Multi-year prediction of ENSO

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Developing a multi-year prediction system at BoM:

1. ACCESS-S1: New BoM prediction system based on UK GC2 (60 km atmosphere + 25km ocean, high vertical resolutions)
2. Collaboration with UK Met Office: DePreSys3

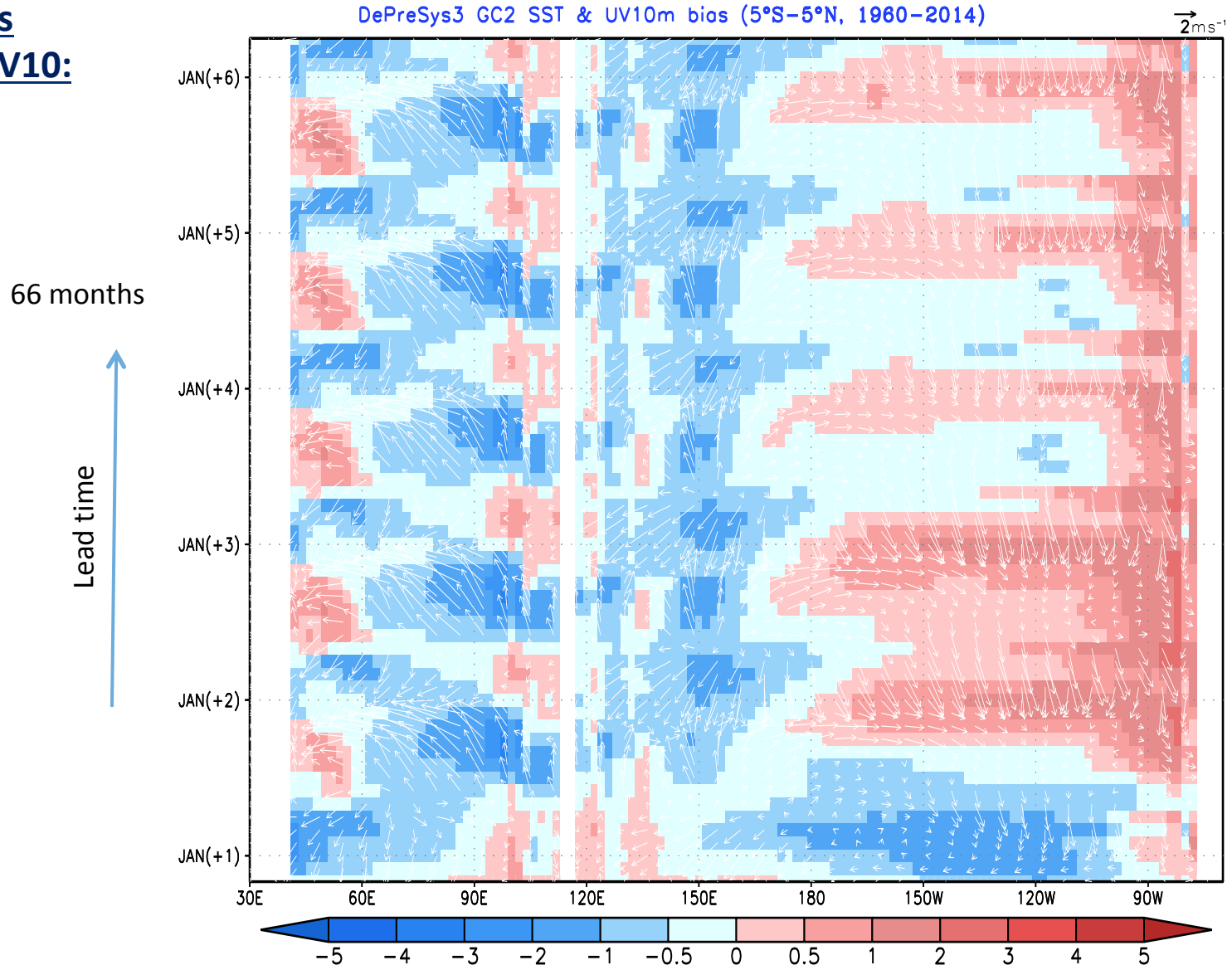
UKMO DePreSys3

- **16 months:** 1 Nov start date, every year during 1980-2014; 30 members
- **66 months:** 1 Nov start date, every 2-3 year during 1960-2014; 10 members

