



Environnement
Canada

Environment
Canada

Canada



Seasonal Prediction, based on Canadian Seasonal to Interannual Prediction system (CanSIPS) for the Fifth South West Indian Ocean Climate Outlook Forum

Dr. Marko Markovic

NWP Section

Canadian Centre For Meteorological and Environmental Prediction
(CCMEP aka CMC)

Dr. Bertrand Denis

Manager, Product and Service Innovation Section
Canadian Centre For Meteorological and Environmental Prediction
(CCMEP aka CMC)

OUTLINE

- The Canadian Seasonal to Interannual Prediction System (CanSIPS): formulation
- Definition of the seasons
- Probabilistic and deterministic forecasts for temperature (seasons and separate months)
- Probabilistic and deterministic forecasts for precipitation (seasons and separate months)
- Climate indices, forecasts of SWIO and WTIO



The Canadian Seasonal to Interannual Prediction System (CanSIPS)

- Developed and operational at Environment Canada since 2011
- 2 atmosphere-ocean coupled models: CanCM3/4, 10 ensemble members each
- Forecasts initialized at the start of every month
- Hindcast verification period = 1981-2010
- Operational forecasts contribute to **WMO** and NMME/APCC/IRI ensembles
- Forecast range = 12 months

Reference: Merryfield et al., *MWR*, 2013



Environment
Canada

Environnement
Canada

Canada

CanSIPS Models

CanCM3

CanCM4

CanAM3 *Atmospheric model*

- T63/L31 ($\approx 2.8^\circ$ spectral grid)
- Deep convection scheme of Zhang & McFarlane (1995)
- No shallow conv scheme
- Also called AGCM3

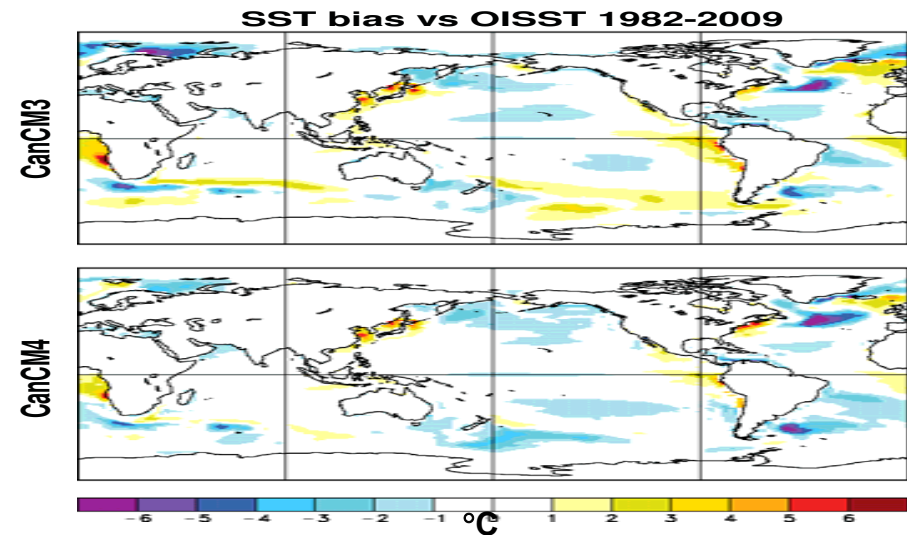
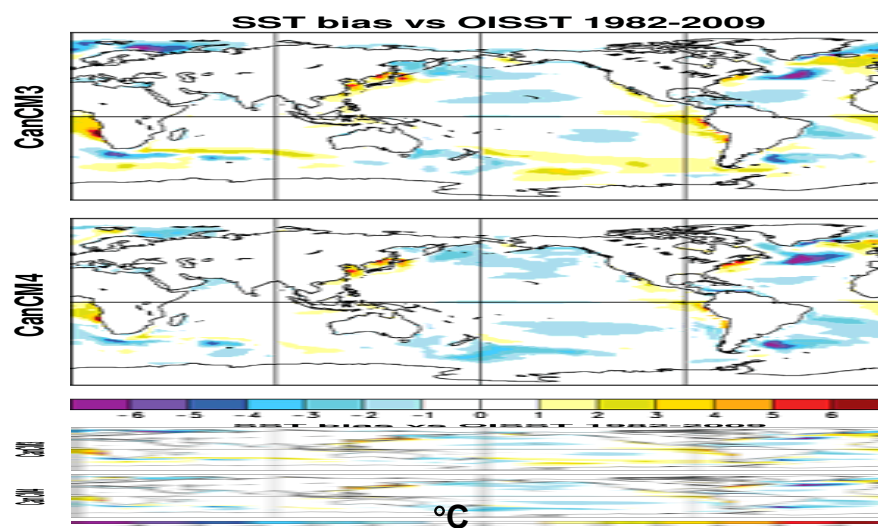
CanOM4 *Ocean model*

- $1.41^\circ \times 0.94^\circ \times L40$
- GM stirring, aniso visc
- KPP+tidal mixing
- Subsurface solar heating climatological chlorophyll

CanAM4 *Atmospheric model*

- T63/L35 ($\approx 2.8^\circ$ spectral grid)
- Deep conv as in CanCM3
- Shallow conv as per von Salzen & McFarlane (2002)
- Improved radiation, aerosols

SST bias vs obs (OISST 1982-2009)

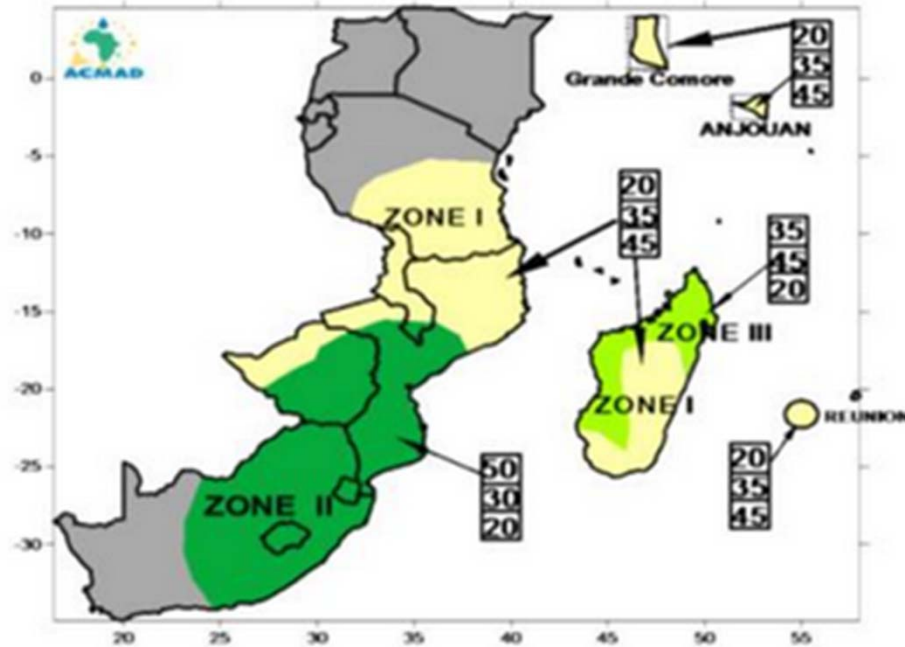


Definition of the seasons

- Official CanSIPS forecasts for the next 12 months are initialized at the start of every month. However, for internal needs, CanSIPS forecasts are also produced at mi-month. In this document, we took advantage of this mid-month run generated on 15 September 2015 and covering the next few months starting with October 2016.
- The seasonal output of the CanSIPS forecasts are structured as the seasonal means of the seasons: 123, 234, 456, 789, 101112 with respect to the starting date of the seasonal forecast. In this case of these forecasts initialized on 15 Sept 2016, season 123 is Oct-Nov-Dec (OND) and the season 234 is NDJ. Therefore, the seasonal forecast for **OND** is considered as a forecast with **0.5 month lead time**, and for NDJ with **1.5 month lead time**.
- We are able to provide 2016 autumn-winter forecasts as the seasonal means for OND and NDJ which correspond to the dry season.



