Metrics for S2S: Examples from The Subseasonal Experiment (SubX)

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NOAA

MAPP Modeling, Analysis, Predictions, and Projections

National Weather Service

Office of Naval Research Science & Technology

NASA

COLA

To Improve Prediction on S2S Timescales, we need:

1. Model Data – ideally long free simulations & a large re-forecast database; save enough variables for process diagnostics

1. To evaluate and understand our model biases

1. To evaluate deterministic and probabilistic skill

2. To know how well models represent and predict phenomena and processes that are known sources of S2S predictability

3. To evaluate conditional skill based on known sources of predictability

4. A framework for testing new models/model improvements and a baseline for evaluating those improvements

SubX BY THE NUMBERS

7 Global Models

1 Year of *Real-time* Forecasts

17 Years of *Retrospective* Forecasts

3-4 week guidance for Climate Prediction Center Outlooks

SubX Protocol

- Prediction System Details up to Provider
- Real-time and Retrospective Systems Identical
  - Ensemble Generation Issues
- Reforecast Period: 1999-2015
- At Least 3 Ensemble Members
- Minimum Length: 32 Days
- Real-time Forecast Made Available to CPC Through NCO *Every Thurs* by 6am of *Every week*
- Data on Uniform 1x1 Grid

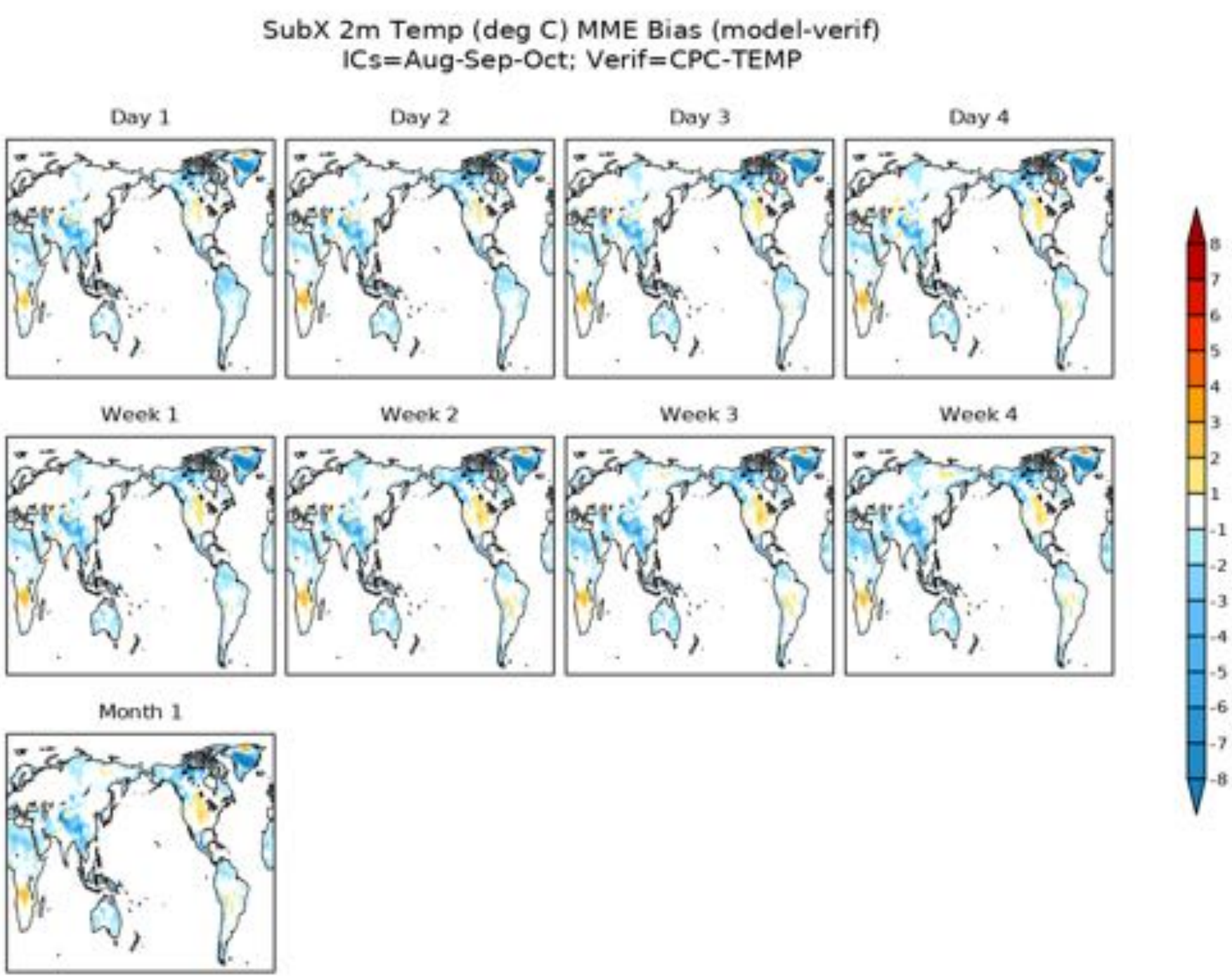
SubX Re-forecast Database

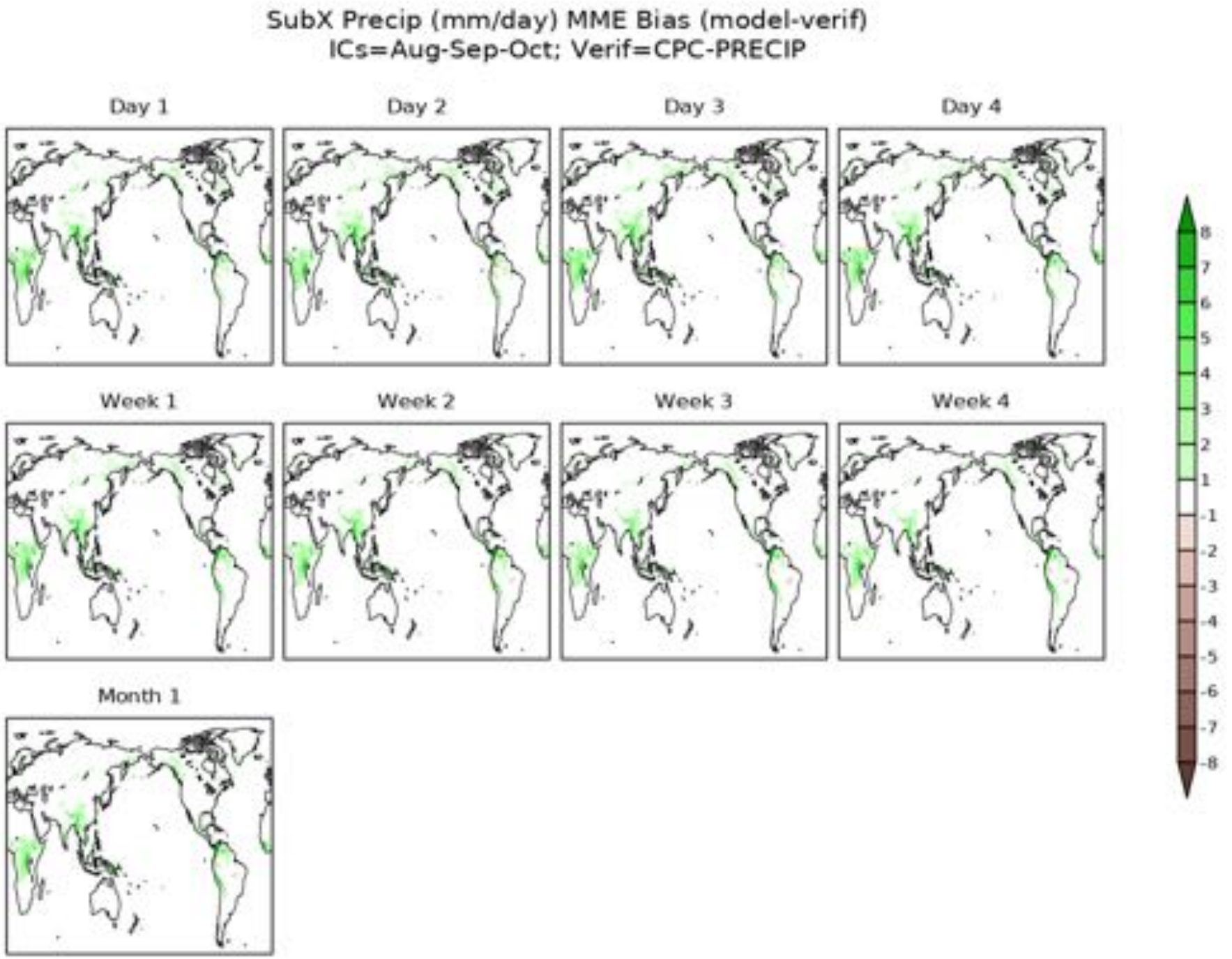
Current Data Holdings (Last updated: Feb 14, 2018)