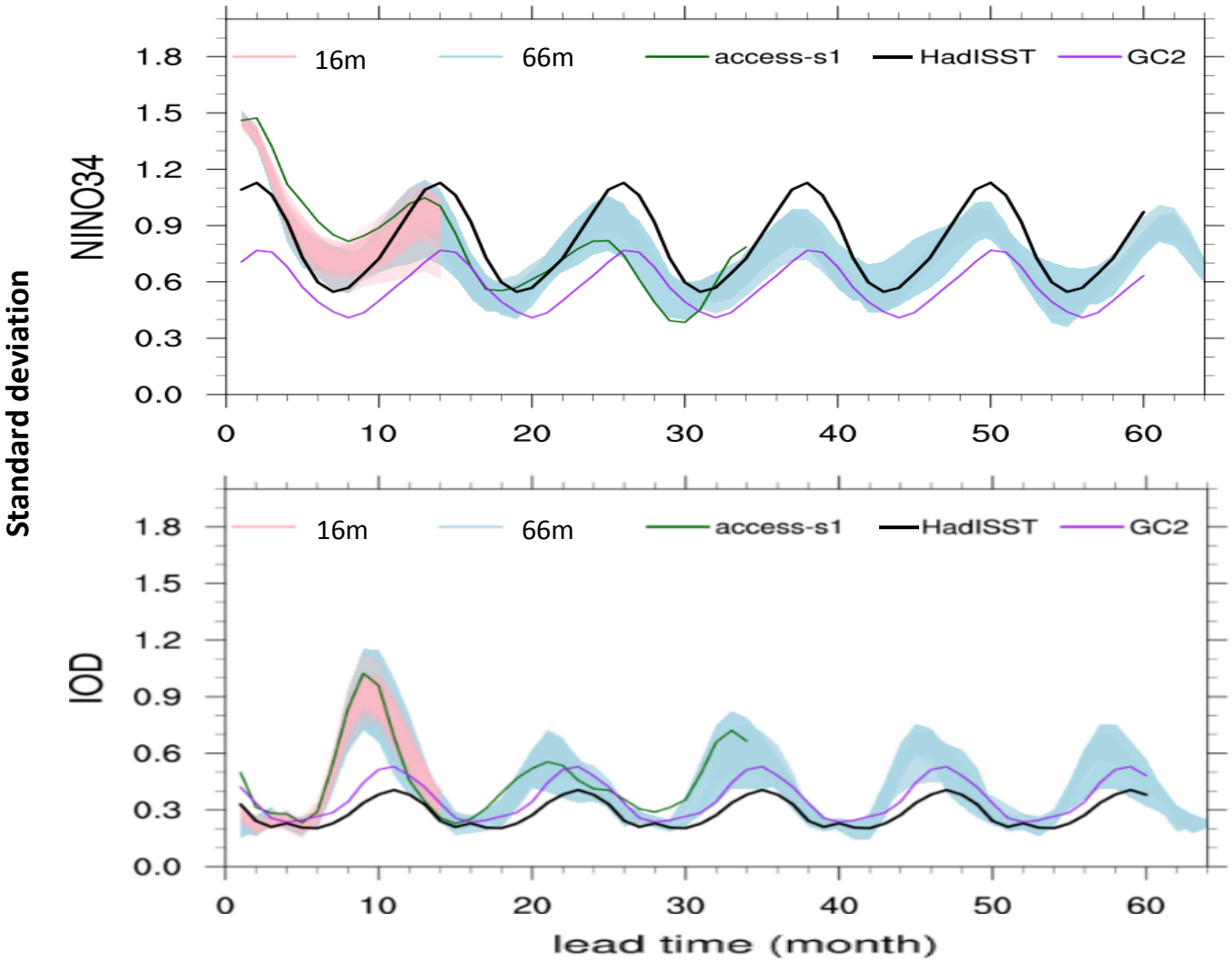
JAMSTEC SINTEX-F

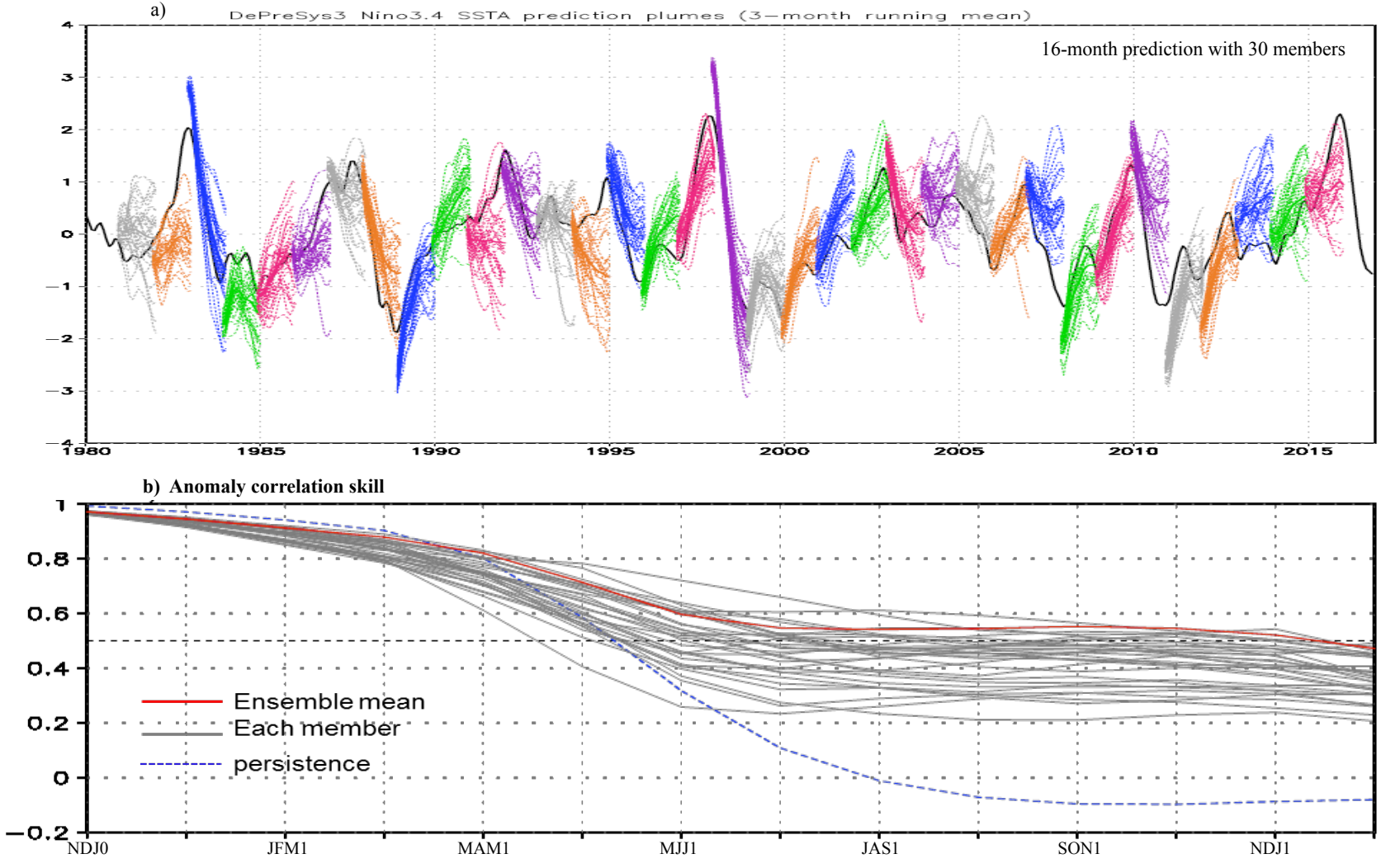
- **24 months:** start from 1st day of every month, 1982-2012, 9 members.

Climate drifts of SST and UV10:

