

# NOAA CTB Outstanding Operational Forecast Challenges

(<http://www.nws.noaa.gov/ost/CTB/openpb.htm>)

## Geographical separation of seasonal prediction skill between statistical tool and dynamical model

**Statistical tool:** Constructed Analog (CA) (van den Dool 1992, 2007)

- 1) Data: HAD SST (45°S-45°N, 1948-1980)
- 2) Ensemble size: 24 members (1-4 seasons data in ICs, 6 EOF cutoffs (35, 40, 45, 50, 55, 60))

**Dynamical model:** North American Multi-Model Ensemble (NMME) (Kirtman *et al.* 2014)

**Initial condition (IC) season:** MAM, JJA, SON, DJF

**Forecast lead-time:** 1 and 5 months

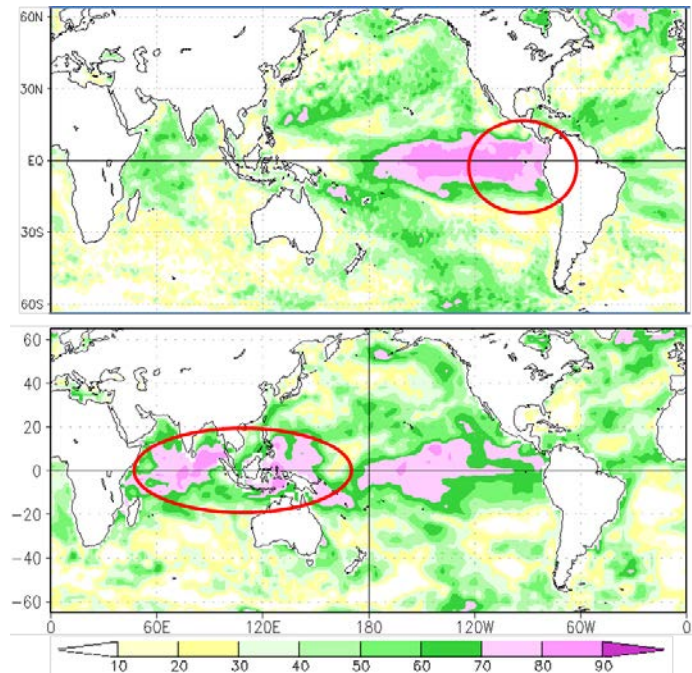
**Skill metrics:** Anomaly Correlation (AC)

**Assessment time period:** CA ~ 1981-2015; NMME ~ 1981-2010

**Verification data:** NOAA-OI-v2 SST

**Puzzle:** It was found distinct geographical separation of seasonal prediction skill with decent skill shown over the tropical western Pacific and Indian Ocean by CA and that over the tropical central-eastern Pacific by NMME (e.g. Fig. 1). A summary of all cases (varied initial seasons and lead times) is given by Table 1.

**Challenges:** The Constructed Analog (CA), a statistical tool, clearly revealed appreciable predictability over the tropical western Pacific and Indian Ocean, where dynamical models had little skill; pointing to possibly missing of important process(es) common to dynamical models, whose development efforts more focused on improving ENSO forecast historically.



**Fig.1** Anomaly correlation skill (%) of 5-month lead NDJ SST forecast (ICs through MAM) by NMME (top) and CA (bottom).

IC season & Lead	Indian Ocean	Western Pacific	Central Pacific	Eastern Pacific	Atlantic
MAM, L1	CA	CA		NMME	CA
MAM, L5	CA	CA		NMME	
JJA, L1	CA	CA		NMME	
JJA, L5	CA	CA			CA
SON, L1	CA	CA			
SON, L5	CA	CA	NMME		NMME
DJF, L1	CA	CA		NMME	NMME
DJF, L5	CA	CA	NMME	NMME	CA

**Table 1** Geographical skill comparison between CA and NMME in predicting tropical ocean basin SSTs with varied IC seasons and lead-times.

## References

van den Dool, H.M., 1994: Searching for analogues, how long must we wait? *Tellus*, **46A**, 314-324.

van den Dool, H. M., 2007: *Empirical Methods in Short-Term Climate Prediction*. Oxford University Press, 215 pp.

Ben P. Kirtman, Dughong Min, Johnna M. Infanti, James L. Kinter, III, Daniel A. Paolino, Qin Zhang, Huug van den Dool, Suranjana Saha, Malaquias Pena Mendez, Emily Becker, Peitao Peng, Patrick Tripp, Jin Huang, David G. DeWitt, Michael K. Tippett, Anthony G. Barnston, Shuhua Li, Anthony Rosati, Siegfried D. Schubert, Michele Rienecker, Max Suarez, Zhao E. Li, Jelena Marshak, Young-Kwon Lim, Joseph Tribbia, Kathleen Pegion, William J. Merryfield, Bertrand Denis, and Eric F. Wood, 2014: The North American multimodel ensemble: phase-1 seasonal-to-interannual prediction; phase-2 toward developing intraseasonal prediction. *Bull. Amer. Meteor. Soc.*, **95**, 585–601. doi: <http://dx.doi.org/10.1175/BAMS-D-12-00050>.

(This study was presented by Peitao Peng at a NCEP/CPC internal meeting on 7 April 2016)