South West Indian Ocean Region, source WMO



The Southwest Indian Ocean Countries Climate Outlook Forum (SWIOCOF) is coordinated by the African Centre of Meteorological Application for Development ([ACMAD](http://www.acmad.org)) in Niamey, Niger. It covers Comoros, La Réunion, Madagascar, Mauritius, Mozambique, South Africa, Seychelles and Tanzania.

<http://public.wmo.int/en/our-mandate/climate/regional-climate-outlook-products>

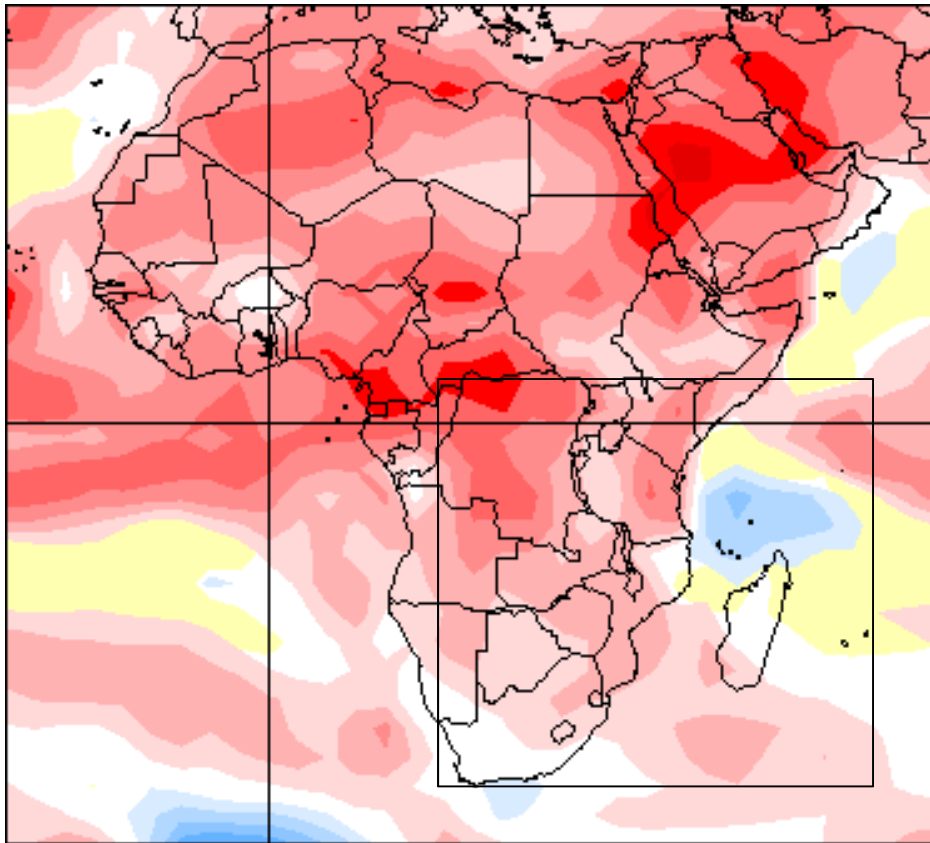


Environment
Canada

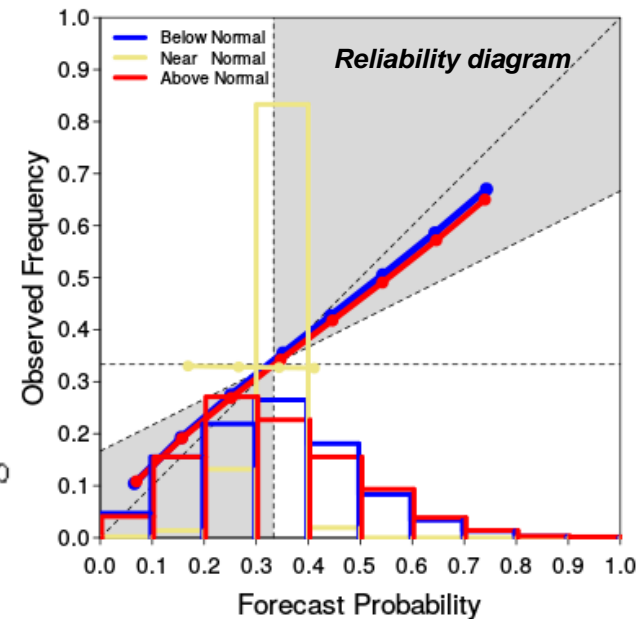
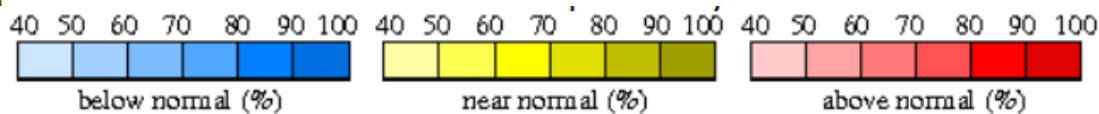
Environnement
Canada

Canada

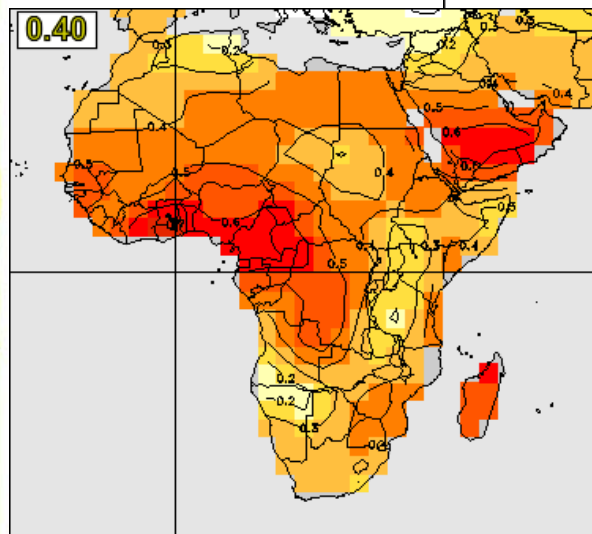
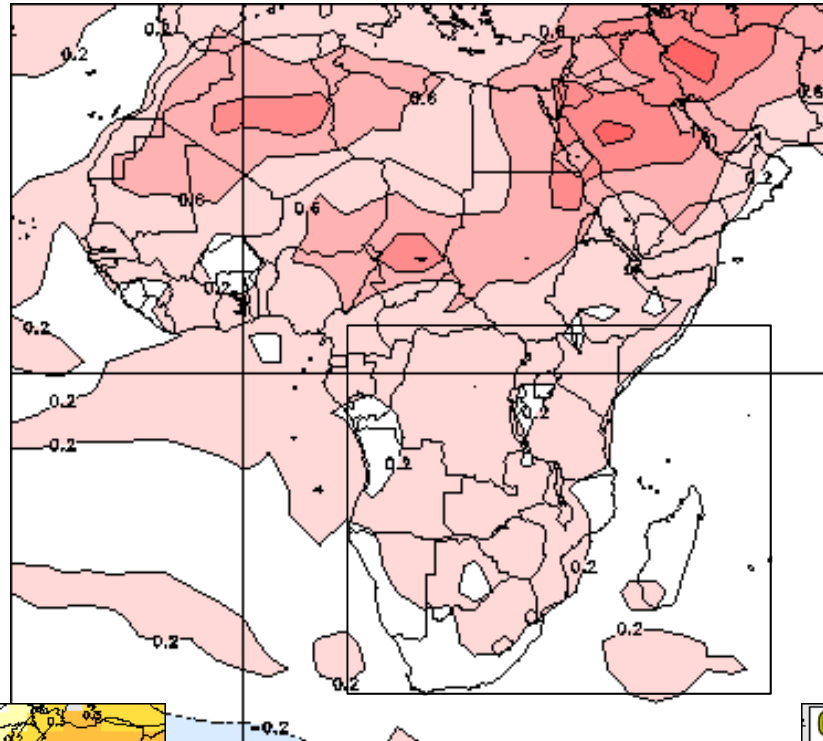
Temperature for OND, 0.5 month lead time Probabilistic Forecast