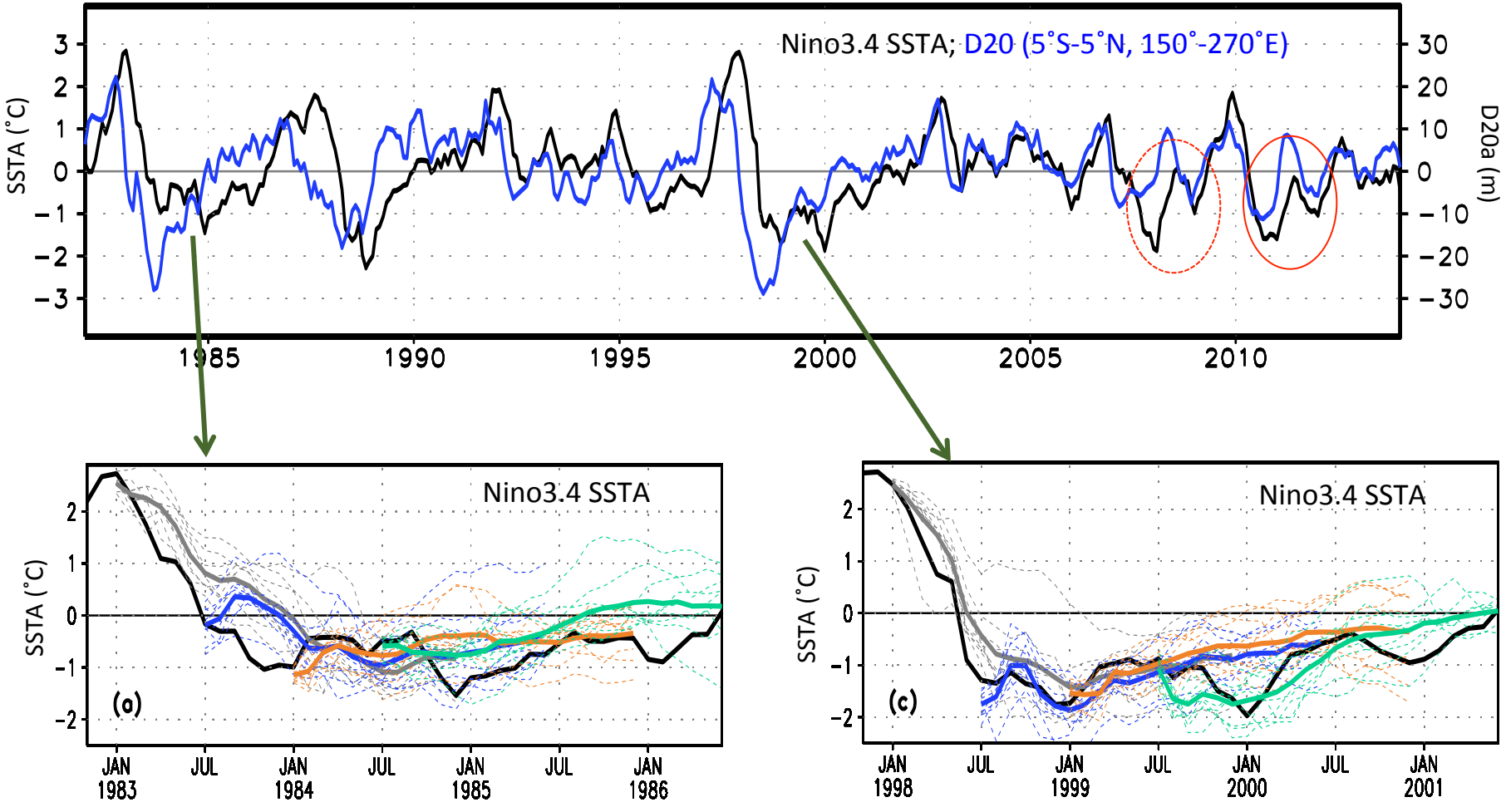


Initial shock



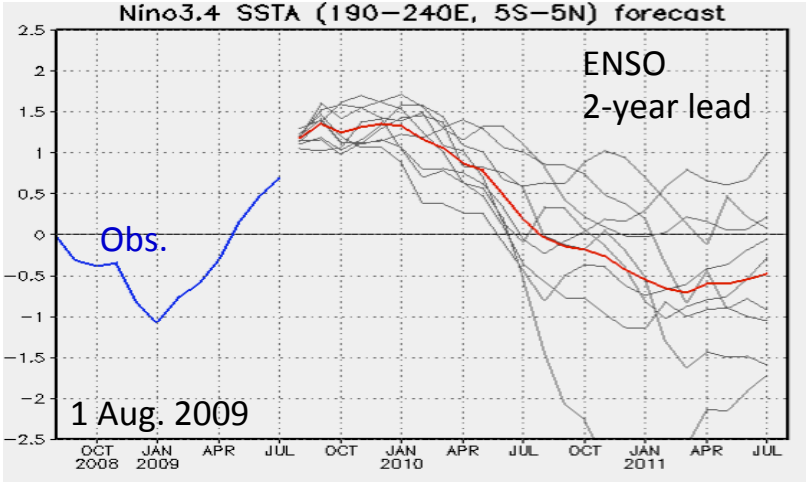

a)
DePreSys3 Nino3.4 SSTA prediction plumes (3-month running mean)
16-month prediction with 30 members
4
3
2
1
0
−1
−2
−3
−4
1980
1985
1990
1995
2000
2005
2010
2015
b) Anomaly correlation skill
1
0.8
0.6
0.4
0.2
0
−0.2
Ensemble mean
Each member
persistence
NDJ0
JFM1
MAM1
MJJ1
JAS1
SON1
NDJ1
Lead time (season)

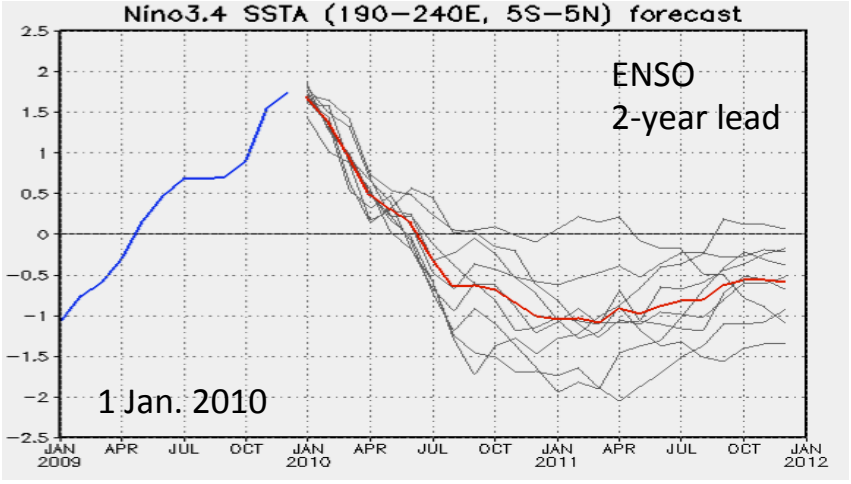
2-year prediction of La Niña events (SINTEX-F):