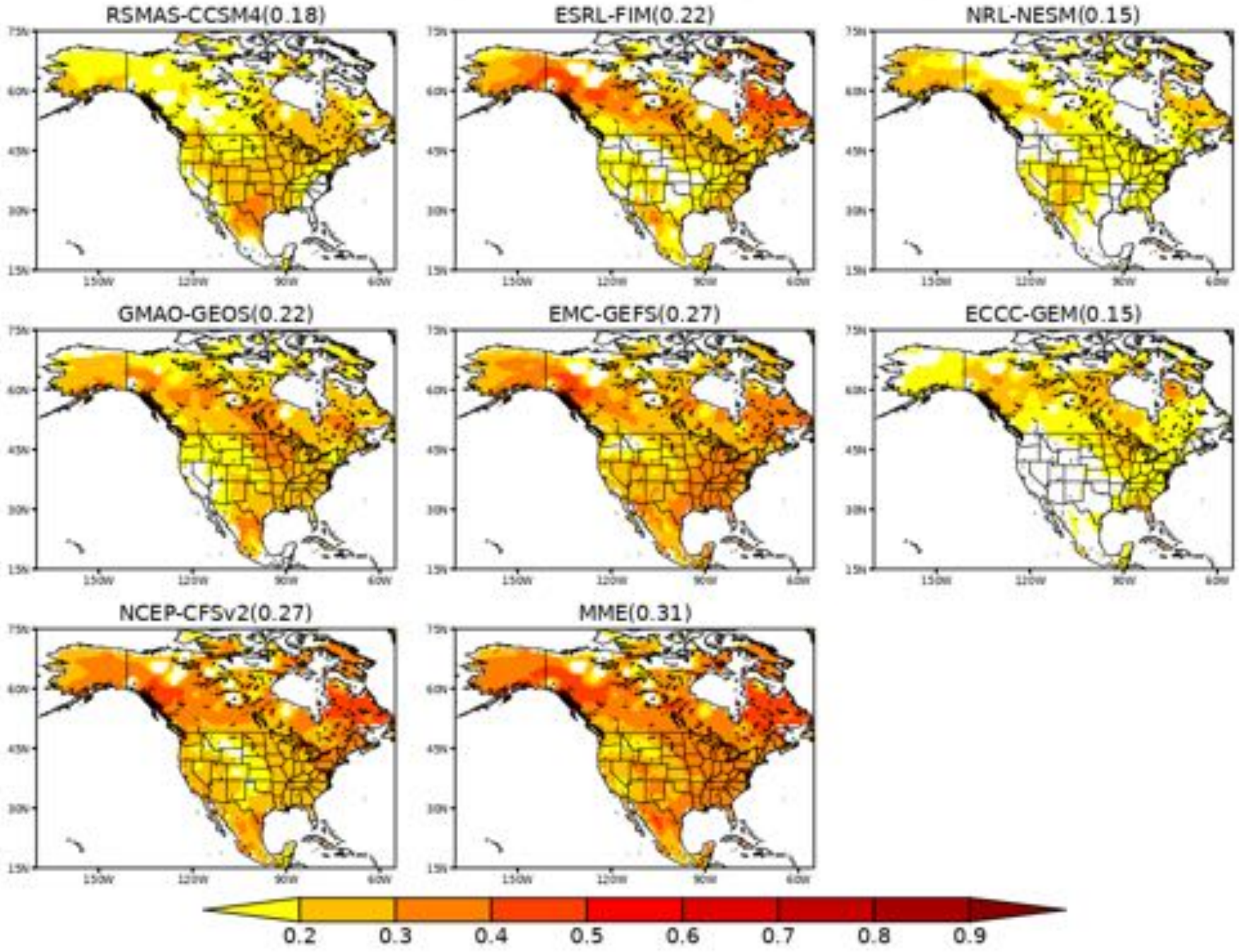
Re-Forecasts

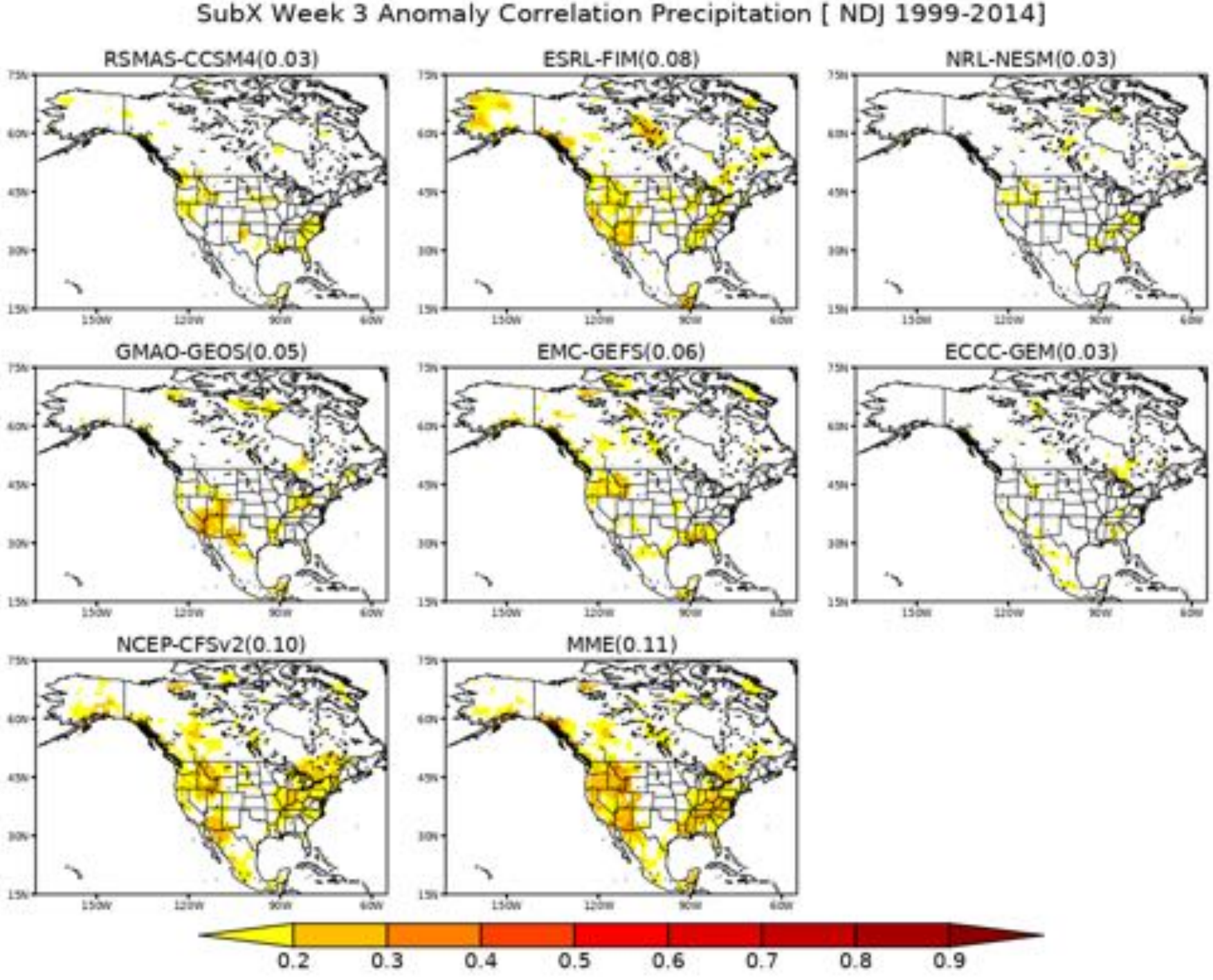
Model	Ens Members	Init Interval	P1	P2	Climo	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ECCC-GEM	4	7-days	✓	✓		1995-2014	✓							✓	✓	✓	✓	✓
EMC-GEFS	11	7-days	✓	✓		1999-2016	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ESRL-FIM	4	7-days	✓	✓		1999-2016	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GMAO-GEOS	4	5-days	✓			1999-2015	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NRL-NESM	1	4 inits every 7-days	✓	✓		1999-2016	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RSMAS-CCSM4	3	7-days	✓			1999-2016	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NCEP-CFSv2	4	1-days	tas,pr			1999-2016	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