Probabilistic forecast is based on 3 equiprobable categories: below, near and above normal with respect to 1981-2010 CanSIPS climatology. The figure below shows the reliability diagram for zero-month lead time with respect to ERA-interim data.



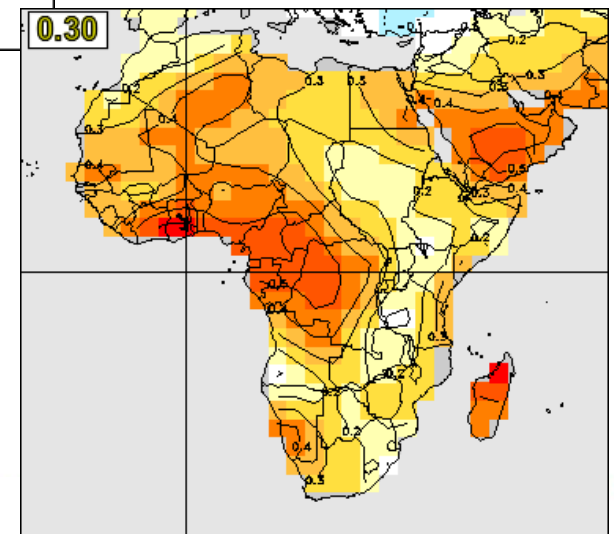
Temperature for OND, 0.5 month lead time Deterministic anomaly forecast



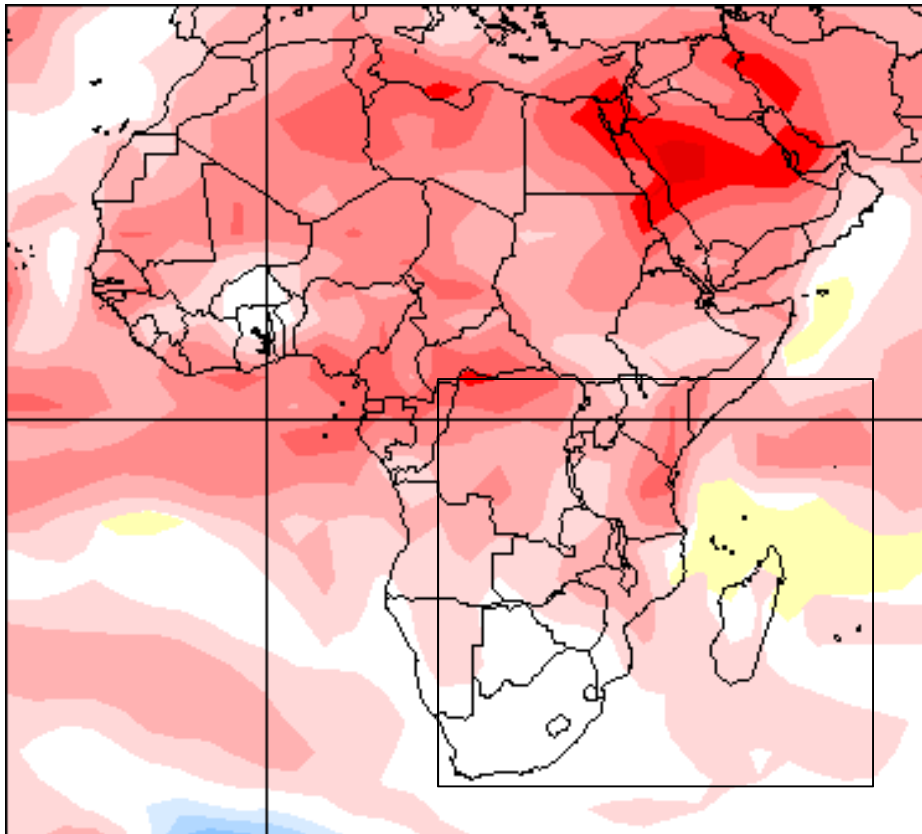
Historical correlation skill
for

← 0-month lead time

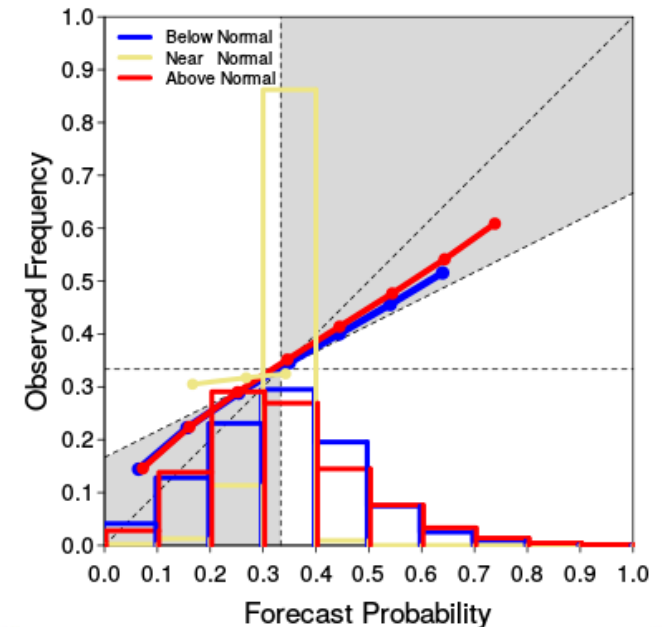
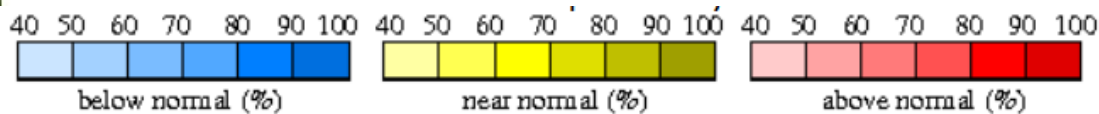
1-month lead time →



