THE CANADIAN REGIONAL CLIMATE MODEL, VERSION 5 (CRCM5) SENSITIVITY TO THE DOMAIN LOCATION AND VALIDATION IN WEST AFRICA (CORDEX domain : WA-S and WA-N)

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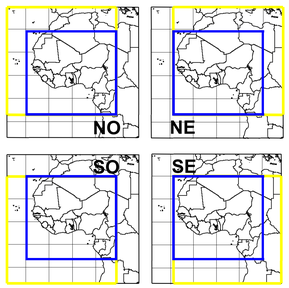
1. Introduction

West Africa has been affected by extreme climate of drought and floods during recent years. Some adaptation options were taken, but they are insufficient for food safety. A major challenge is to anticipate and to adapt to these extreme weather events. It is in this vein that this study addressed the sensitivity of the CRCM5's simulations to the domain location and its reliability to reproduce the climate as observed in West Africa.

2. Sensitivity to the domain location

Four simulations: NO, NE, SO and SE
Study year: 2006
Time step: 10 min
Horizontal resolution: 0.2°
Driving fields: ERA-Interim
Domain size: 235x235 grid points
Common area: 185x185 grid points



3. Methodology

The sensitivity to the domain location (VL) is quantified by the differences between the four simulations during the integration period. The deviation from the time average is represented by the transient variability.

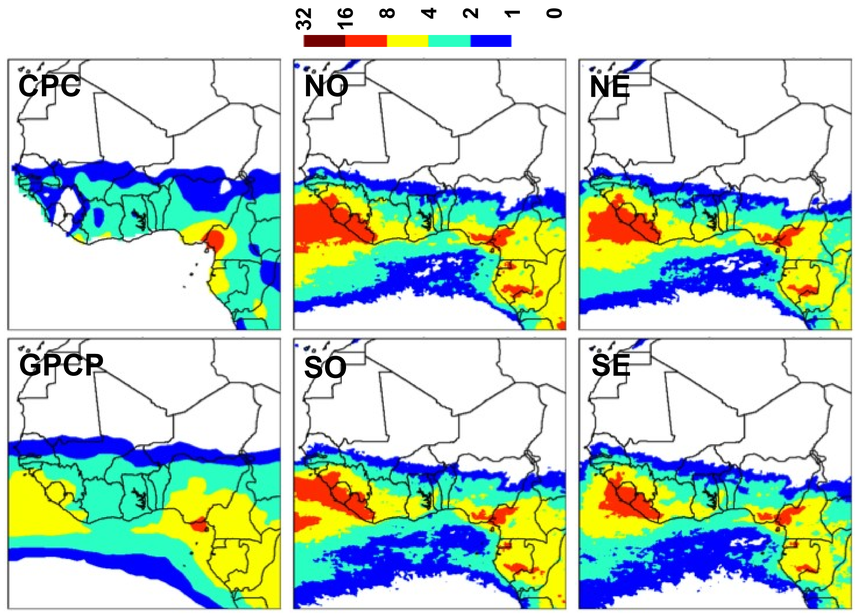
The transient variability (VT)

$$X'_m(i,j,k,t) = X_m(i,j,k,t) - \overline{X_m}^t(i,j,k) \quad \sigma_t^2(i,j,k,m) = \frac{1}{N}\sum_{t=1}^{N}\left(X'_m(i,j,k,t)\right)^2 \quad \langle\sigma_t^2\rangle(i,j,k) = \frac{1}{M}\sum_{m=1}^{M}\sigma_t^2(i,j,k,m)$$