http://iridl.ldeo.columbia.edu/SOURCES/.Models/.SubX/

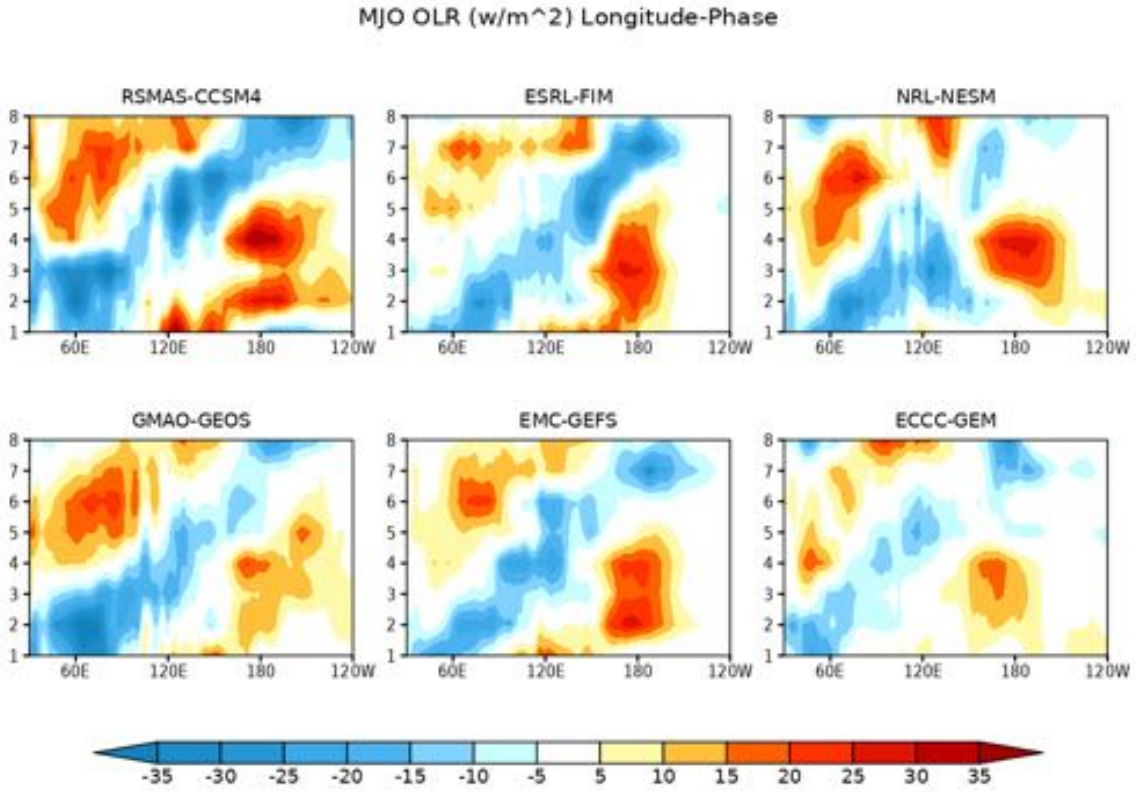

SubX 2m Temp (deg C) MME Bias (model-verif)
ICs=Aug-Sep-Oct; Verif=CPC-TEMP
Day 1
Day 2
Day 3
Day 4
Week 1
Week 2
Week 3
Week 4
Month 1
8
7
6
5
4
3
2
1
-1
-2
-3
-4
-5
-6
-7
-8

