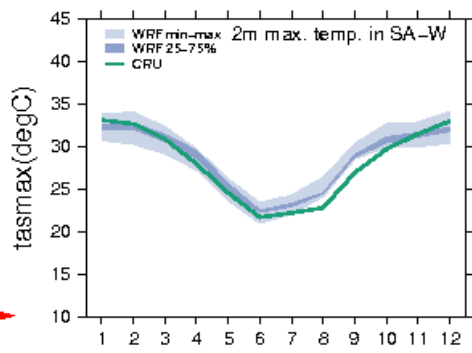




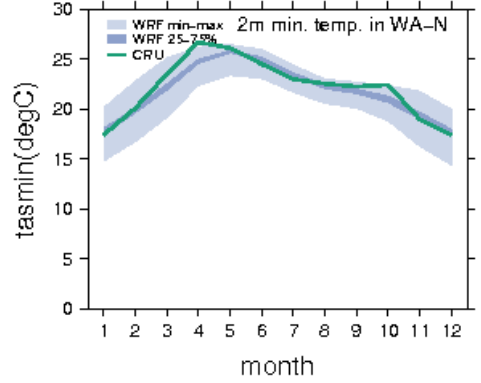


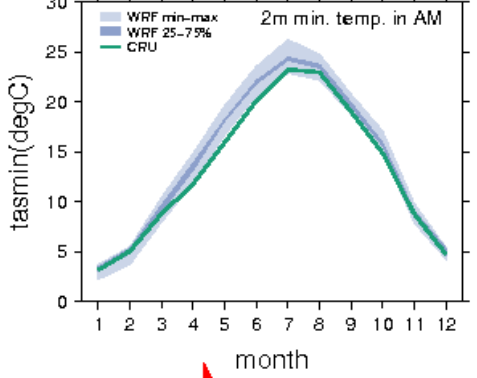


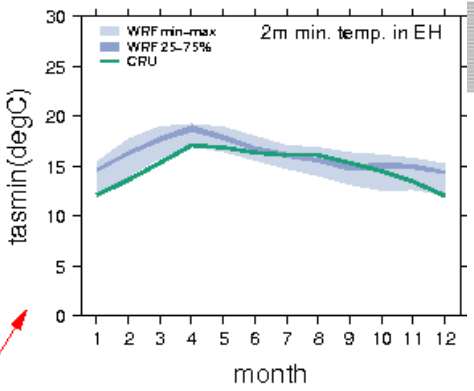


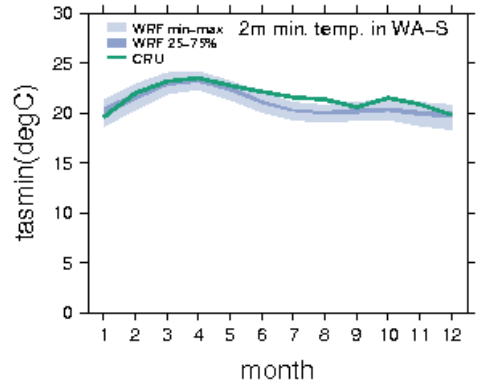


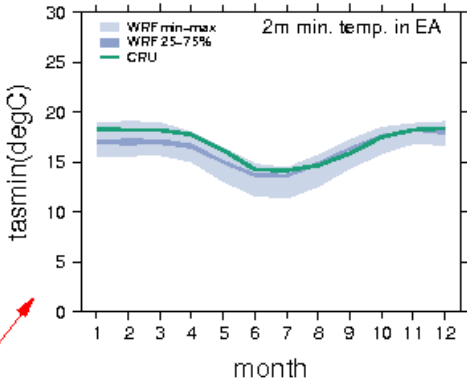
Monthly annual cycle
2m min temperature

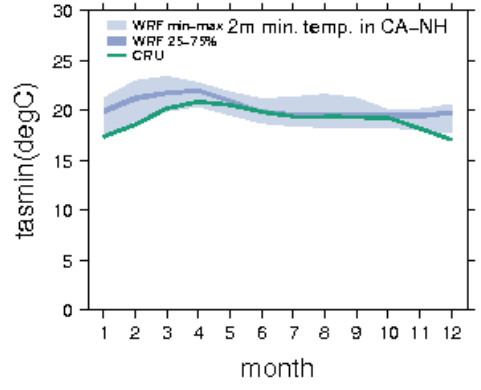


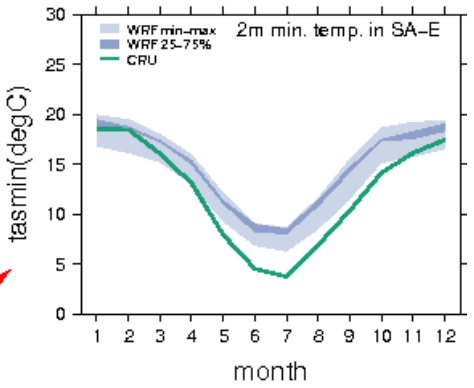


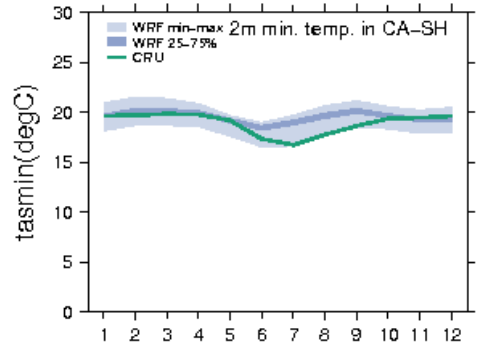