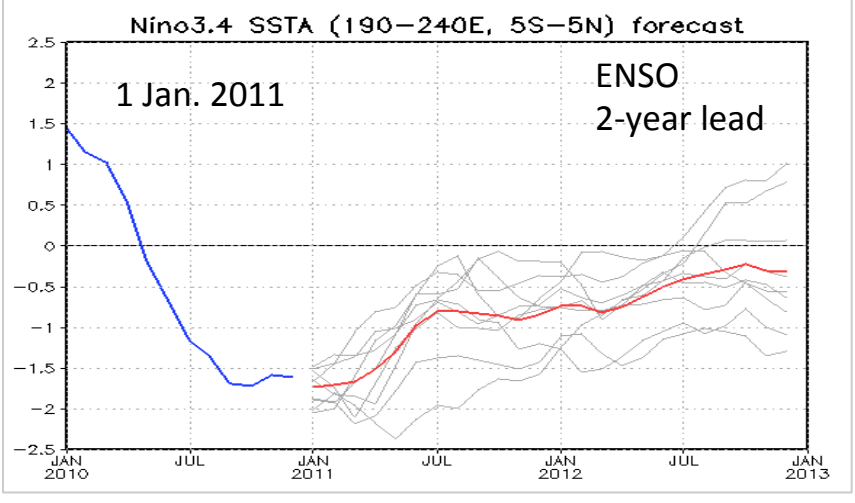


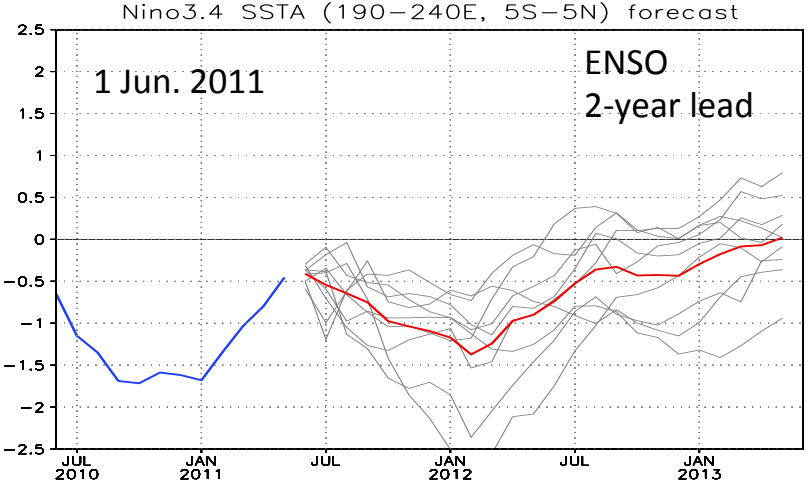
Luo et al. J. Climate 2008

Real time forecasts (http://www.jamstec.go.jp/frsgc/research/d1/iod/e/seasonal/outlook.html)

