# Interannual variability and predictability assessment of JJA surface air temperature over the Arabian Peninsula in North American Multimodel Ensemble


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## Abstract


Interannual variability and predictability of summer (June-July-August: JJA) surface air-temperature (SAT) over the Arabian Peninsula (AP) referred to as AP-SAT hereafter, is investigated using observations and reforecast data obtained from the six North American Multimodel Ensemble (NMME) project for the period of 1982-2017. The observation shows that the warmest season over the AP is JJA, with the highest temperature over the central AP regions. The AP-SAT during summer also shows a strong statistically significant warming trend. The warming over the AP is related to the equatorial Indian and Atlantic Ocean SSTs as well as SSTs located in Mediterranean and Arabian Seas, which itself showed significant warming trend in recent time. Summer AP-SAT variability is associated with the anomalous low pressure over the AP and eastern Mediterranean region, and a high pressure over the Siberia. The focus of this study is to estimate the potential predictability and skill of the AP-SAT in coupled models reforecast data initialized at different months for a fixed target season. Unanimously all models shows positive temperature anomalies in recent decades (after 1998), which is matching with observed trend. Secondly the interannual variability of the AP-SAT anomalies in all the models is synchronized, but the magnitude of the predicted anomalies is notably different and underestimates the observed anomaly, usually due to the large error in the predicted temperature climatology. Coupled Forecast System Version 2 (CFSv2) show higher summer AP-SAT potential predictability and skill as compared to other models in NMME.


## Models, Data and Methodology

**6-NMME** CGCM Seasonal Forecast Models are;

- ✧ NCEP-CFSv2 (24)
- ✧ NASA-GMAO-062012 (11)
- ✧ COLA-RSMAS-CCSM4 (10)
- ✧ GFDL-CM2p1-Aer04 (10)
- ✧ GFDL-CM2p5-FLOR-A06 (12)
- ✧ GFDL-CM2p5-FLOR-B01 (12)

✓ GHCN_CAMS TREF
✓ HadISST SST
✓ MSLP, Winds and geopotential height

**Period:** 36 years reforecasts (1982-2017)
**Target:** June-July-August (JJA)
**Initialized:** 1 May and 1 Apr (Lead-1 & Lead-2)

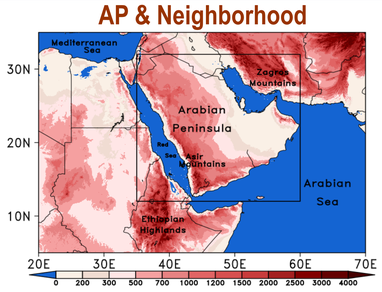
Potential predictability is a model dependent quantity. Several different techniques have been employed to study the potential and actual predictability.

These includes;

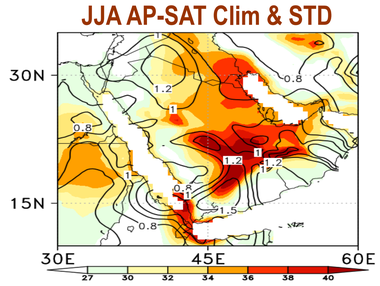
- ✓ Signal, Noise and Signal-to-Noise Ratio
- ✓ Perfect Model Correlation
- ✓ Prediction Skill (Correlation between Model and Observation)