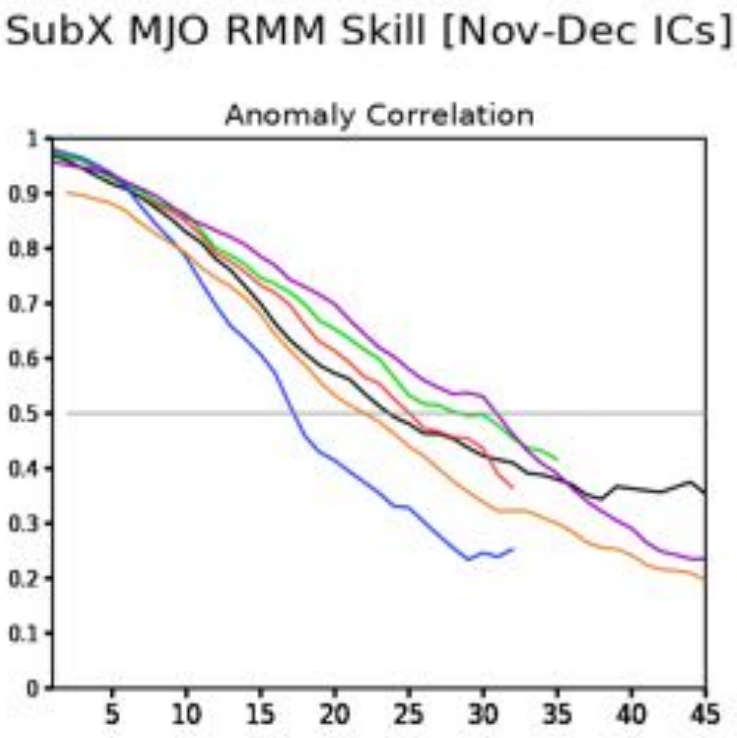

SubX Precip (mm/day) MME Bias (model-verif)
ICs=Aug-Sep-Oct; Verif=CPC-PRECIP
Day 1
Day 2
Day 3
Day 4
Week 1
Week 2
Week 3
Week 4
Month 1
8
7
6
5
4
3
2
1
-1
-2
-3
-4
-5
-6
-7
-8


SubX Week 3 Anomaly Correlation 2m Temperature [NDJ 1999-2014]
RSMAS-CCSM4(0.18)
ESRL-FIM(0.22)
NRL-NESM(0.15)
GMAO-GEOS(0.22)
EMC-GEFS(0.27)
ECCC-GEM(0.15)
NCEP-CFSv2(0.27)
MME(0.31)
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

