# Evaluation of Stratospheric Aerosol Injection (SAI) impact on extreme temperature Intensity and Amplitude over West Africa using SRM G4 scenario

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## BACKGROUNDS

- The rise in GHG concentration induce important modifications on global climate
- Several previous studies have shown global temperature reduction under SRM
- Bias correction studies results indicates reduction of climates models uncertainties
- Under RCP4.5 a general increase in extremes temperatures is perceived
- Few studies investigates SRM impact on extremes temperature intensity at regional scale over West-Africa
- Evaluate SRM effect on extreme temperature intensity over West Africa is the objective of this study

## DATA AND METHODOLOGY

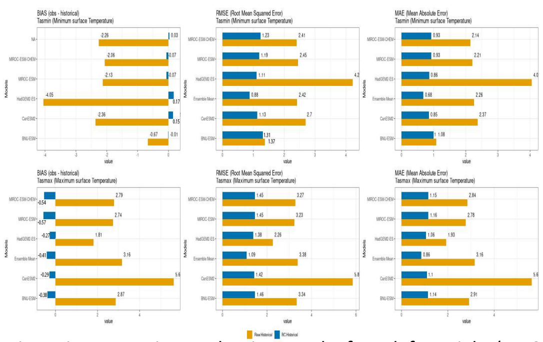
### Data

- Five climate models from CMIP5 ensemble (BNU-ESM, CanESM2, HadGEM2-ES, MIROC-ESM, MIROC-ESM-CHEM) with an historical (1979-2005) and future (2021-2070) period at 2.8x2.8°for RCP4.5 and G4 scenario
- NCEP Climate Forecast System Reanalysis (CSFR) was used as observation dataset during 1979-2005 at a resolution of 0.35x0.35°

### Methodology

- Regridding of models data to match observational resolution (0.35x0.35).
- Statistical bias correction of models data using EQM MW method with a training (1979-1997) and testing (1997-2005) sets.
- Evaluation of Bias correction results using accuracy metrics (BIAS, RMSE, MAE).
- Building the five models ensemble mean
- Computation of ETCCDI extreme temperature indices(TXn, TXx, TNn, TNx and DTR).
- The difference between G4 and RCP4.5 indicates SAI effect on climate extremes under mitigation scenario

## RESULTS AND DISCUSSION



The bias correction procedure considerably reduce the BIAS and error (RMSE and MAE) contained in RAW models as shown in **fig1. Orange** color stand for **RAW data** and **blue** for **Bias Corrected data**

Fig1: Bias correction evaluation results from left to right (BIAS, RMSE MAE)

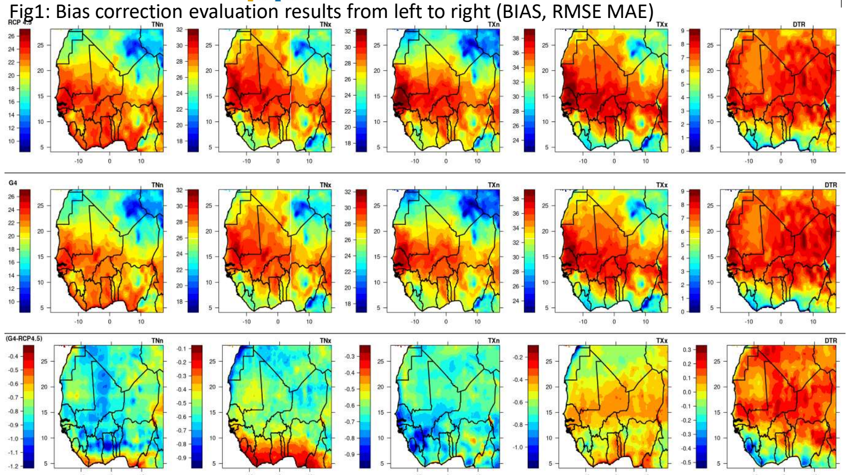


Fig2: Climatological spatial distribution of extremes temperature intensity and amplitude indices from left to right (TNn, TNx, TXn, TXx, DTR)

The Ensemble mean differences between G4 and RCP4.5 indicates a generally a reduction of each intensity extremes indices

- (TNn and TXn) reduction is more important over SHL and GZ region with a maximum cooling of 1.2°C and 0.9°C respectively
- (TNx and TXx) present a maximum cooling of 0.8°C and 0.6°C respectively, SHR and SHL are the most affected during night while at each region is affected the same way.
- DTR, an increase reaching 0.3°C in both SHR sand SHL regions and decrease in GZ with as maximum of 0.5°C .

- The cooling effect of SAI over whole West Africa perceived in temperature intensity extremes is higher than the expected –0.70 to –0.80°C identified by Haywood et al in (Haywood et al., 2013)
- The reduction of minimum and maximum daily temperature are associated with significant modification in the spatial and temporal distribution of diurnal temperature range
- Many studies corroborate SAI ability to reduce extremes temperature intensity perceived in this study even with RCP8.5 as based scenario (Ji et al., 2018; Obahoundje et al., 2020, Pinto et al., 2020)

## CONCLUSION AND PERSPECTIVES

- The bias correction procedure improve climate models data according to statistical evaluation results
- Under SAI West Africa experienced a reduction of extremes temperature Intensity with an emphasis over Sahel and Guinean region which the most affected
- Instead for maximum temperature intensity (TNx and TXx) SHR and SHL are the most affected.
- This cooling affect the temporal and spatial distribution of DTR, over GZ the temperature amplitude decrease while it increase over SHL and SHR regions

## REFERENCES


- OBAHOUNDJE S., BI V.H.N., DIEDHIOU A. et KRAVITZ B. (2020). Influence of stratospheric aerosol geoengineering on precipitation mean and extremes in Africa.
- PINTO I., JACK C., LENNARD C., TILMES S. et ODOULAMI R.C. (2020). Africa's Climate Response to Solar Radiation Management With Stratospheric Aerosol. Geophysical Research Letters, 47(2), p. e2019GL086047.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