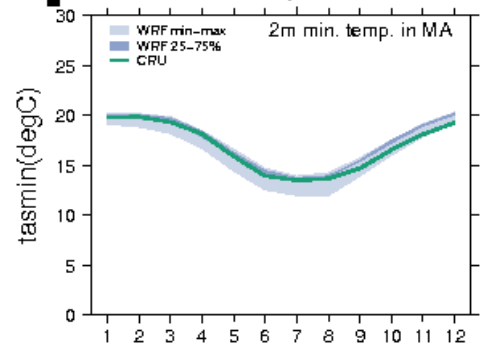


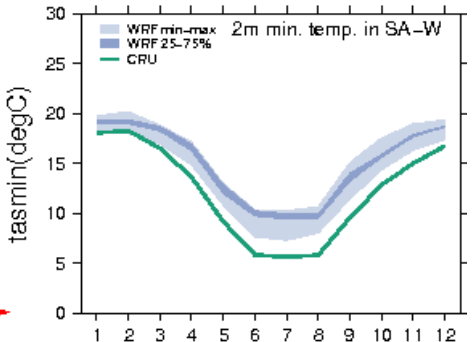




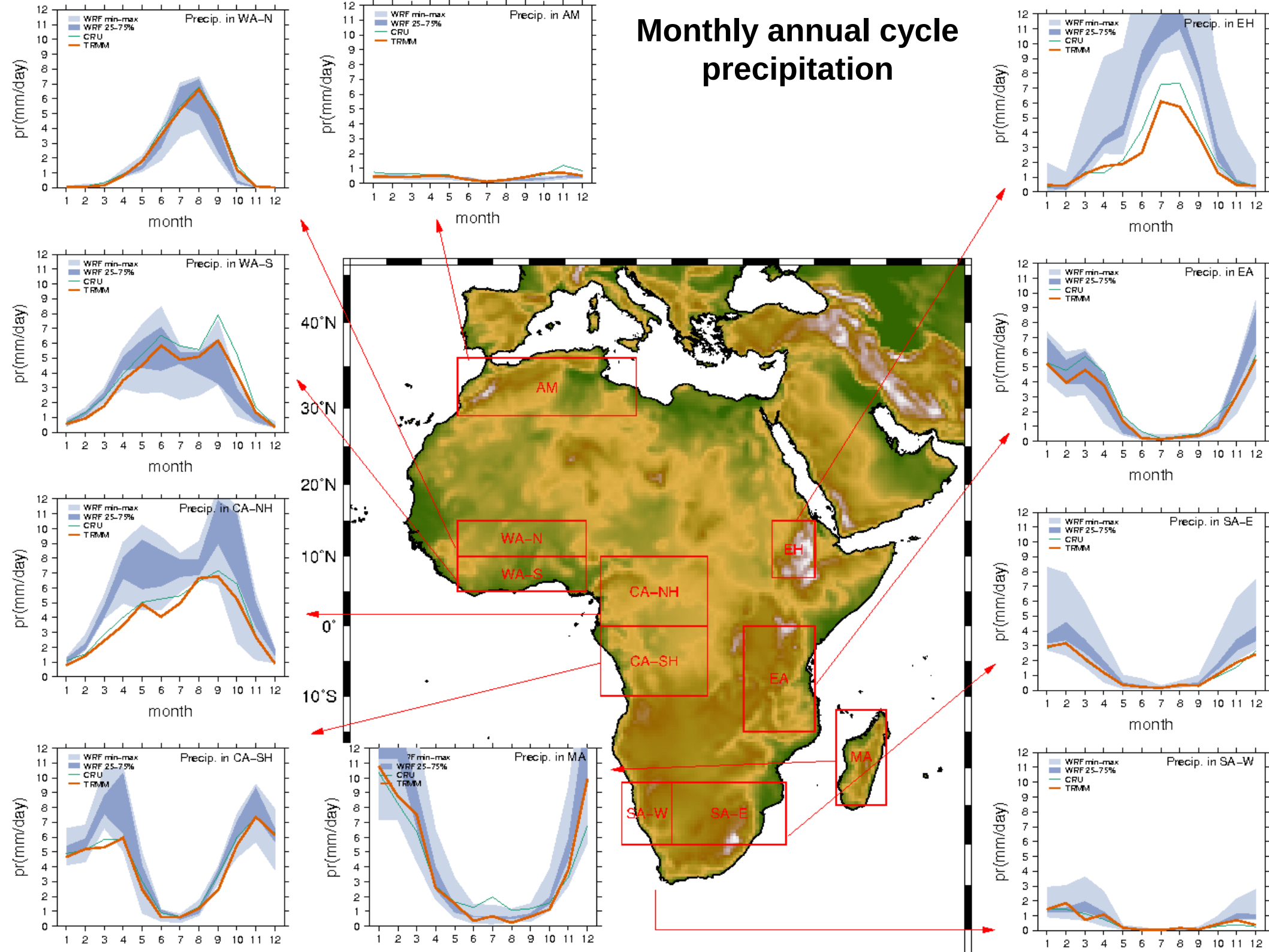






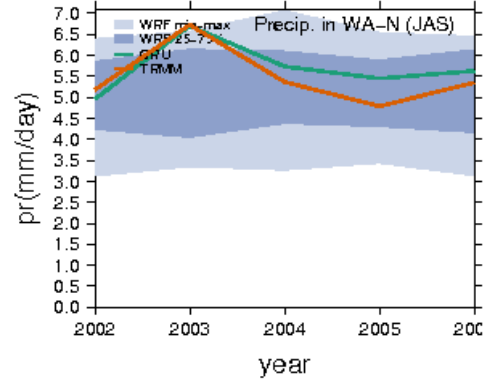


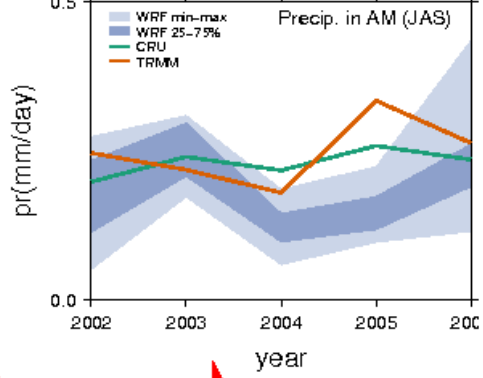
Monthly annual cycle precipitation

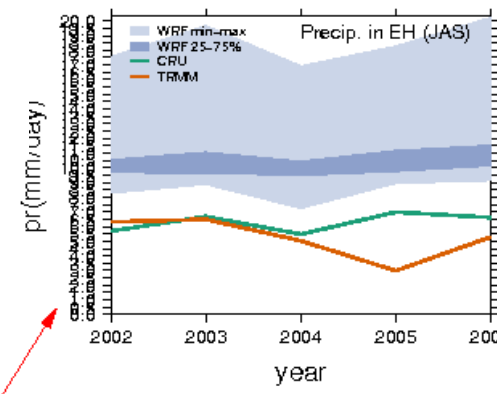


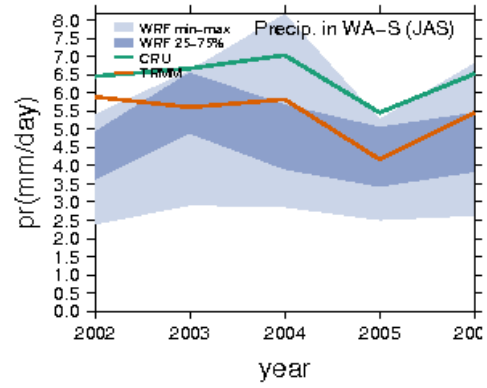
Outline

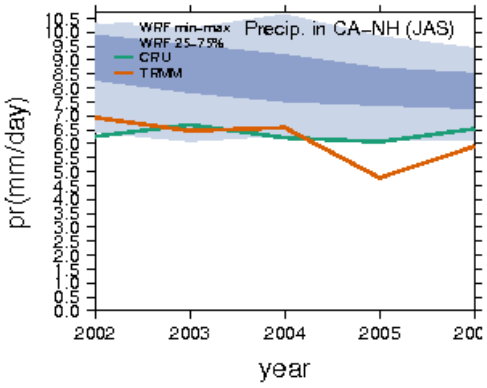
Yearly time series Precip (JAS)