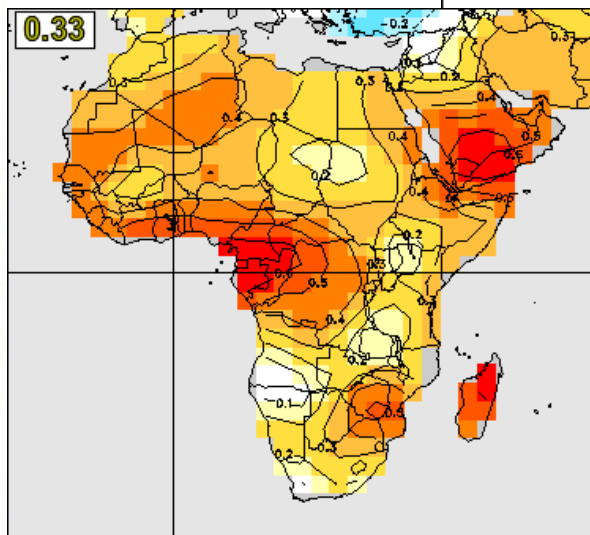
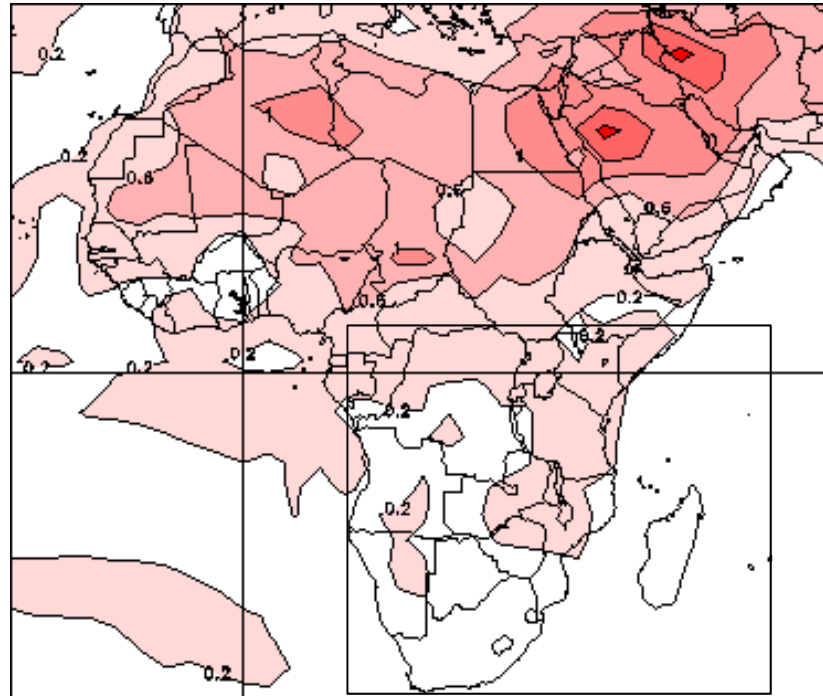
Temperature for NDJ, 1.5 month lead time Probabilistic Forecast



Probabilistic forecast is based on 3 equiprobable categories: below, near and above normal with respect to 1981-2010 CanSIPS climatology. The figure below shows the reliability diagram for 1-month lead time with respect to ERA-interim data.



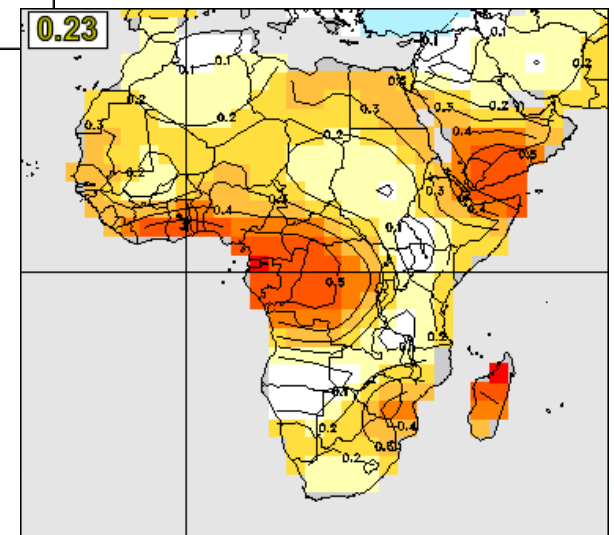
Temperature for NDJ, 1.5 month lead time Deterministic anomaly forecast



Historical correlation skill
for

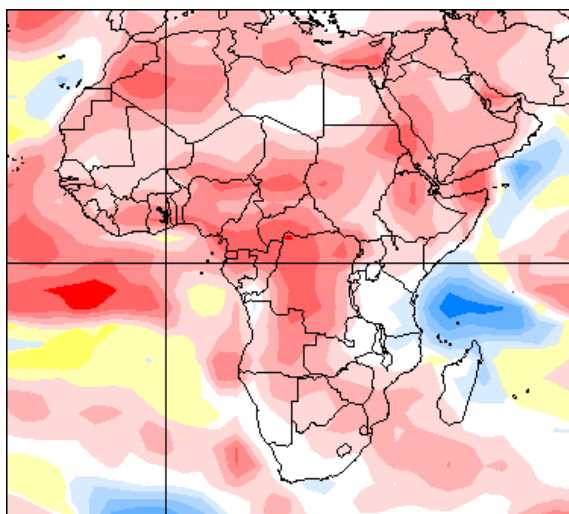
← 1-month lead time

2-month lead time →

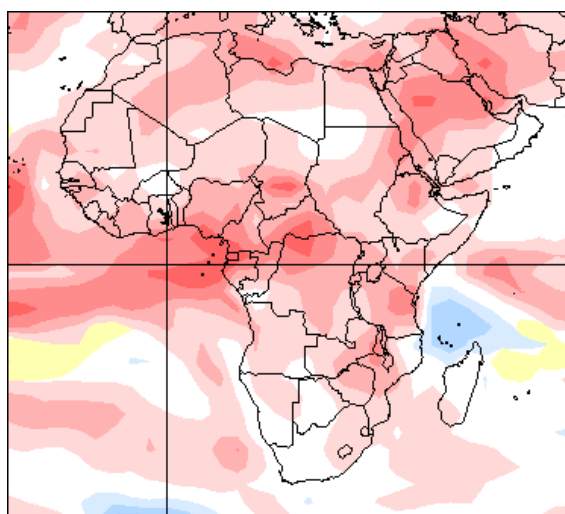


Temperature: Month to month probabilistic forecast. October to December

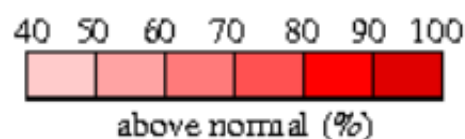
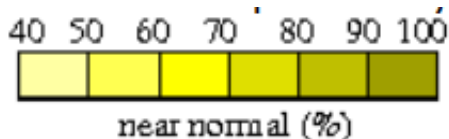
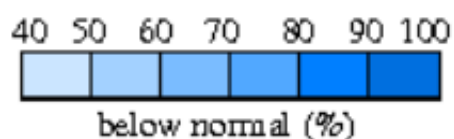
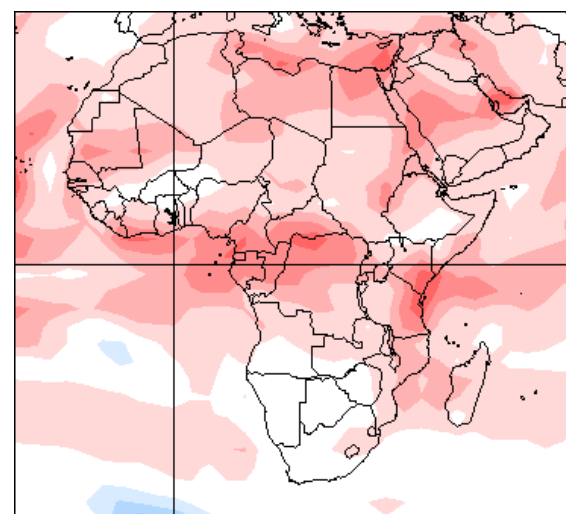
October, lead 0.5 month