## The Arabian Peninsula (AP)

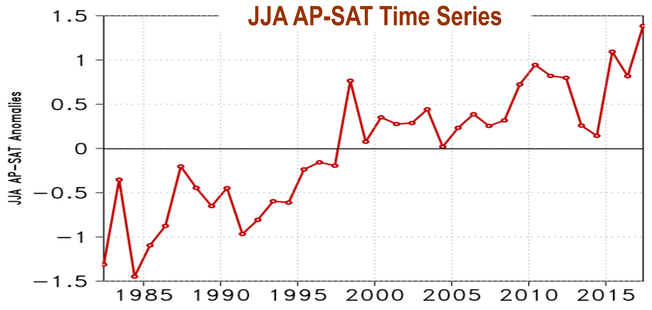
AP & Neighborhood




JJA AP-SAT Clim & STD

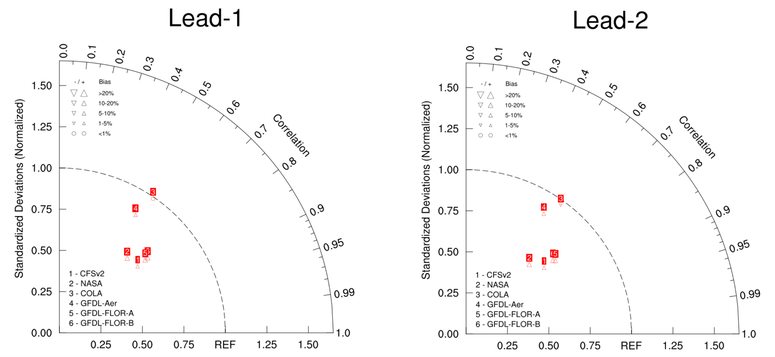



JJA AP-SAT Time Series



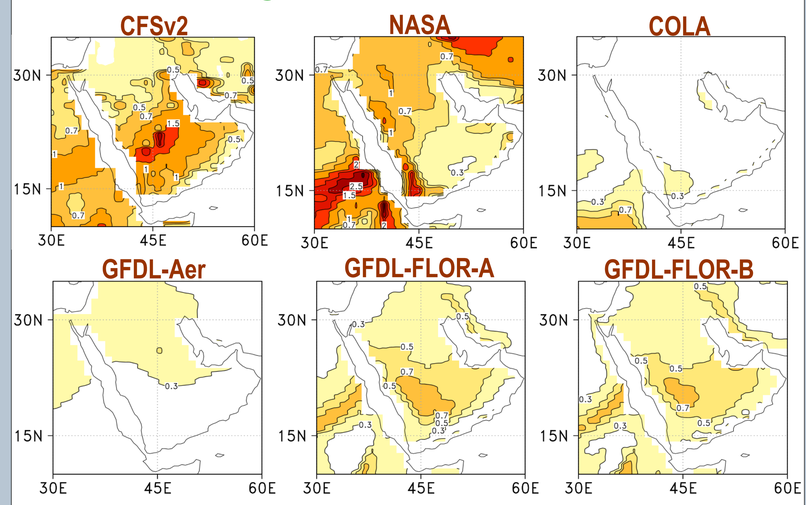

## Model Fidelity

At Lead-1 and 2, CFSv2 seems performing better than the other NMME models.