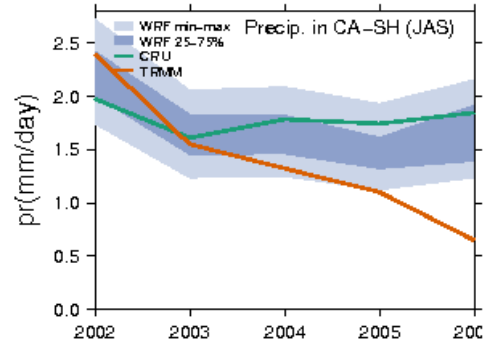


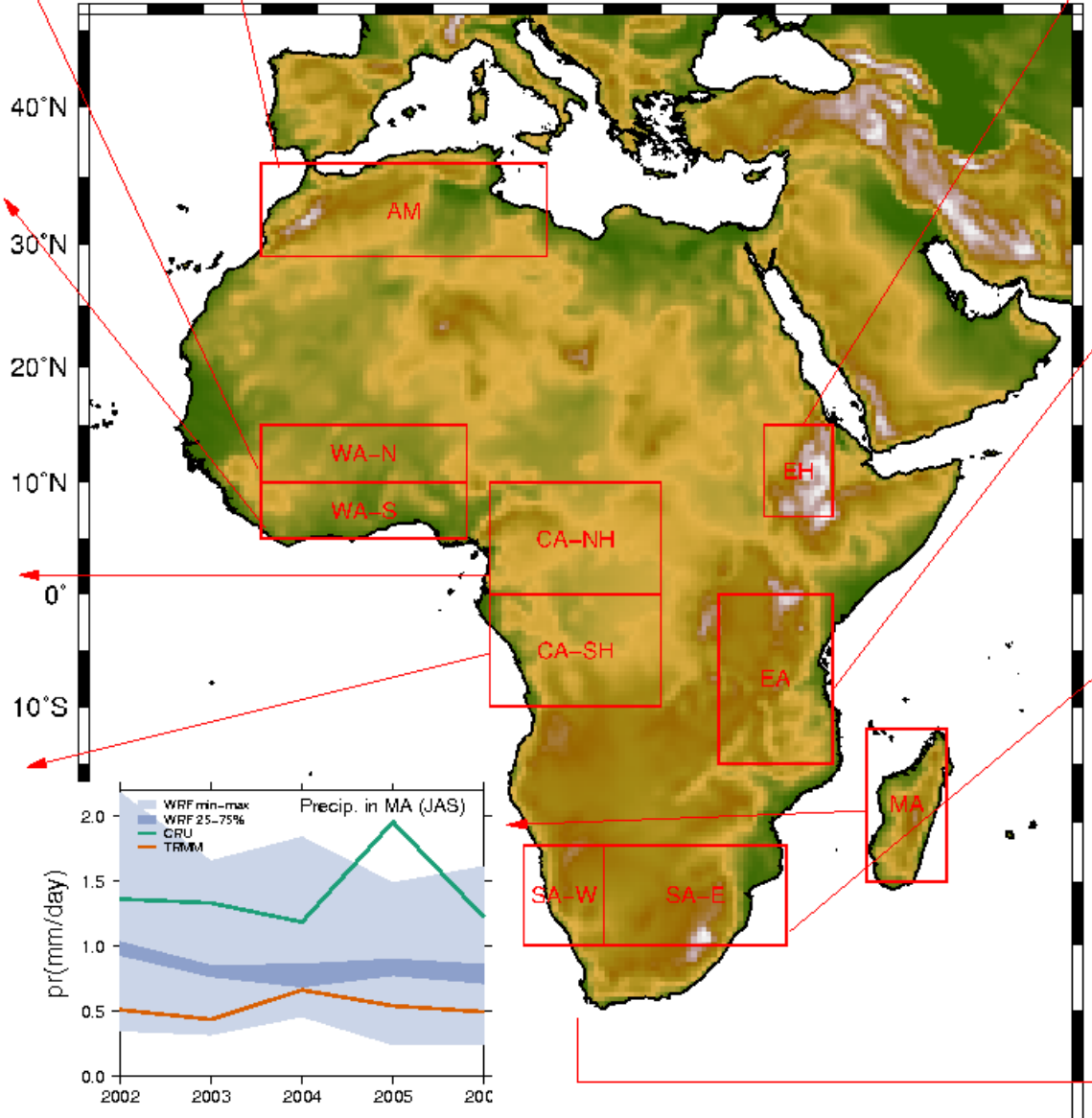


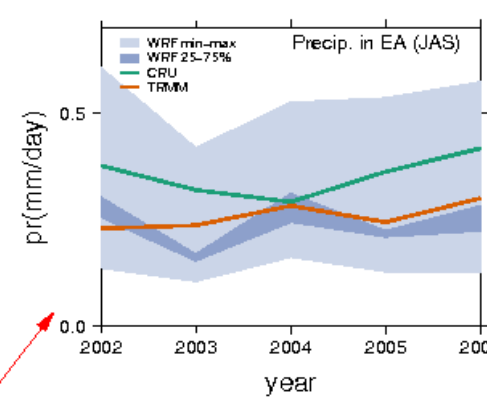


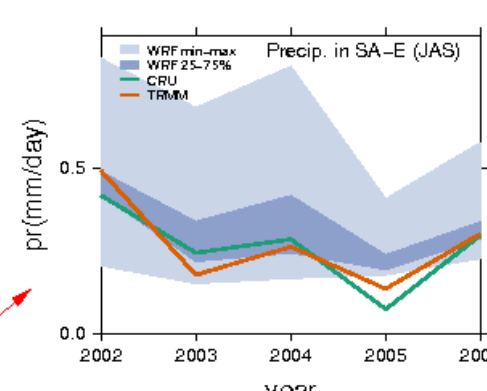


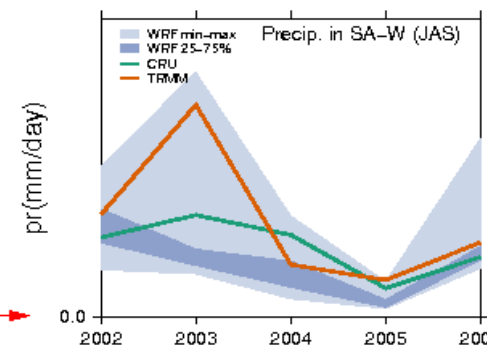




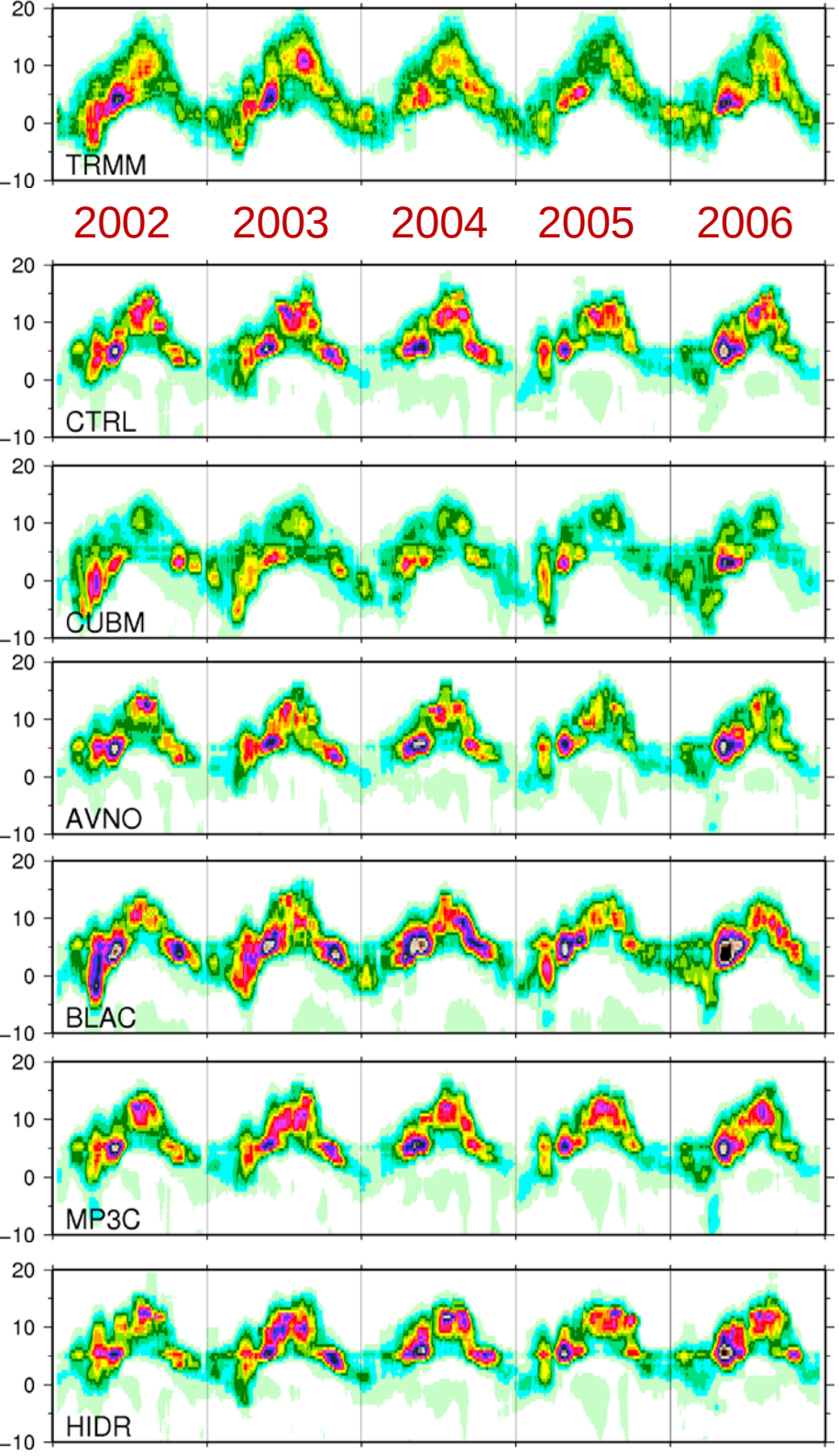