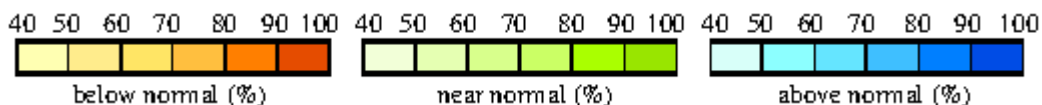
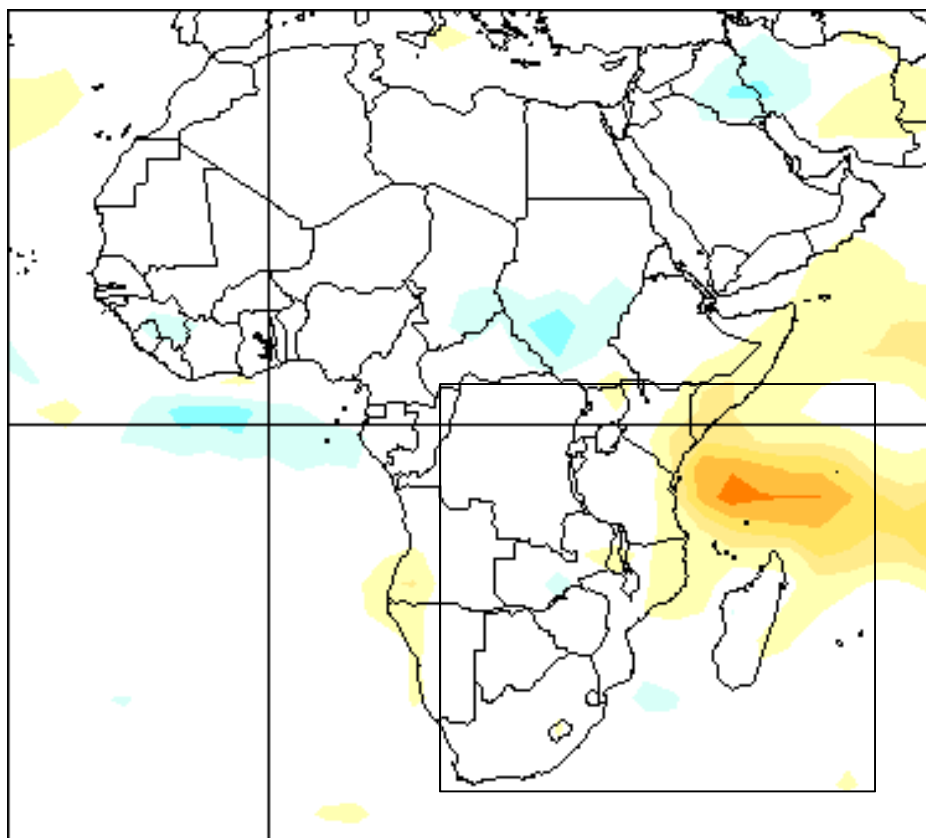
November, lead 1.5 month



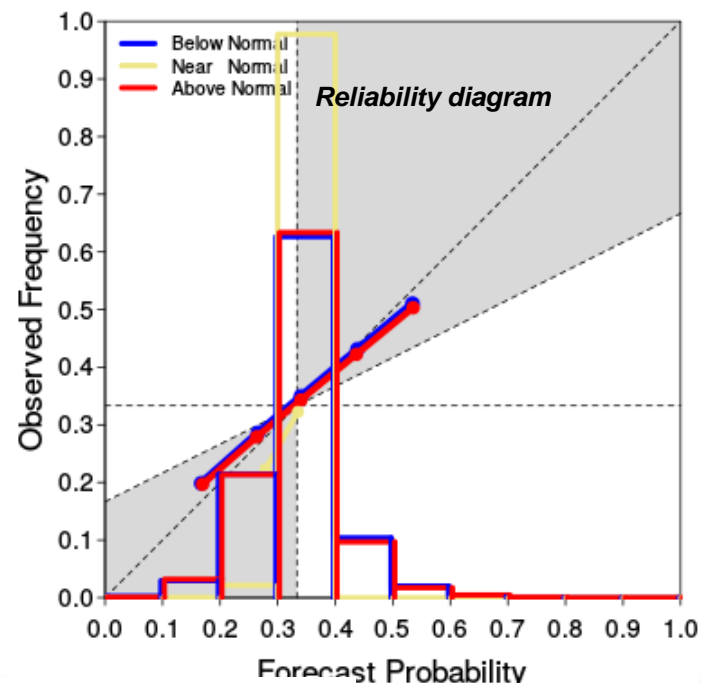
December, lead 2.5 month



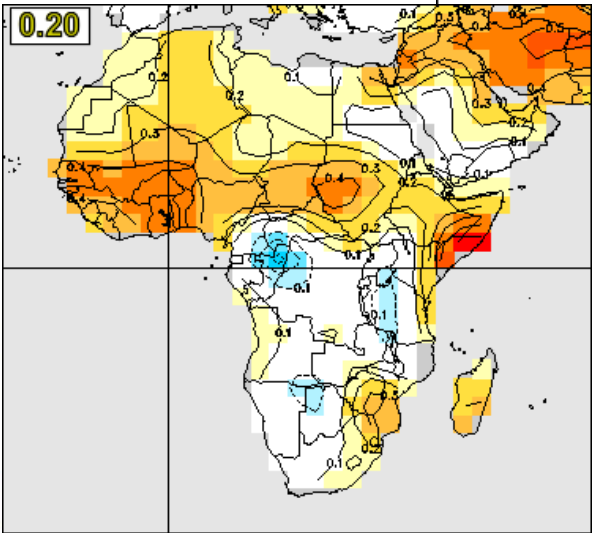
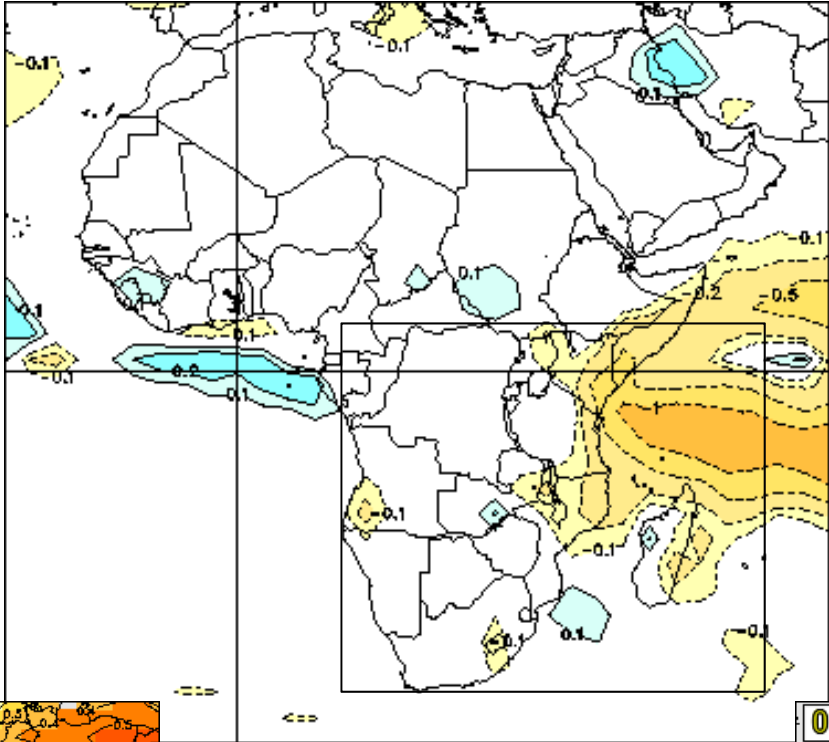
Precipitation for OND, 0.5 month lead time Probabilistic Forecast