The variability due to different locations, VL

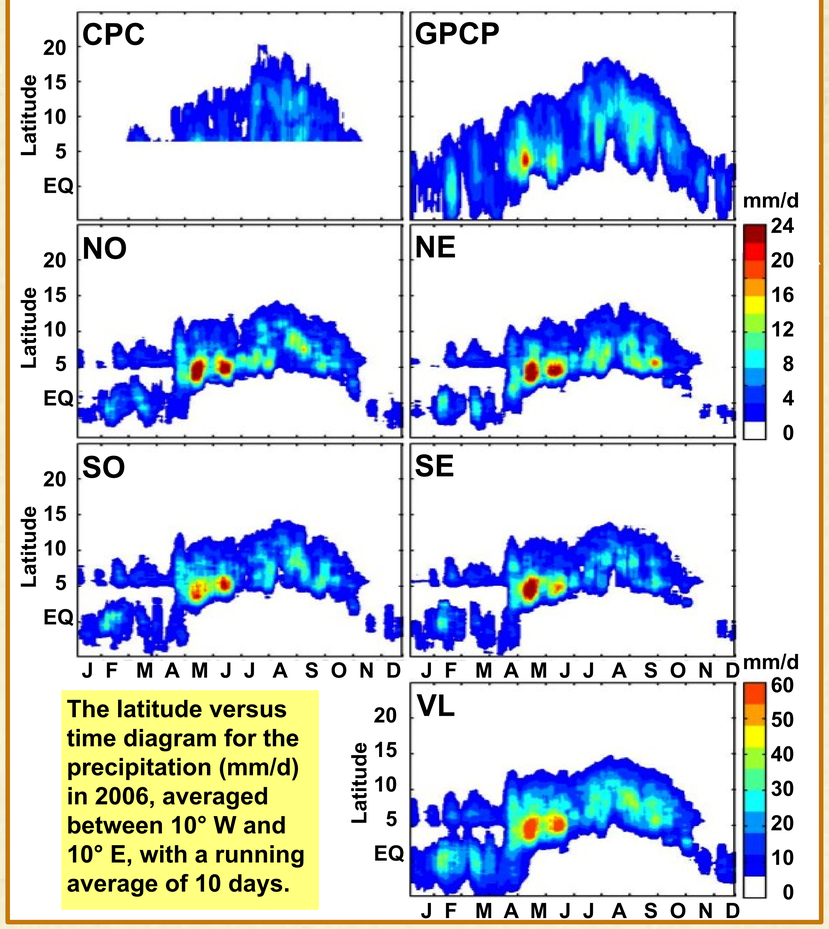
$$X^*_m(i,j,k,t) = X_m(i,j,k,t) - \langle X\rangle(i,j,k,t) \quad \sigma_l^2(i,j,k,t) = \frac{1}{M-1}\sum_{m=1}^{M}\left(X^*_m(i,j,k,t)\right)^2 \quad \overline{\sigma_l^2}^t(i,j,k) = \frac{1}{N}\sum_{t=1}^{N}\sigma_l^2(i,j,k,t)$$

4. Mean annual precipitation (mm/d)



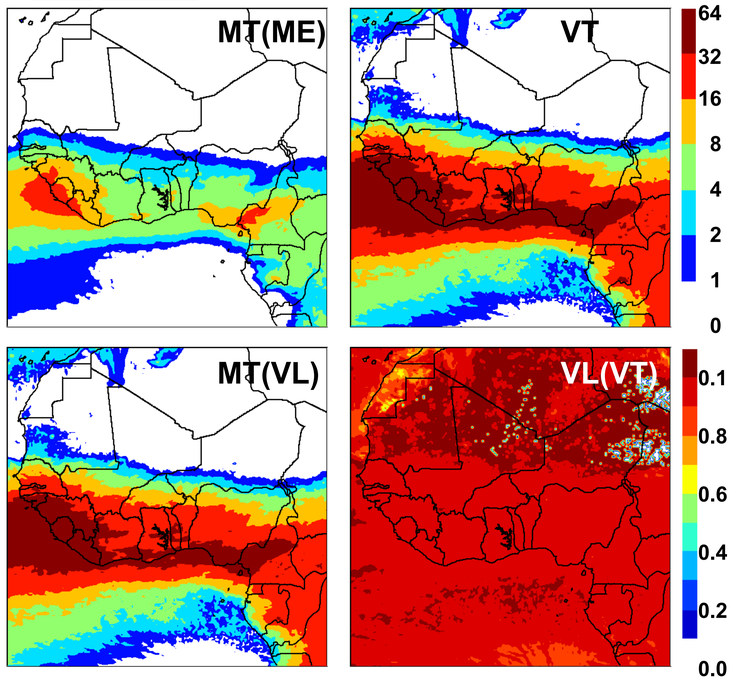
Mean annual precipitation (mm/d) in 2006, for observations (CPC and GPCP) and for four simulations of CRCM5 (NO, NE, SO and SE).