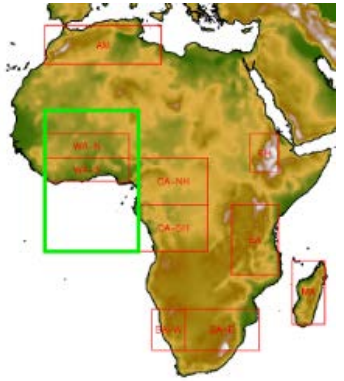


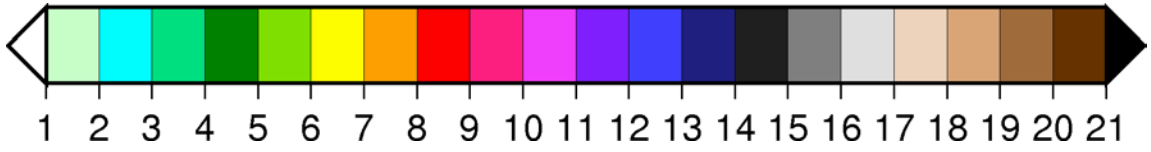


Interannual Variability

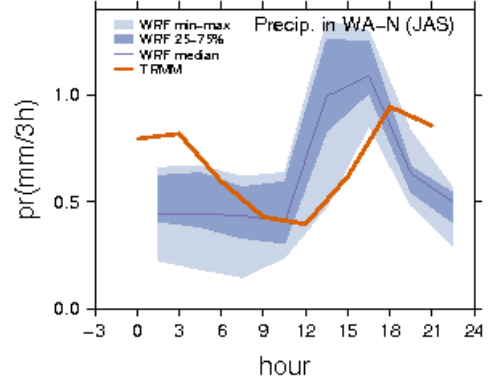


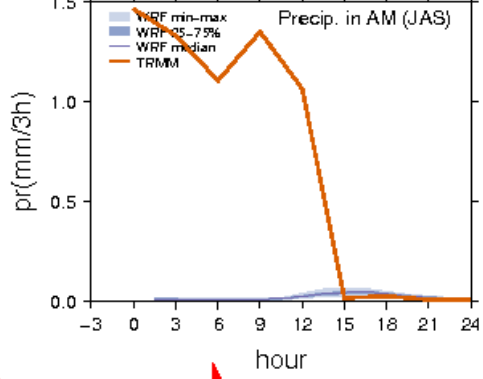
10W-10E
Zonal averaged precipitation (mm/day)