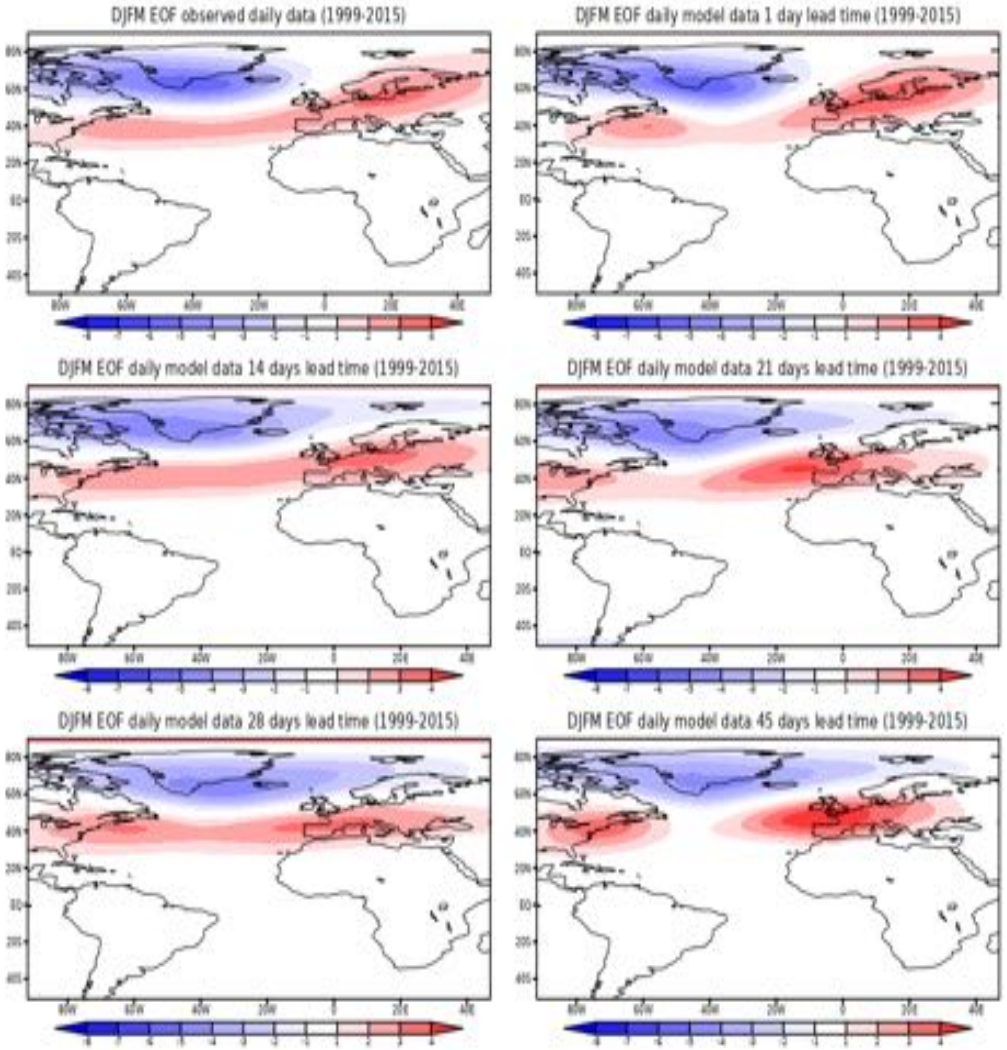

SubX Week 3 Anomaly Correlation Precipitation [NDJ 1999-2014]
RSMAS-CCSM4(0.03)
ESRL-FIM(0.08)
NRL-NESM(0.03)
GMAO-GEOS(0.05)
EMC-GEFS(0.06)
ECCC-GEM(0.03)
NCEP-CFSv2(0.10)
MME(0.11)
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

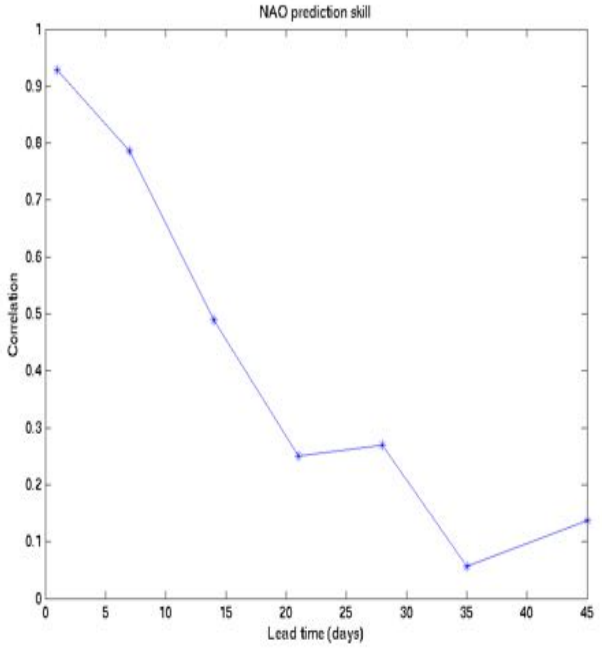
Evaluating the MJO in SubX





Evaluating the NAO in SubX





SubX Working Groups

- Verification

Defining climatology & bias corrections, deterministic and probabilistic verification, Multi-model Combinations

- MJO

Performance, process-based, impacts, providing indices on IRIDL

- NAO

Performance, impacts, NAO-MJO, NAO-SST, providing indices on IRIDL

To Improve Prediction on S2S Timescales, we need:

1. **Model Data – ideally long free simulations & a large re-forecast database; save enough variables for process diagnostics**
   a) *SubX provides a re-forecast database*
   b) *Would like to have long simulations & more data/variables*

2. **To evaluate and understand our model biases**
   a) *SubX has started to evaluate model biases for S2S – could this be automated so effort can focus on process oriented diagnostics?*

3. **To evaluate deterministic and probabilistic skill**
   a) *Have started to evaluate deterministic skill, probabilistic in progress*
   b) *This is something that could be automated so we can move on to process-oriented diagnostics/critical science for understanding*

To Improve Prediction on S2S Timescales, we need:

4. To know how well models represent and predict phenomena and processes that are known sources of S2S predictability

a) *Basic evaluation of S2S phenomena could be automated (e.g. CVDP for forecast systems) – SubX as test platform for this*

b) *Process oriented diagnostics needed – additional variables needed*

5. To evaluate conditional skill based on known sources of predictability

a) *This has not been done comprehensively and is needed, could be done using SubX*

6. A framework for testing new models/model improvements and a baseline for evaluating those improvements

a) *Community modeling framework and automated basic skill and set of diagnostics*

b) *SubX provides a good framework/baseline for evaluating new models and model improvements*

Where to find more information: **http://cola.gmu.edu/kpegion/subx/**