5. Annal variability

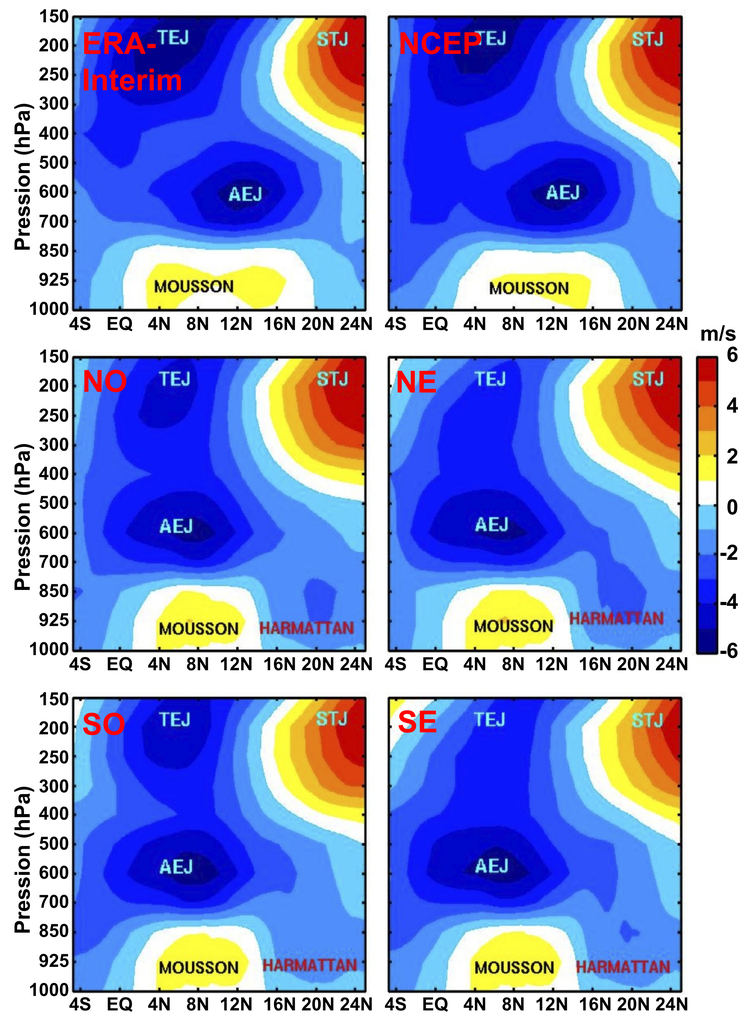


The latitude versus time diagram for the precipitation (mm/d) in 2006, averaged between 10° W and 10° E, with a running average of 10 days.

6. Precipitation (mm/d): Time mean, VT, VL and VL/VT



7. Zonal wind profile



Pressure-latitude cross-section of MJJA 2006, average zonal wind (m/s) between 10° W and 10° E for reanalysis (ERA-Interim and NCEP) and simulations (NO, NE, SO and SE)

8. Conclusion

An annual simulation with the new CRCM5 was analysed, with special emphasis on the annual cycle and geographical distribution of precipitation. It was shown that the location of the computational domain induces important differences amongst the four simulations, with the maximum VL corresponding to convective zones during the wet season when the lateral boundary conditions appear to exert little control.

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