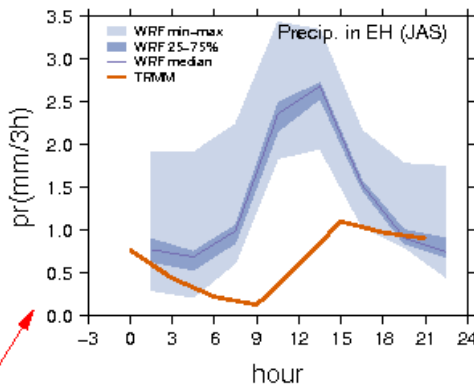


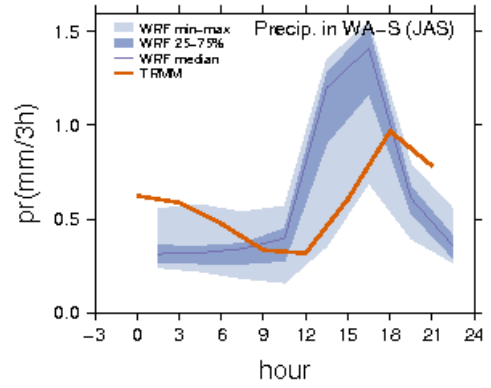


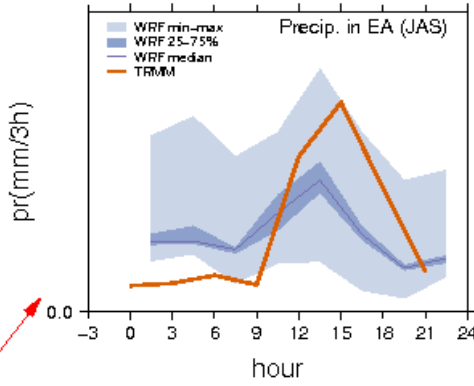
3-hourly daily cycle
Precip (JAS)