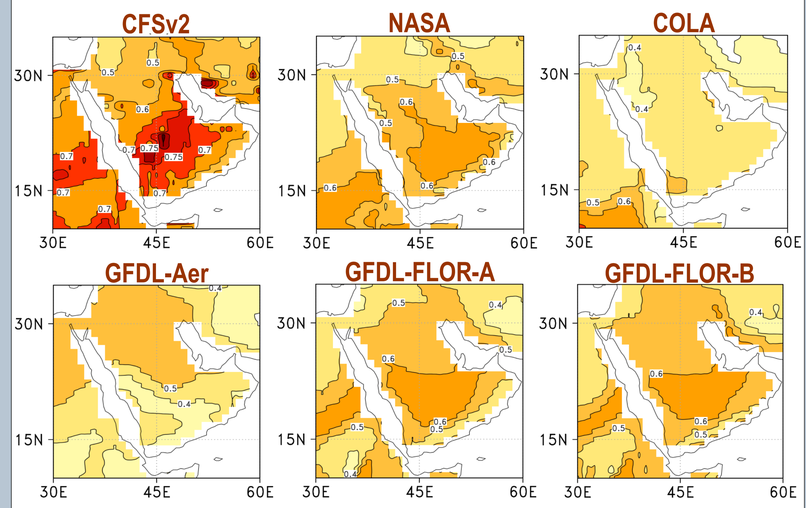



## Potential and Actual predictability Assessments

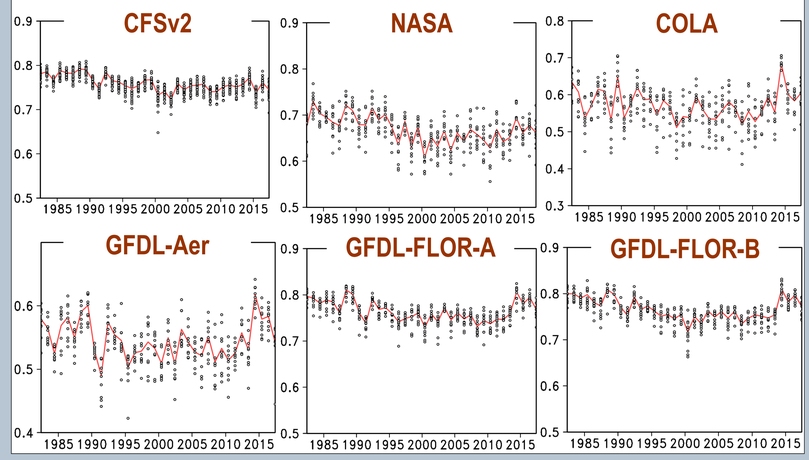
### Signal-to-Noise-Ratio




### Perfect Model Correlation (PMC)

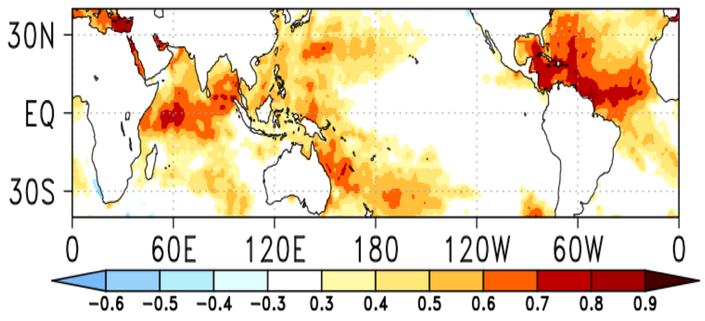



### Prediction Skill (ACC)

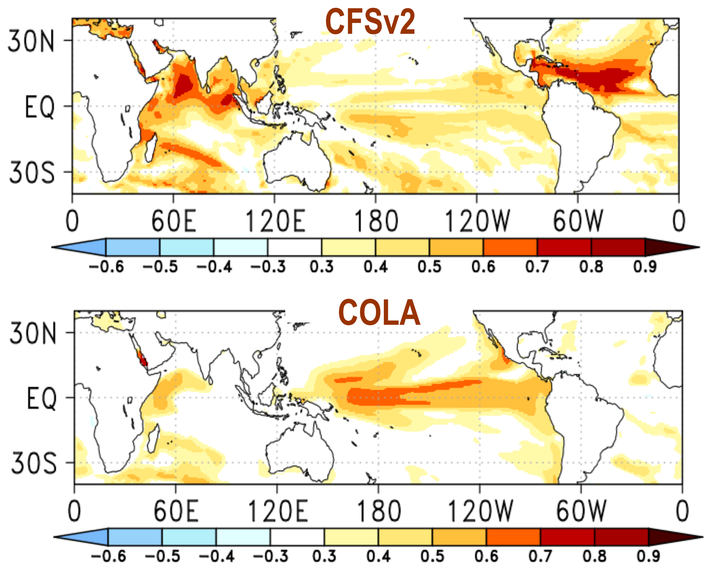



## Observed and Modeled Teleconnection

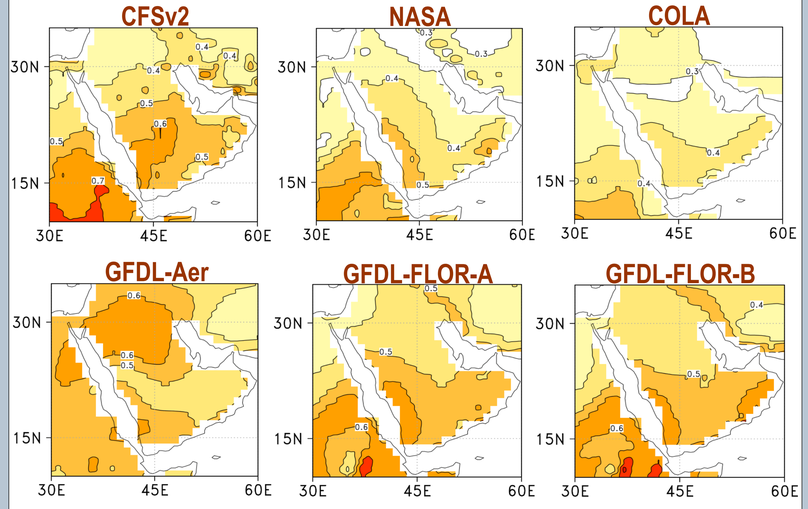
### OBS Corr (AP-SAT, G-SST)




### Prediction Corr (AP-SAT, G-SST)




## Predictability Assessment in Detrended Data (PMC)




## Summary and Conclusion

This study investigates the variability, potential predictability and skill assessment of summer AP-SAT in NMME CGCM prediction models. Main conclusion of study are;

- ✓ **Summer AP-SAT** have robust increasing trend, and well correlated with EIO, TNA and MED SSTs.
- ✓ **CFSv2 provides high** SNRatio, Perfect Model Correlation, Skill, AP-SAT & G-SSTs connections as compared to other NMME models.
- ✓ Further research is in progress to pinpoint the underlying Physical Mechanism.