Subseasonal predictability of precipitation and temperature over North America and relationships with teleconnection patterns

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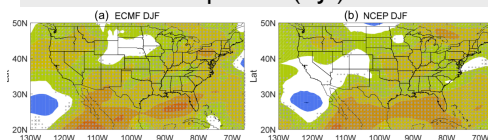
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Introduction

The subseasonal predicta...
temperature is examined...
prediction system reforec...
Database, 1999–2010 (E...
CFSv2). The regions of s...
terms of large-scale telec...
NAO, ENSO).

N34 **NAO**

PNA

Precip...

(a) ECMF DJF   (b) NCEP DJF

Tempe...

(a) ECMF DJF   (b) NCEP DJF
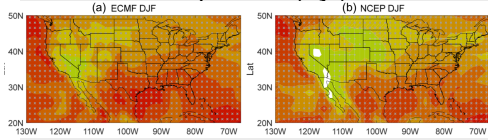
Geopotential Height 500hPa (DJF)

Dot / cross symbol is significant at the 5 / 1% level.
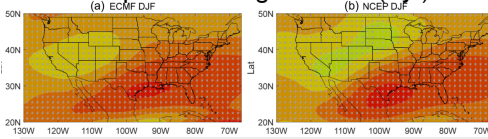
- Skill is comparable in both models.
- Precipitation skill is highest south of 30N, with some skill over the NE and NW U.S.
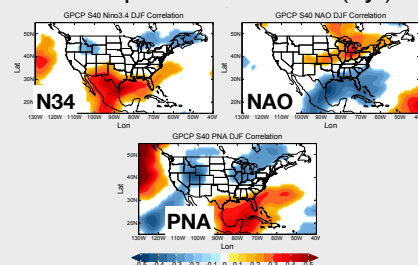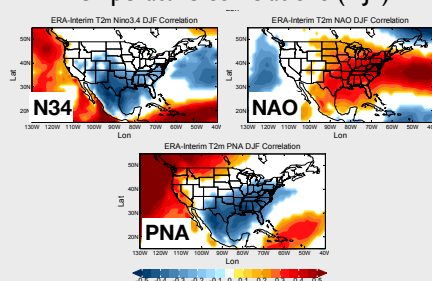- Temperature skill is highest over Oceans and S & E U.S.
- Lobe of high skill in Z500 corresponds with skillful areas in precip. and temperature.

Temperature correlations (DJF)

N34 **NAO**

PNA

-0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5

- Maps are computed with dekadal averages with the seasonal cycle subtracted.
- Both observed precip. and temperature exhibit high correlations with all 3 indices south of 30N, and moderate correlations over the NE U.S.
- Temperature correlations are higher, consistent with higher skill.

Week 3-4 ACC skill (DJF)

AO   NAO   PNA

ECMF Total
ECMF Subseasonal
NCEP Total
NCEP Subseasonal
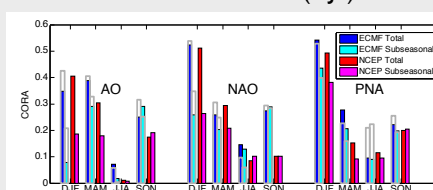
- PNA skill is mostly subseasonal
- NAO skill is both seasonal and subseasonal
- Both models have comparable skill

Figure 4: Week-3&4 CORA and the subseasonal components for ECMWF (blue) and NCEP (red) AO, NAO, and PNA indices. Any CORA ... greater than ... 90% (95%) confidence ... a one-tailed t-test...
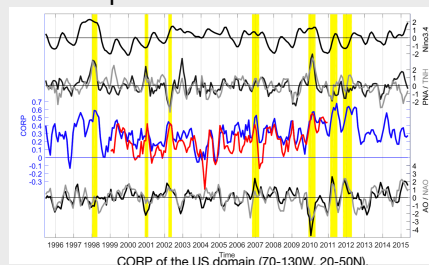
Pattern Correlation vs ENSO

Pattern correlations (CORP) between observed and forecasted week 3–4 averaged anomalies over US domain.

(a) Prcp   NCEP 1999-2010 / ECMF 1999-2010 / ECMF 1995-2014
(b) T2m
(c) Z500
(d) SLP
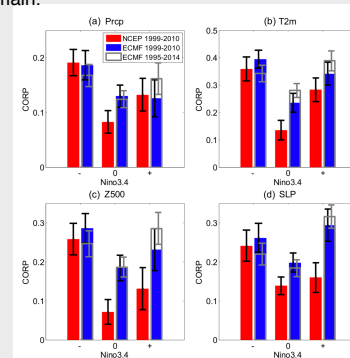
- Negative and positive ENSO phase composites (>1std) have higher skill than neutral for all four variables, esp. for temperature.

Temperature Pattern Corr. Skill

CORP of the US domain (70-130W, 20-50N), compared with the standardized Nino3.4 / PNA / TNH / AO / NAO indices

- 2009/10 winter is extreme case for all indices: Nino3.4 SST ~1, AO ~−5, NAO ~−3, and PNA/ TNH ~4 (st. values), when the T2m CORP was high.
- High CORP during 1997/98 winter corresponds to high values in the Nino3.4 and PNA/TNH.
- High CORP during 2006/2007 winter is accompanied by extreme AO/NAO
- Predictability is usually low when teleconnection modes are quiet (in neutral phases; e.g., 2003/2004 winter).
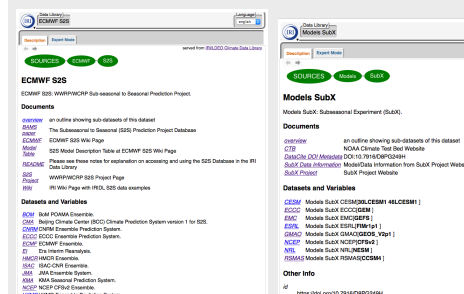
Conclusions

- ECMWF system exhibits slightly higher week 3–4 skill for both temperature and precipitation, but both systems show similar geographical variations in skill in all seasons and encouraging skill in certain regions.
- During winter, week 3–4 predictability is higher during extreme phases of ENSO, PNA, TNH and AO
- Both systems predict these teleconnection indices quite skillfully, with ACC of the wintertime NAO and PNA exceeding 0.5 for both models.
- Subseasonal contribution to the PNA skill is found to be larger than for the NAO, where the seasonal component is large.

Reference: Wang, L., and A. W. Robertson, 2018: Subseasonal Climate Predictability over the United States assessed from Two Operational Ensemble Prediction. Climate Dynamics, sub judice.

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S2S and SubX Databases in IRI Data Library

SubX and large subset of S2S database are both available in IRI Data Library.

http://iridl.ldeo.columbia.edu