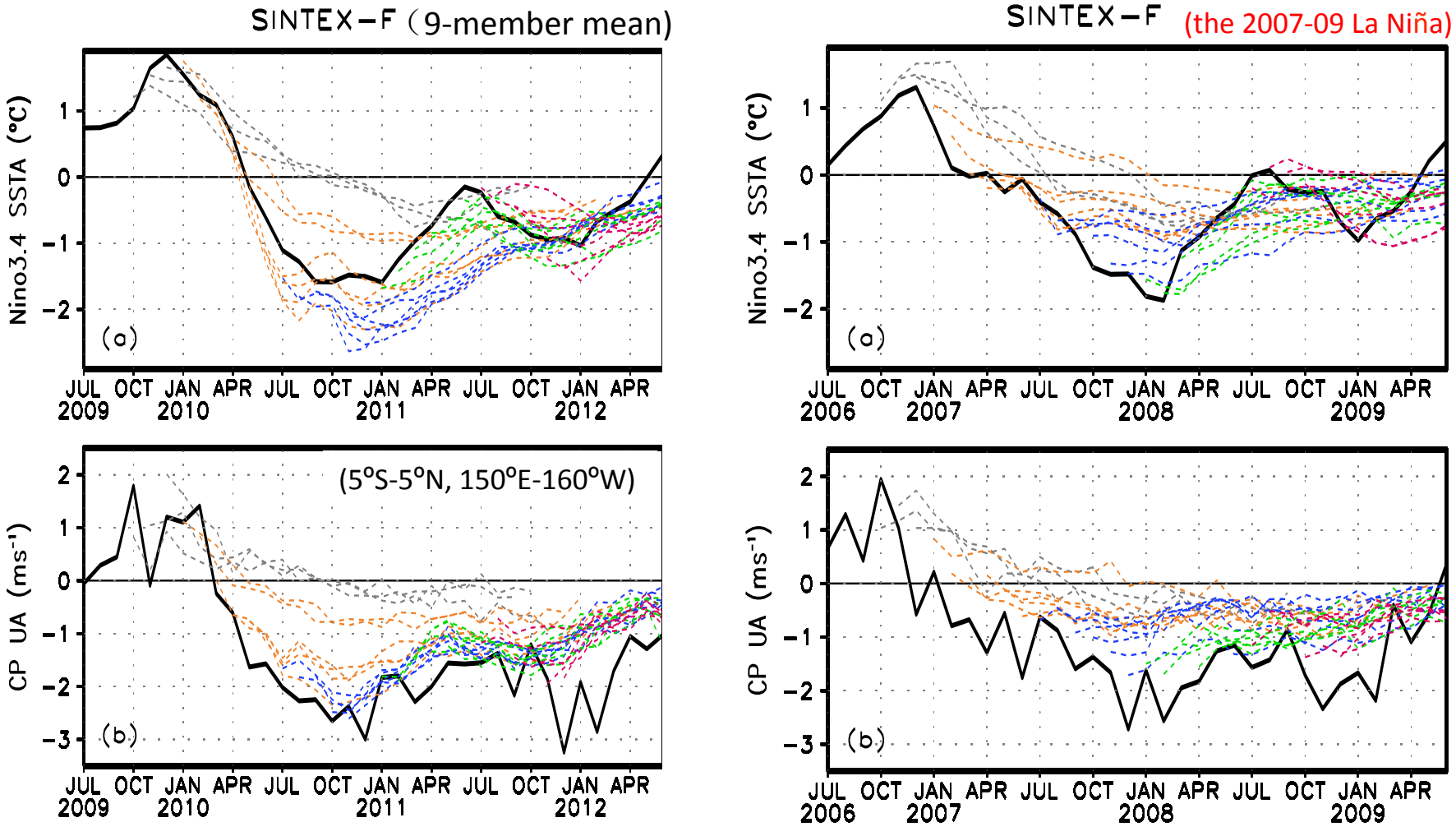


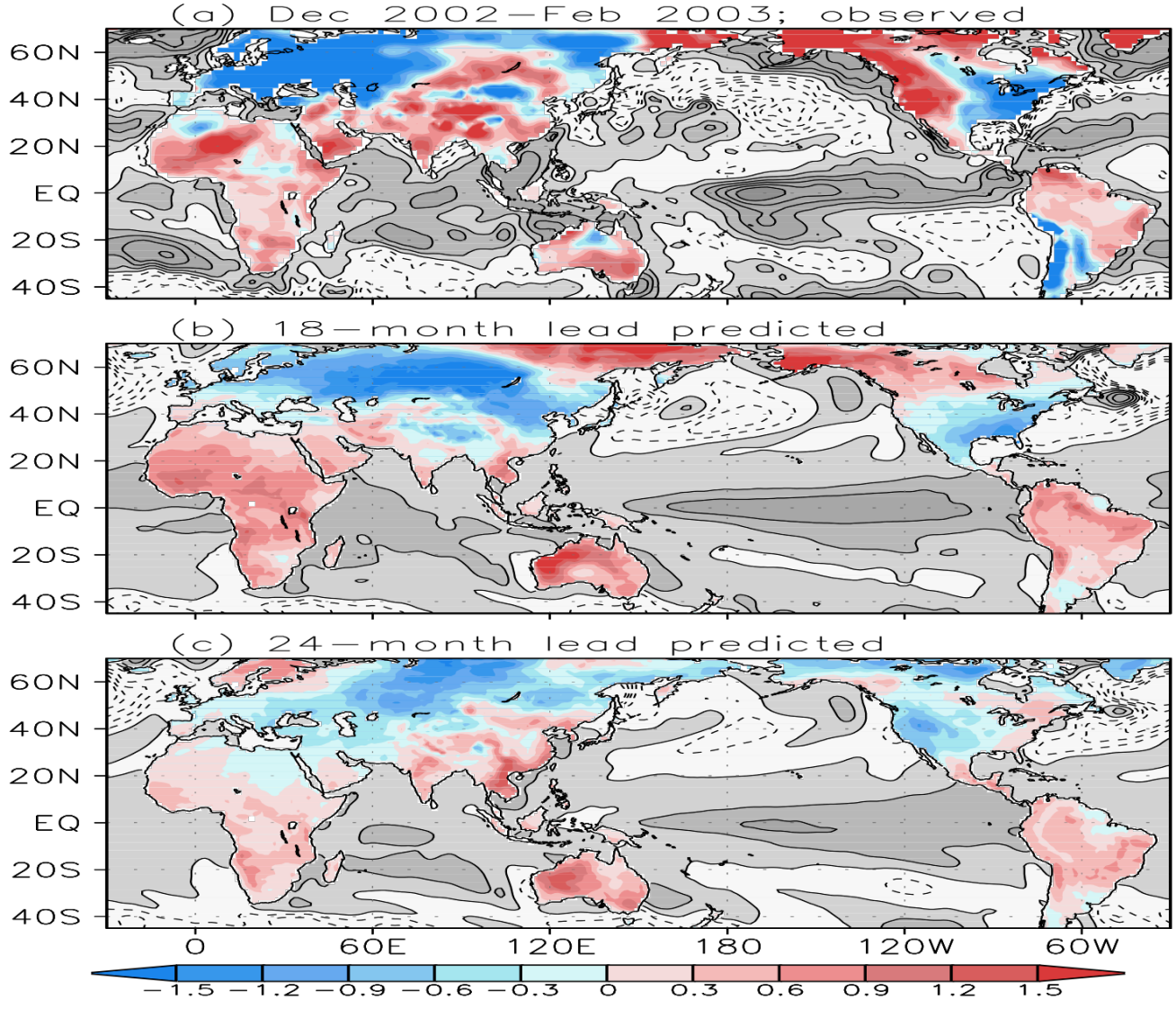






2-year prediction of the 2010-12 La Niña (Luo et al., 2017,*Scientific Reports,* DOI : 10.1038/s41598-017-01479-9)