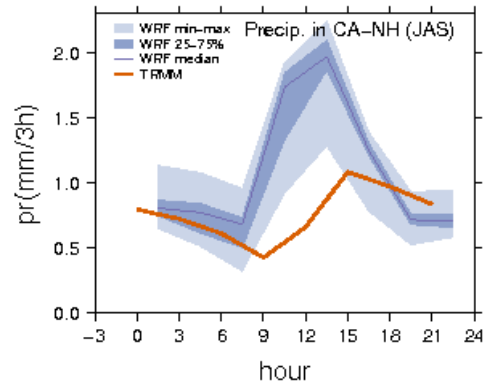


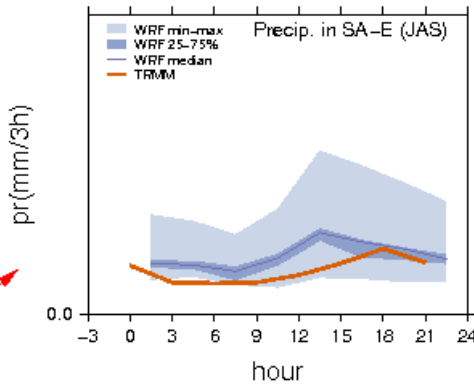


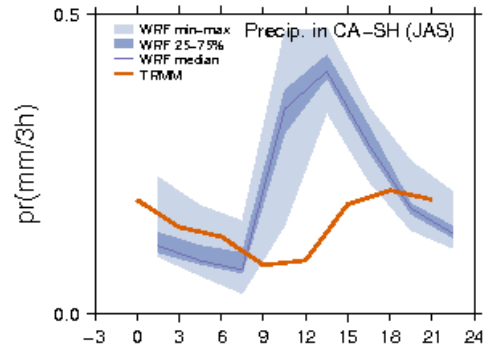


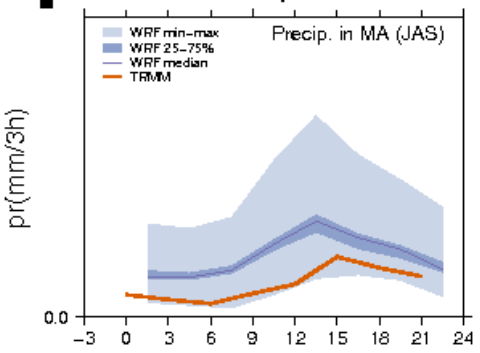


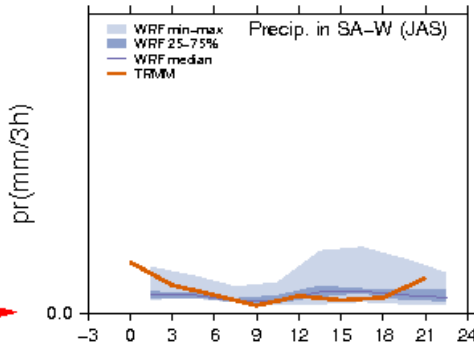


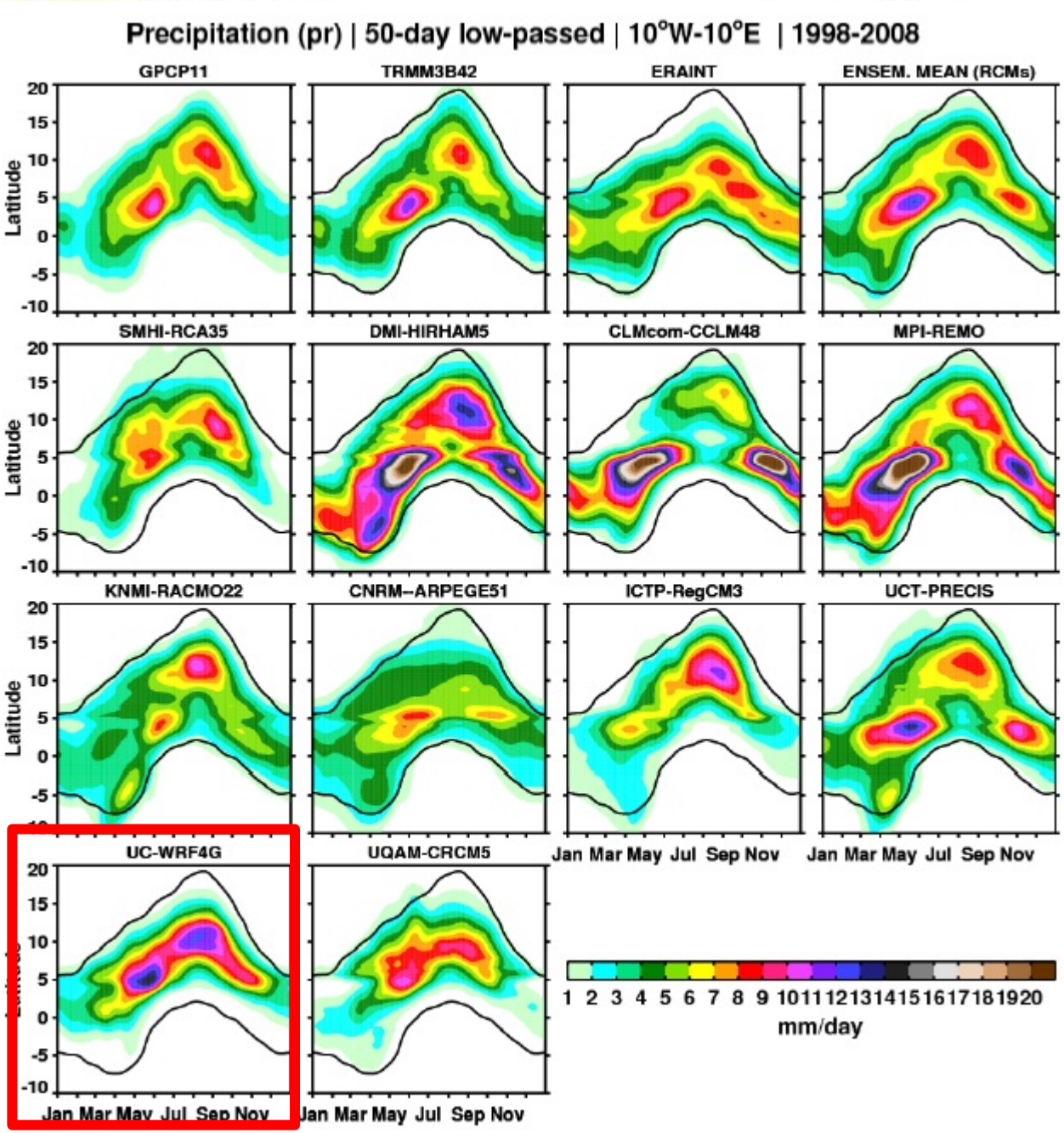






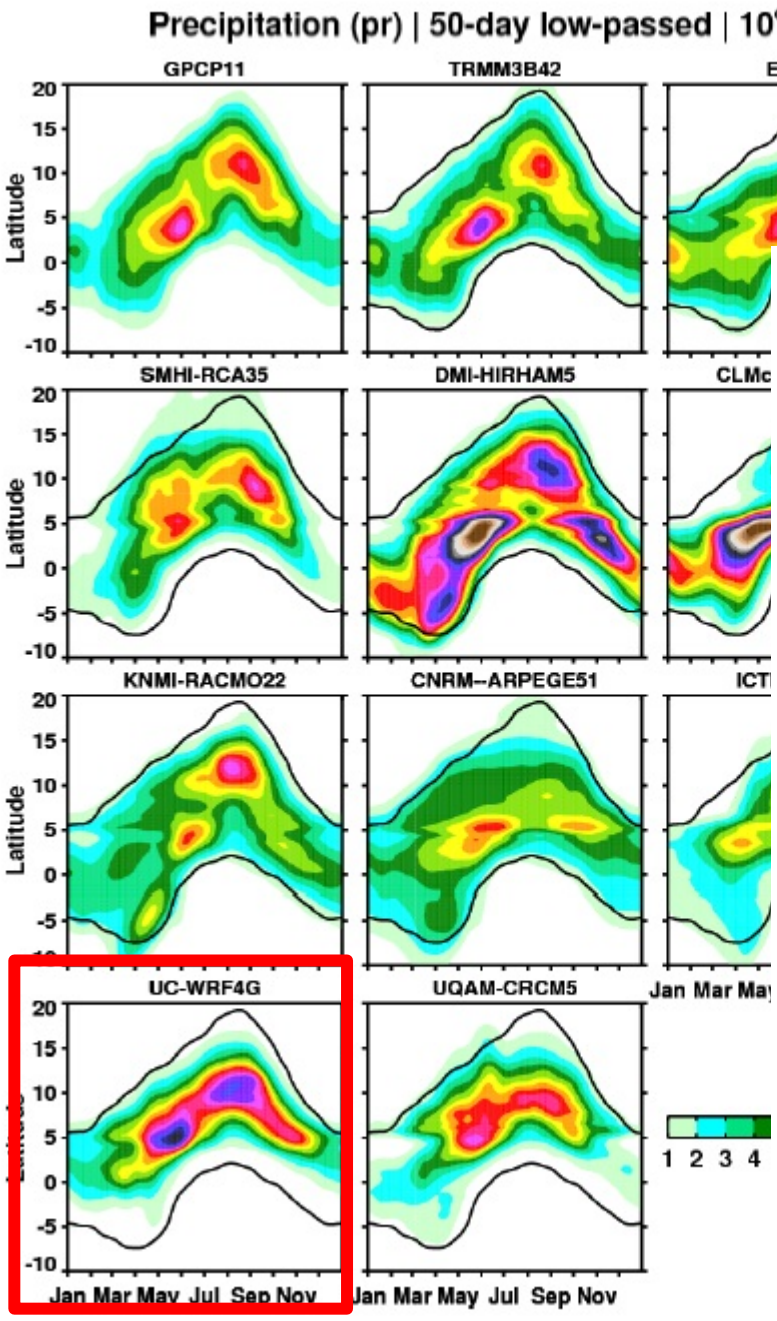


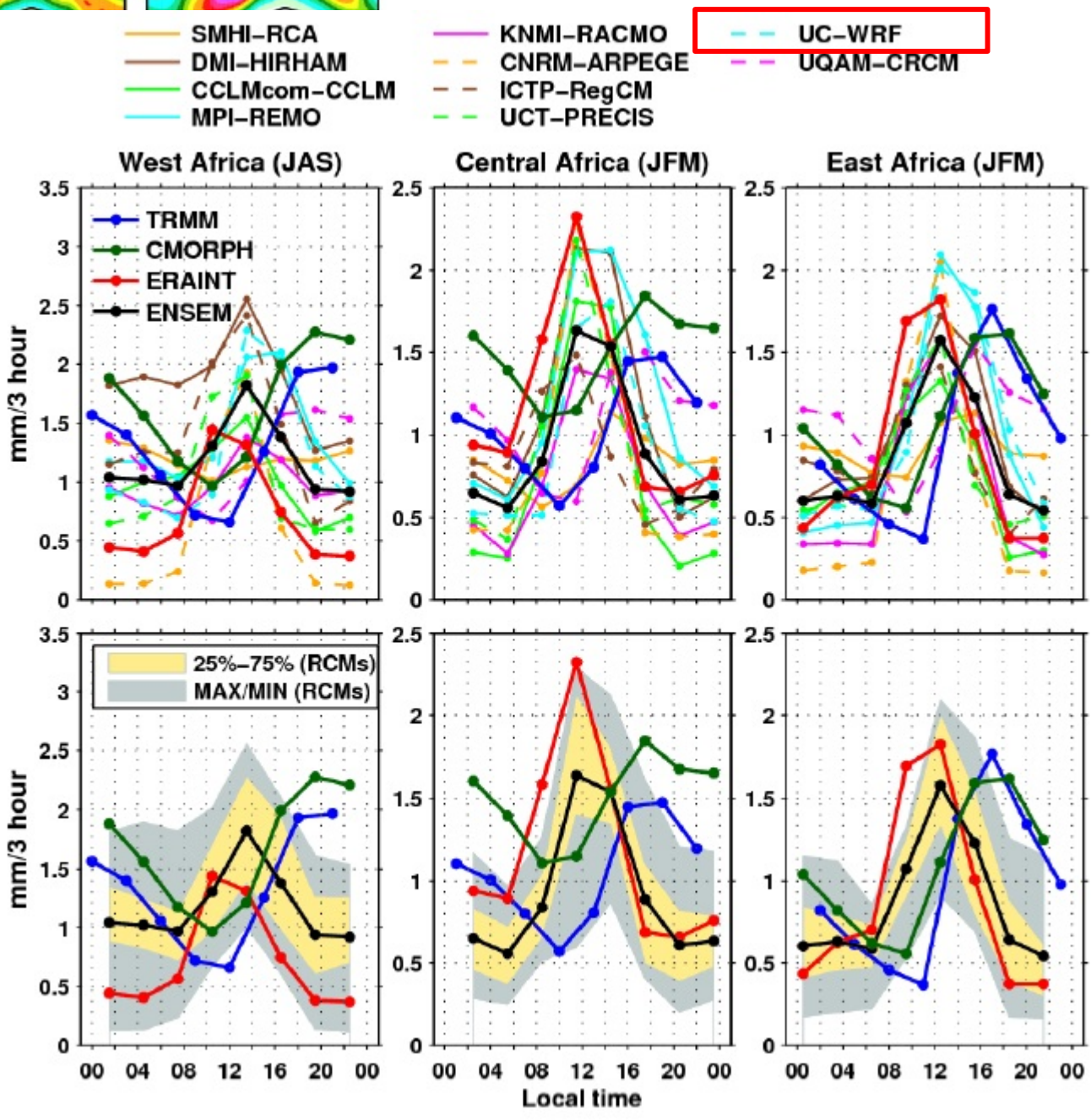




Nikulin et al. 2012

Nikulin, G., C. Jones, F. Giorgi, G. Asrar, M. Büchner, R. Cerezo-Mota, O. Christensen, M. Déqué, J. Fernandez, A. Haensler, E. van Meijgaard, P. Samuelsson, M. Sylla, and L. Sushama, 2012: Precipitation Climatology in An Ensemble of CORDEX-Africa Regional Climate Simulations. J. Climate. doi:10.1175/JCLI-D-11-00375.1, in press.





Nikulin, G., C. Jones, F. Giorgi, G. As
Fernandez, A. Haensler, E. van Meijga
Climatology in An Ensemble of CORDE
doi:10.1175/JCLI-D-11-00375.1, in pres

Outline

1. Objectives
2. Data
3. Results
    - 3.1. Main differences among the ensemble members
    - 3.2. Seasonal cycle
    - 3.3. Interannual variability
4. Conclusions

Conclusions

- Different WRF schemes are able to reproduce the main features of the African climate, although some biases were found, specially in precipitation.

- Different WRF configurations show different spatial patterns:

  BLAC present the highest differences wrt CTRL

  CUBM is the most similar to observations in the monsoon rain belt.

- Annual cycle is well reproduced by the ensemble for temperature but not for precipitation, specially in Central Africa and Ethiopian Highlands.

- Precipitation interannual variability is not well captured by WRF.

Future Work

- These are very preliminar results.

- We need to study separately each ensemble member to analize individually:

  the annual cycle

  the interannual variability

  the diurnal cycle

- We would like to shed light also on other variables.

Thank you

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Yearly time series Precip (JFM)