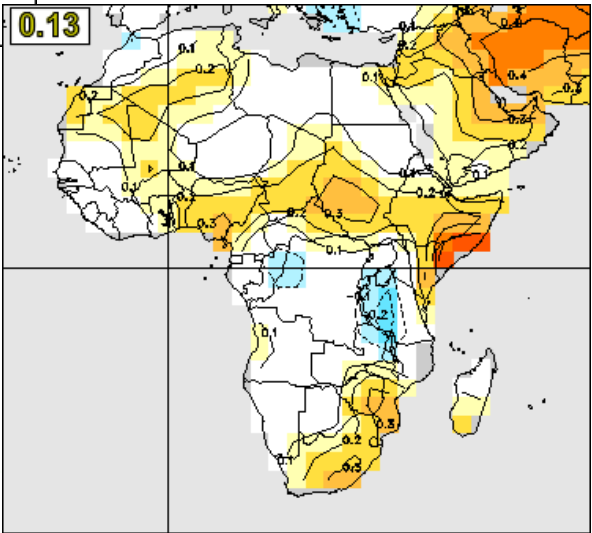
Probabilistic forecast is based on 3 equiprobable categories: below, near and above normal with respect to 1981-2010 CanSIPS climatology. Reliability diagram shows the performance of CanSIPS climatology (hindcasts) with respect to gpcp data.



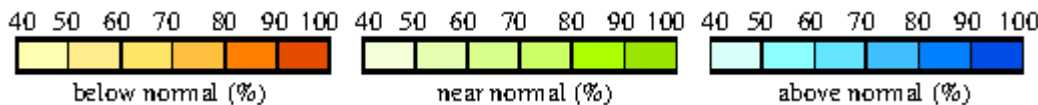
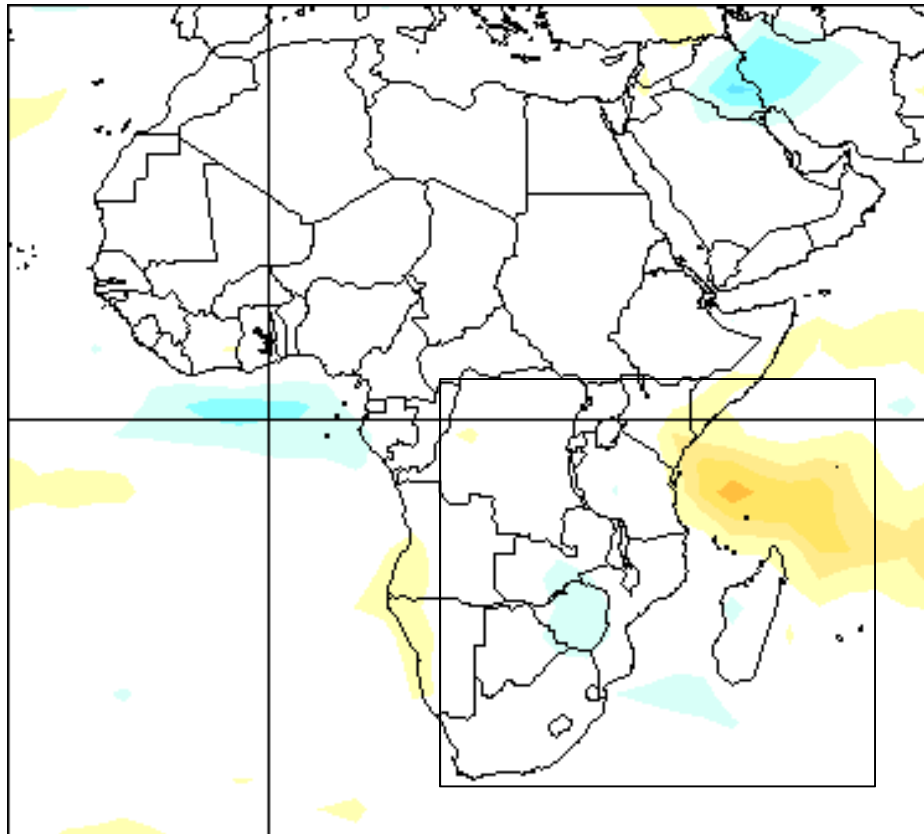
Precipitation for OND, 0.5 month lead time Deterministic anomaly forecast



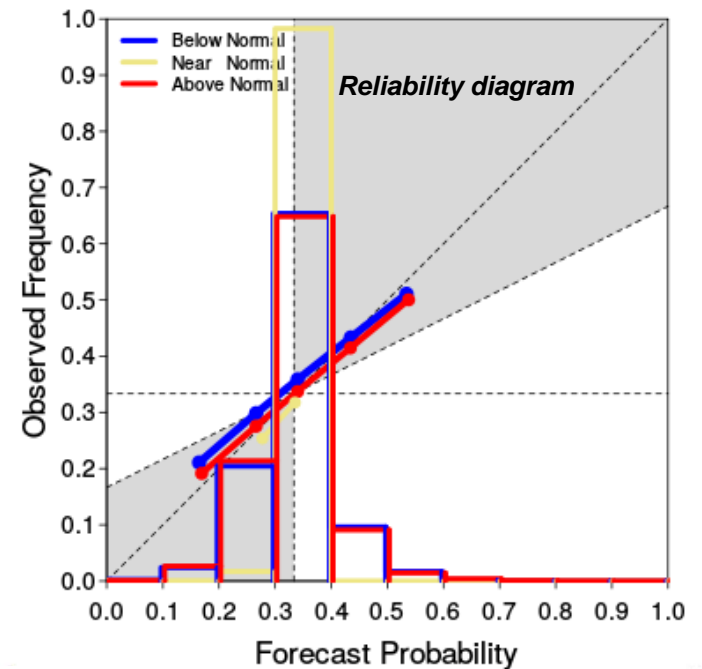
Historical correlation skill
for
← 0-month lead time
1-month lead time →