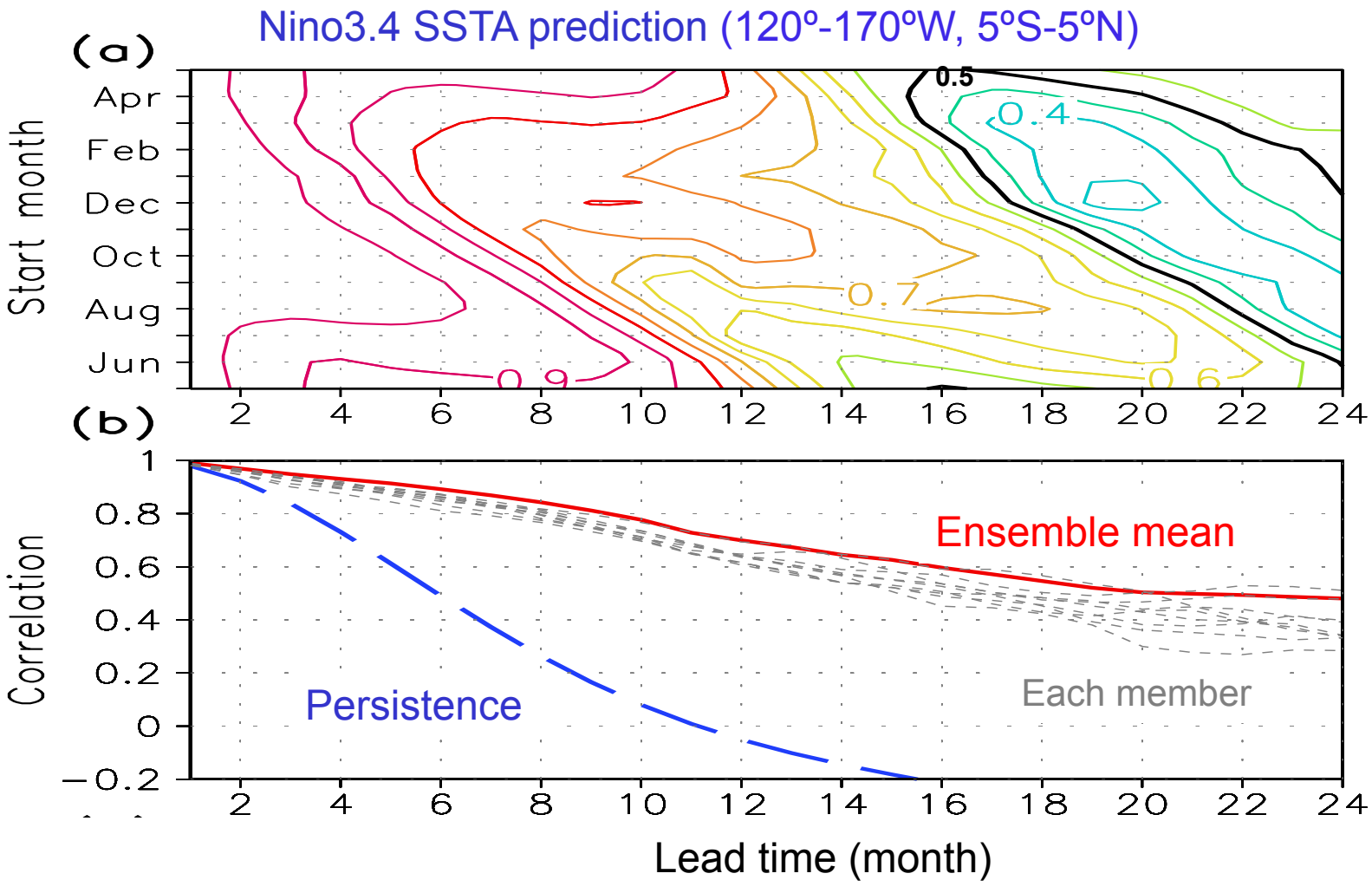




SSTA & 2-m air temperature anomaly

Contour interval is 0.3ºC

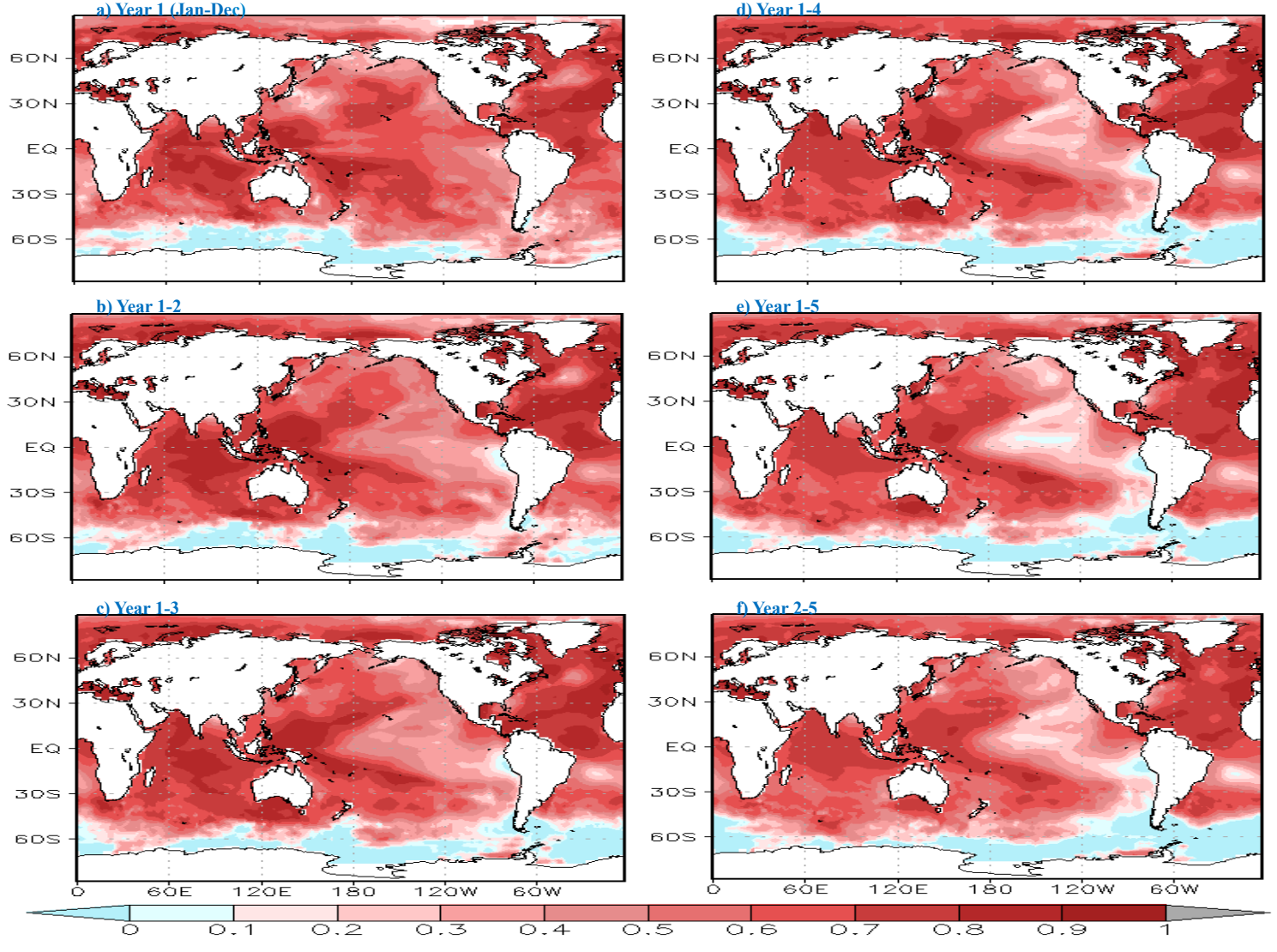
2-year lead ENSO prediction (SINTEX-F, 9 members):

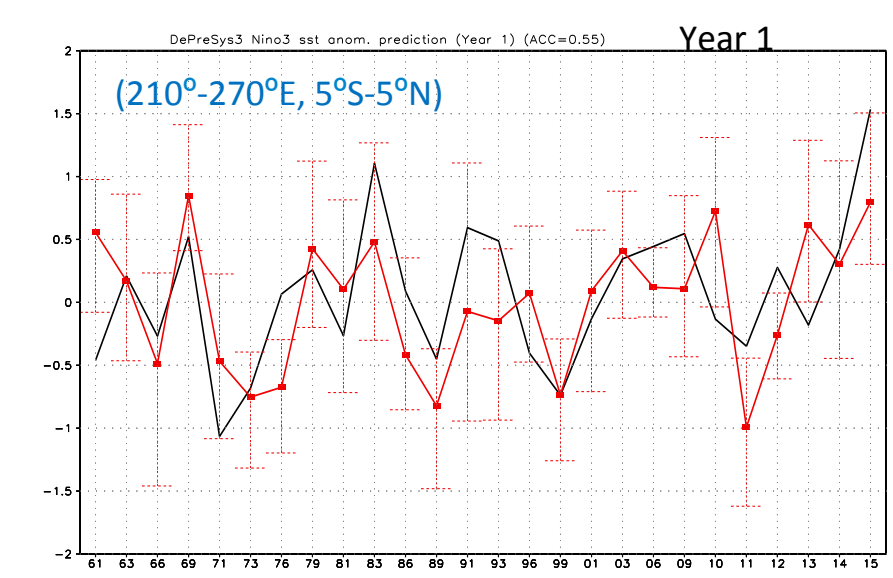


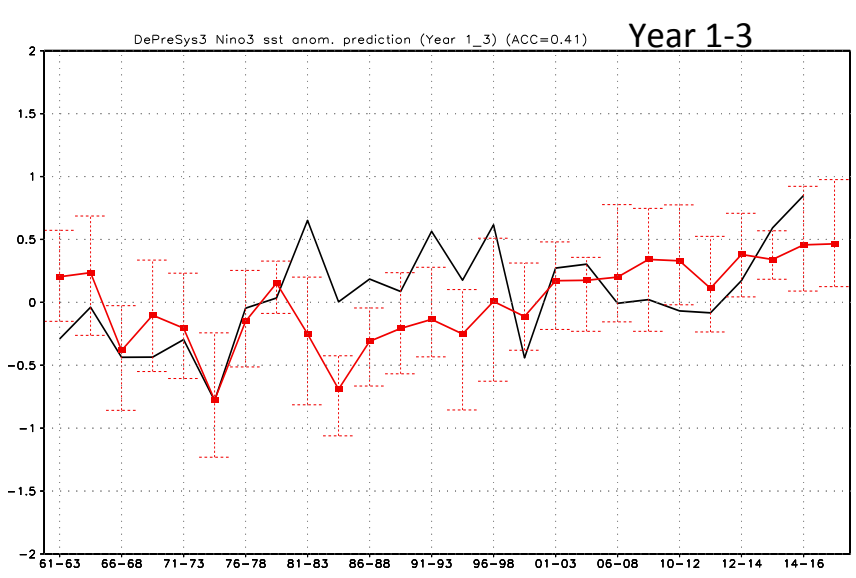
Luo et al., J. Climate, 2008.

