Introduction

Over the past several years, there has been a growing demand for operational forecasts on the sub-seasonal time scale ranging from one week to one month, as many decisions in socio-economic sectors fall into this time range. The NOAA's Climate Prediction Center (CPC) is developing a set of forecasting tools to address the gap in sub-seasonal forecasting. It has developed week 1, week 2 and week 3-4 probabilistic forecasts for:

- precipitation
- 2m air temperature
- heat wave days

These sub-seasonal forecasts cover the area encompassing the Caribbean, Central America and Mexico.

Week 3-4 precipitation forecast

Week 3-4 temperature forecast

Week 1 heat wave day forecast (NOAA's Heat Index ≥ 38°C)

Week 1 heat wave day forecast (T_{max} ≥ 90th percentile)

Methodology

Precipitation and 2m air temperature forecasts

| Precipitation and 2m air temperature forecasts |
| - CPC unified gauge-based analysis of daily precipitation | - CPC unified gauge-based analysis of daily precipitation |
| - Gridded CPC mean temperature | - CPC unified gauge-based analysis of daily precipitation |

Transformation: 2-category probability

Calibration

- Calibration: F' = F - μ̂
- Calibration: F' = F - μ̂

For precipitation, F' is transformed into a normal distribution.

Heat wave day forecasts

| Heat wave day forecasts |
| - Gridded CPC maximum temperature | - CPC GEFS and CPC CFSv2

In this study, a heat wave is defined as a period of:
- at least 3 consecutive days with daily NOAA’s Heat Index ≥ 38°C,
- or at least 3 consecutive days with daily T_{max} ≥ 90th percentile in the 30-year climatological record from 1981-2010

p(heat wave) = \frac{\text{number of ensemble members favourable for heat wave}}{\text{total number of ensemble members}}

Verification

Verification metrics are computed to provide an objective evaluation of the forecast quality.

\[ HSS = \frac{\text{Heidke Skill Score}}{\text{Number of runs}} = \frac{\text{Number of correct forecasts} - \text{Number of incorrect forecasts}}{\text{Number of runs} - \text{Number of runs} \times \frac{1}{2}} \]

\[ AUC = \text{Area Under the ROC Curve} = \frac{\text{Number of correct forecasts}}{\text{Number of runs}} \]

Verification Results

Heat wave days (NOAA’s Heat Index ≥ 38°C)

Week 1/Week 2

AUC = 0.52

Week 2

AUC = 0.52

Heat wave days (T_{max} ≥ 90th percentile)

Week 1/Week 2

AUC = 0.45

Week 2

AUC = 0.42

Conclusion

- Verification reveals skillful forecasts at time ranges of week 1 and week 2.
- Results suggest that the NCEP models perform reasonably well in depicting heat wave events in the Caribbean, Central America and Mexico.
- The heat wave day forecasts, when made available in real time, can help mitigate the impact of heat on human health in vulnerable populations.
- Efforts will be done in performing bias corrected forecasts to help increase the skills, at all time scales.