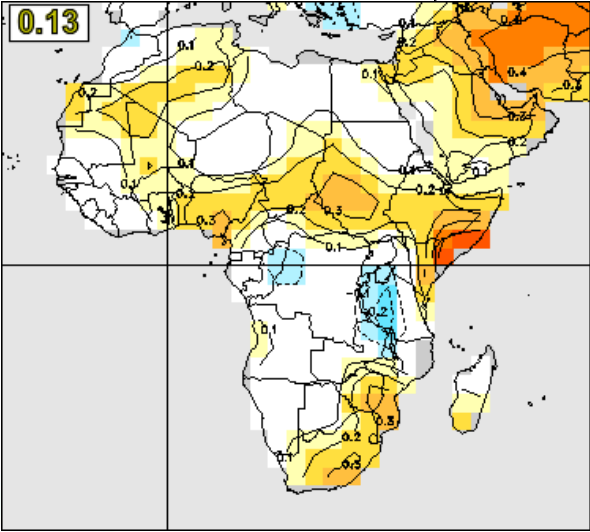
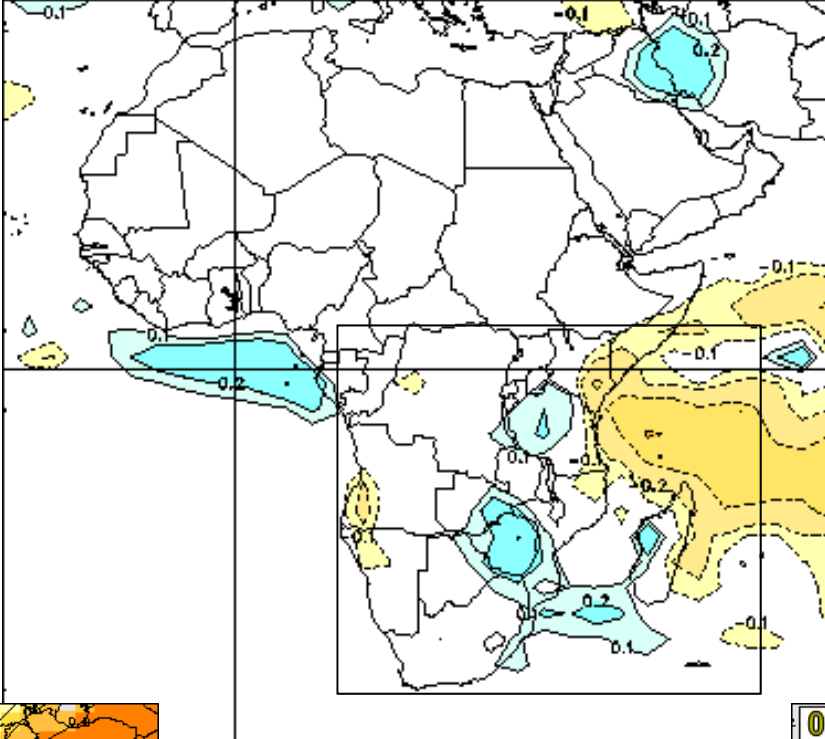
Precipitation for NDJ, 1.5 month lead time Probabilistic Forecast



Probabilistic forecast is based on 3 equiprobable categories: below, near and above normal with respect to 1981-2010 CanSIPS climatology. Reliability diagram shows the performance of CanSIPS climatology (hindcasts) with respect to gpcp data.



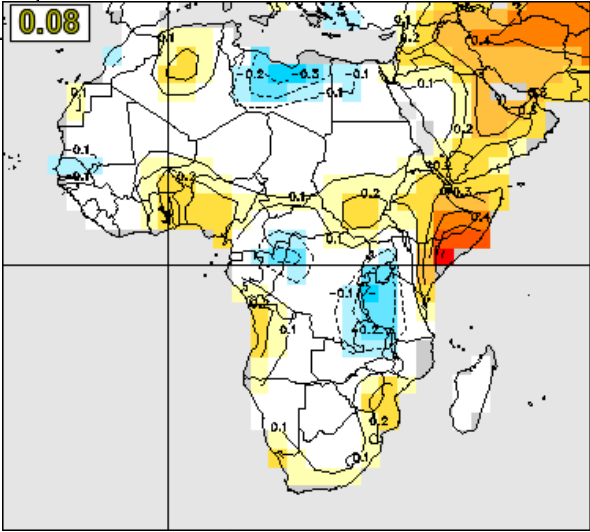
Precipitation for NDJ, 1.5 month lead time Deterministic anomaly forecast



Historical correlation skill
for

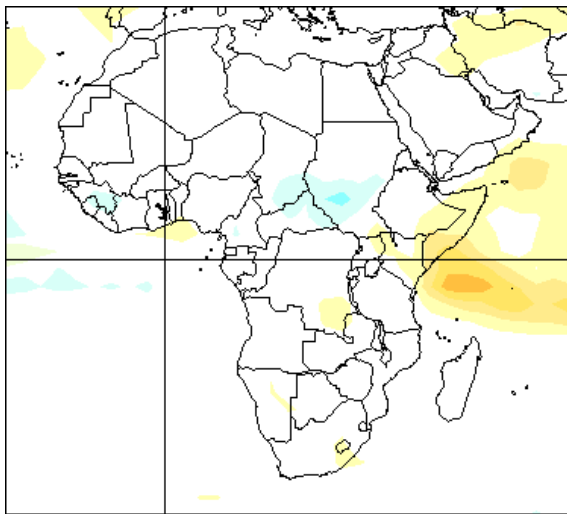
← 1 month lead time

2-month lead time →

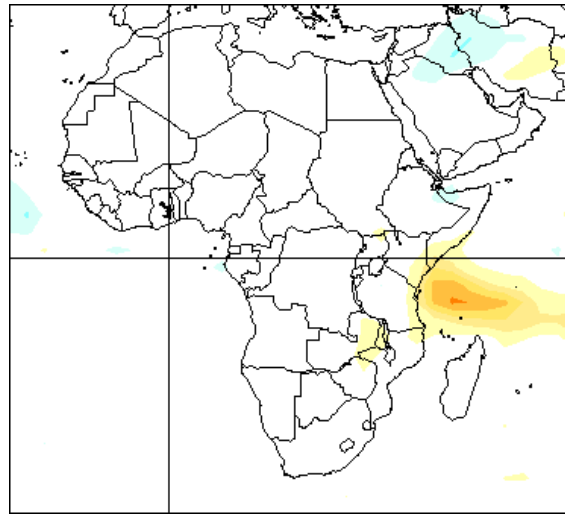


Precipitation: Month to month probabilistic forecast. October to December

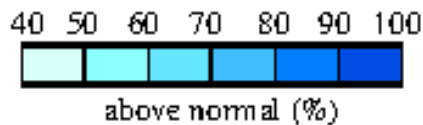
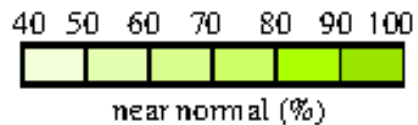
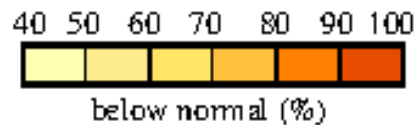
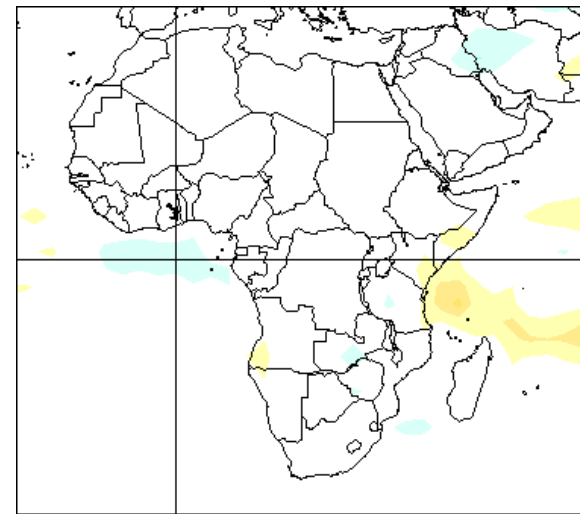
October, lead 0.5 month