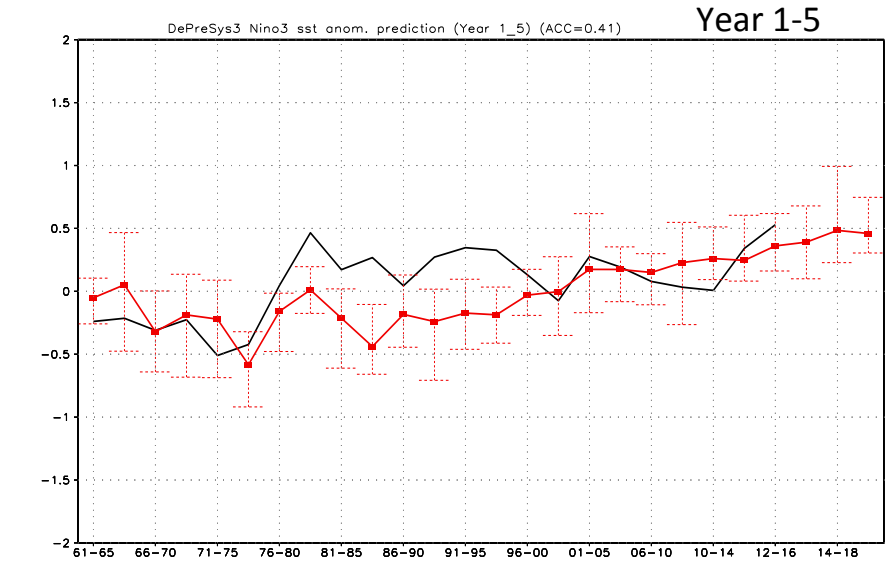
DePreSys3

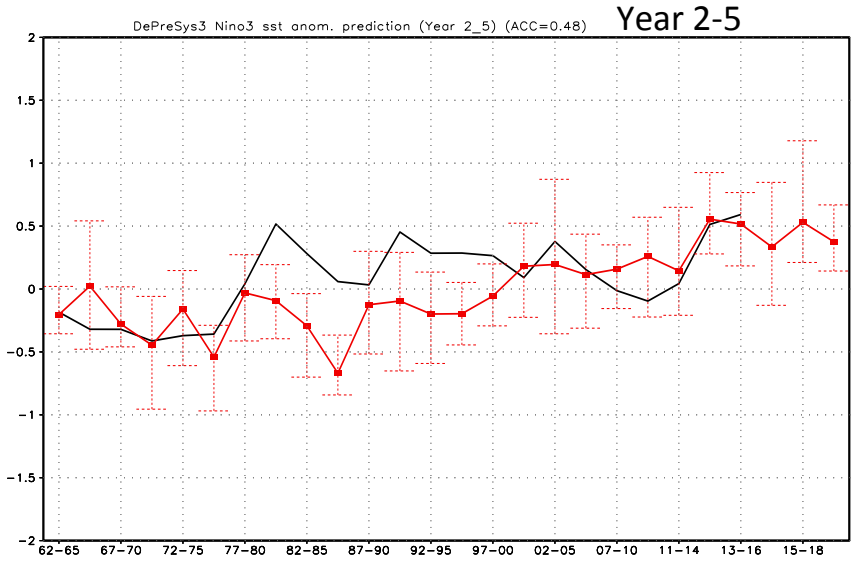
Prediction skill of multi-year mean SST anomaly




DePreSys3 Nino3 sst anom. prediction (Year 1) (ACC=0.55)
Year 1
(210°-270°E, 5°S-5°N)
61 63 66 69 71 73 76 79 81 83 86 89 91 93 96 99 01 03 06 09 10 11 12 13 14 15


DePreSys3 Nino3 sst anom. prediction (Year 1_3) (ACC=0.41)
Year 1-3
61-63 66-68 71-73 76-78 81-83 86-88 91-93 96-98 01-03 06-08 10-12 12-14 14-16

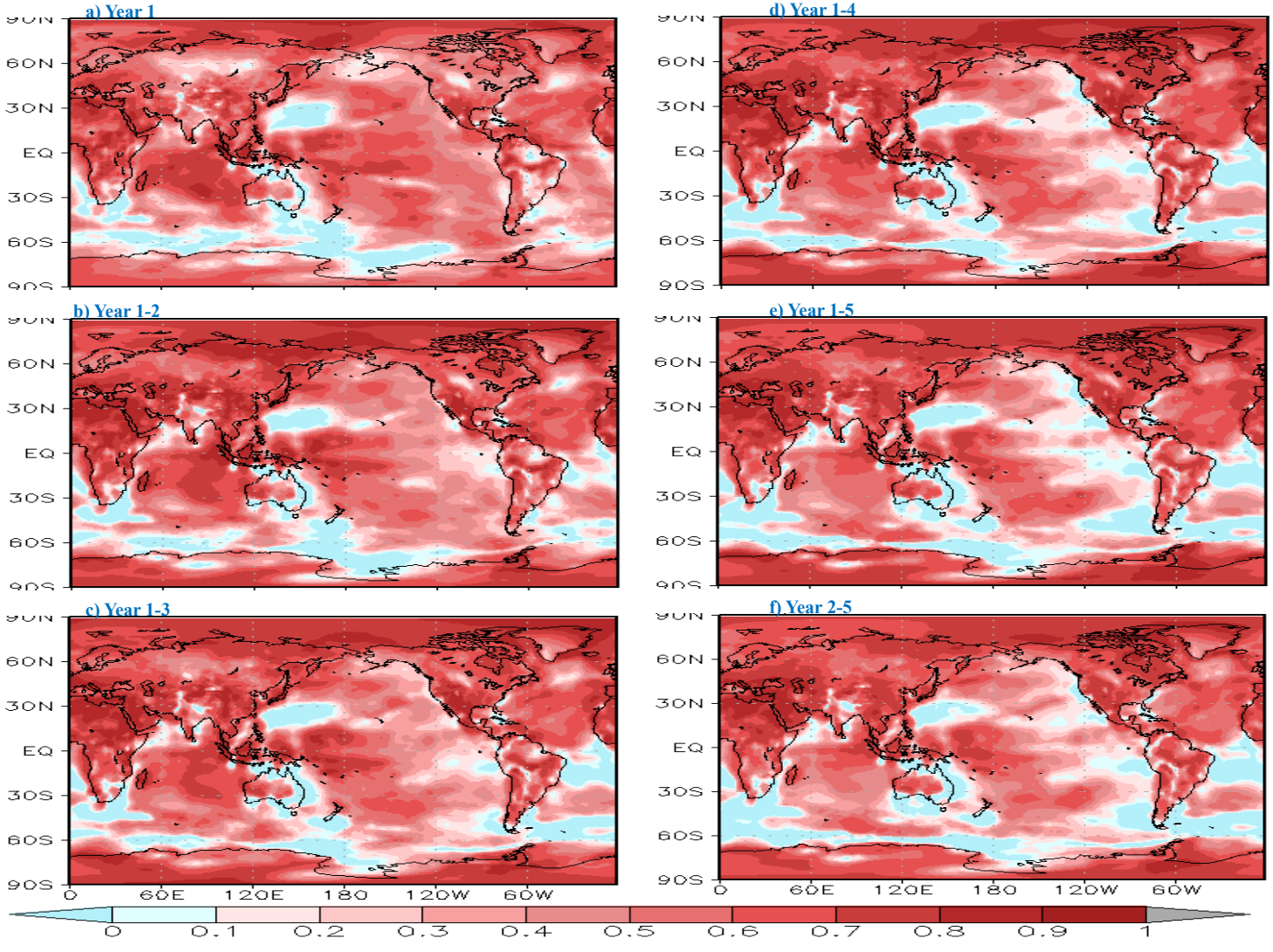

DePreSys3 Nino3 sst anom. prediction (Year 1_5) (ACC=0.41)
Year 1-5
61-65 66-70 71-75 76-80 81-85 86-90 91-95 96-00 01-05 06-10 10-14 12-16 14-18

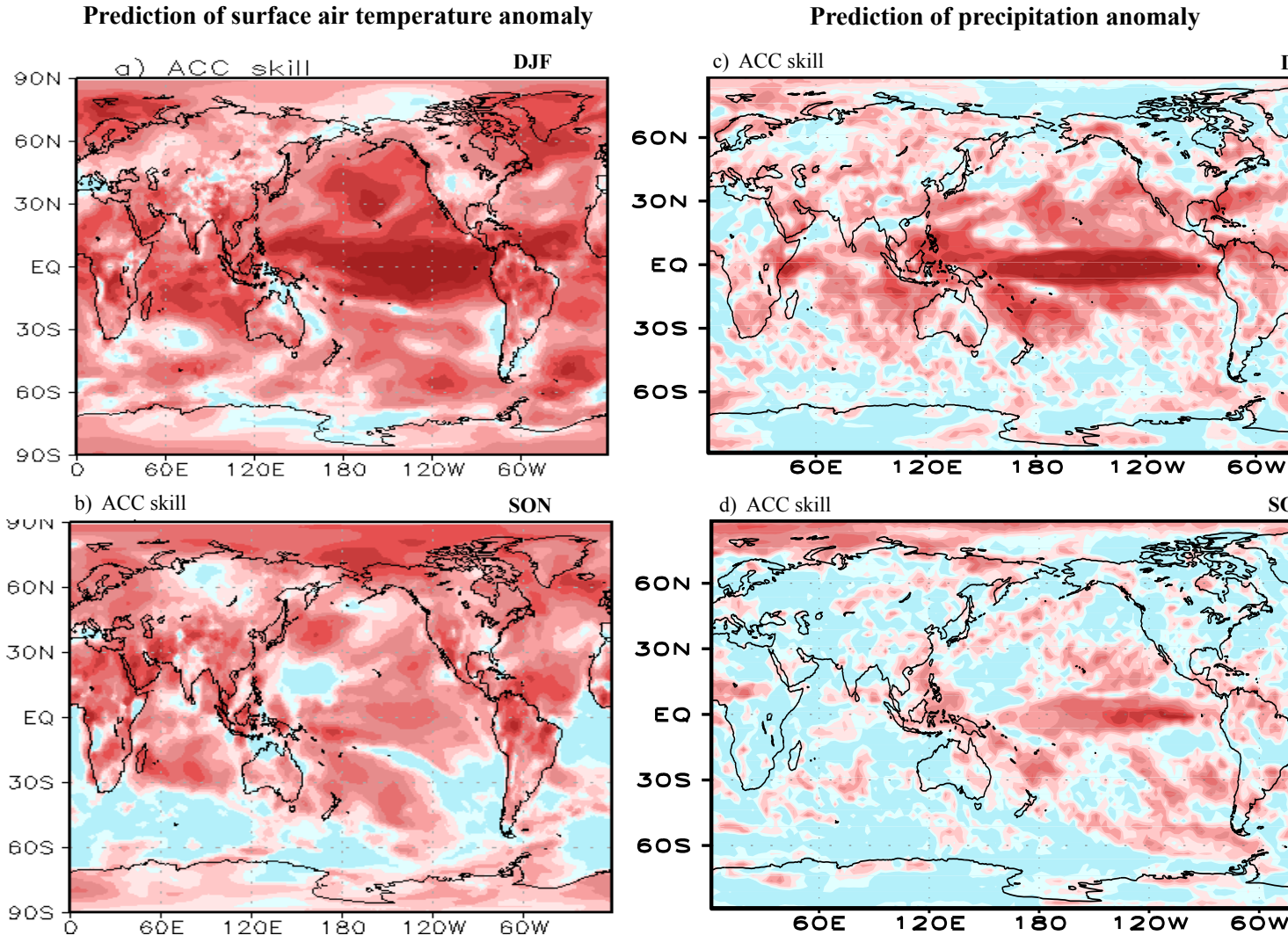

DePreSys3 Nino3 sst anom. prediction (Year 2_5) (ACC=0.48)
Year 2-5
62-65 67-70 72-75 77-80 82-85 87-90 92-95 97-00 02-05 07-10 11-14 13-16 15-18

Summary :

- ❖ Large climate drifts and initial shocks exist.
- ❖ ENSO can be skilfully predicted out to about 1.5 -2 years ahead.
- ❖ Multi-year mean temperature anomalies can be predicted at decadal time scale, particularly in the areas with strong warming trends.
- ❖ Prediction of precipitation is more challenging.

Prediction skill of multi-year mean surface air temperature anomaly




Prediction of surface air temperature anomaly
Prediction of precipitation anomaly
a) ACC skill
DJF
c) ACC skill
DJF
b) ACC skill
SON
d) ACC skill
SON
90N
60N
30N
EQ
30S
60S
90S
0
60E
120E
180
120W
60W
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1