November, lead 1.5 month

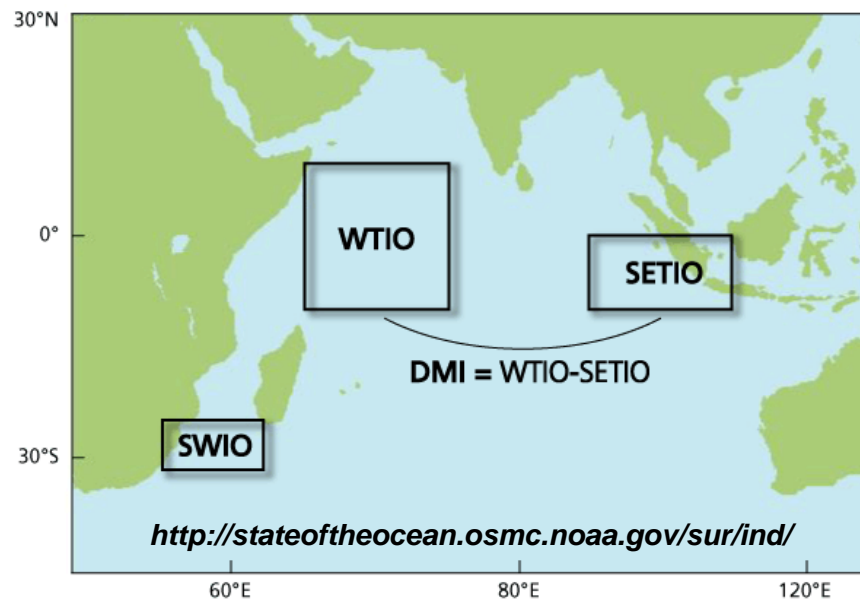


December, lead 2.5 month



Climate indices important for the region

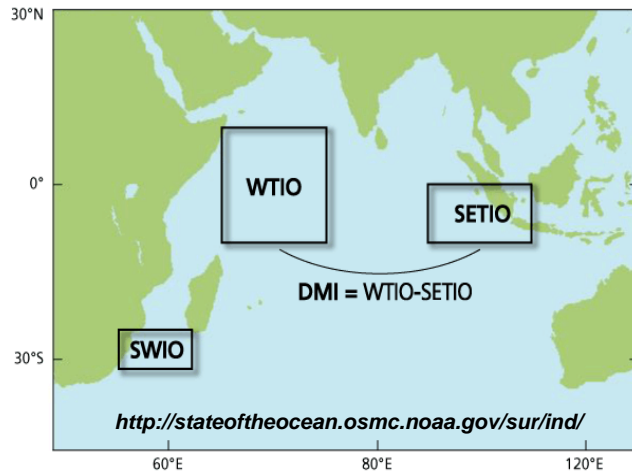
1. South West Indian Ocean SST index- SWIO
2. Western Tropical Indian Ocean SST index - WTIO



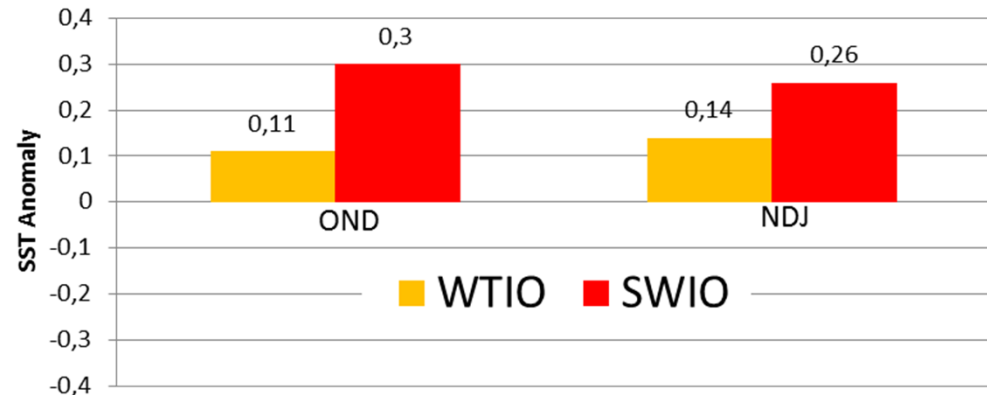
- CanSIPS provides both, monthly and seasonal forecasts, for WTIO and SWIO indices



CanSIPS forecasts for WTIO and SWIO based on the forecast initialized on the 15th Septembre 2016

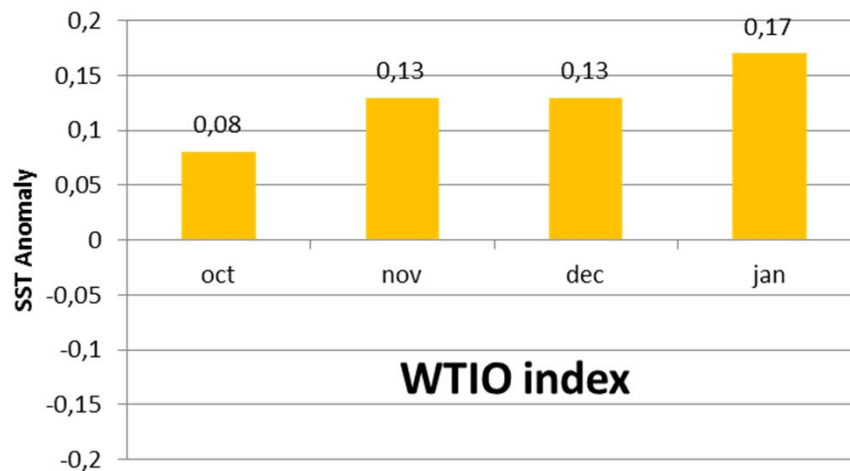


Seasonal indices

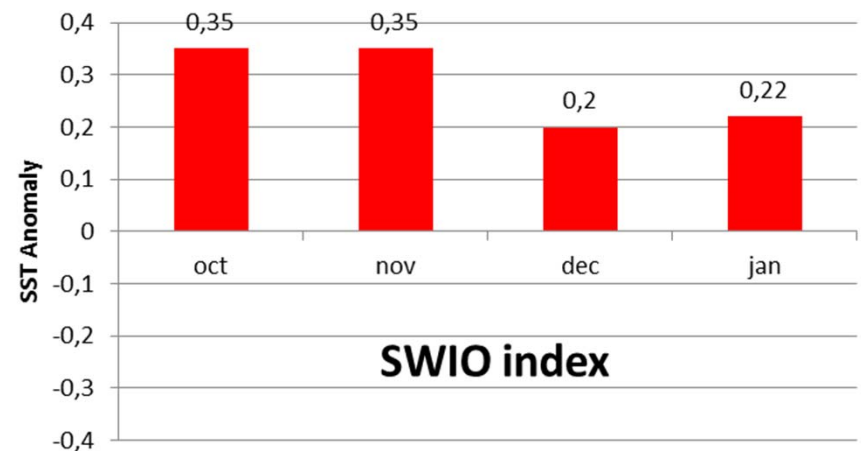


Seasons

Monthly indices



WTIO index



SWIO index

Months

Months



Notes

- The forecasts and expected skill of CanSIPS can be found here: http://www.cccma.ec.gc.ca/cgi-bin/data/seasonal_forecast/sf2 (user: cccmasf, pass: seasforum).



Environment
Canada

Environnement
Canada

Canada