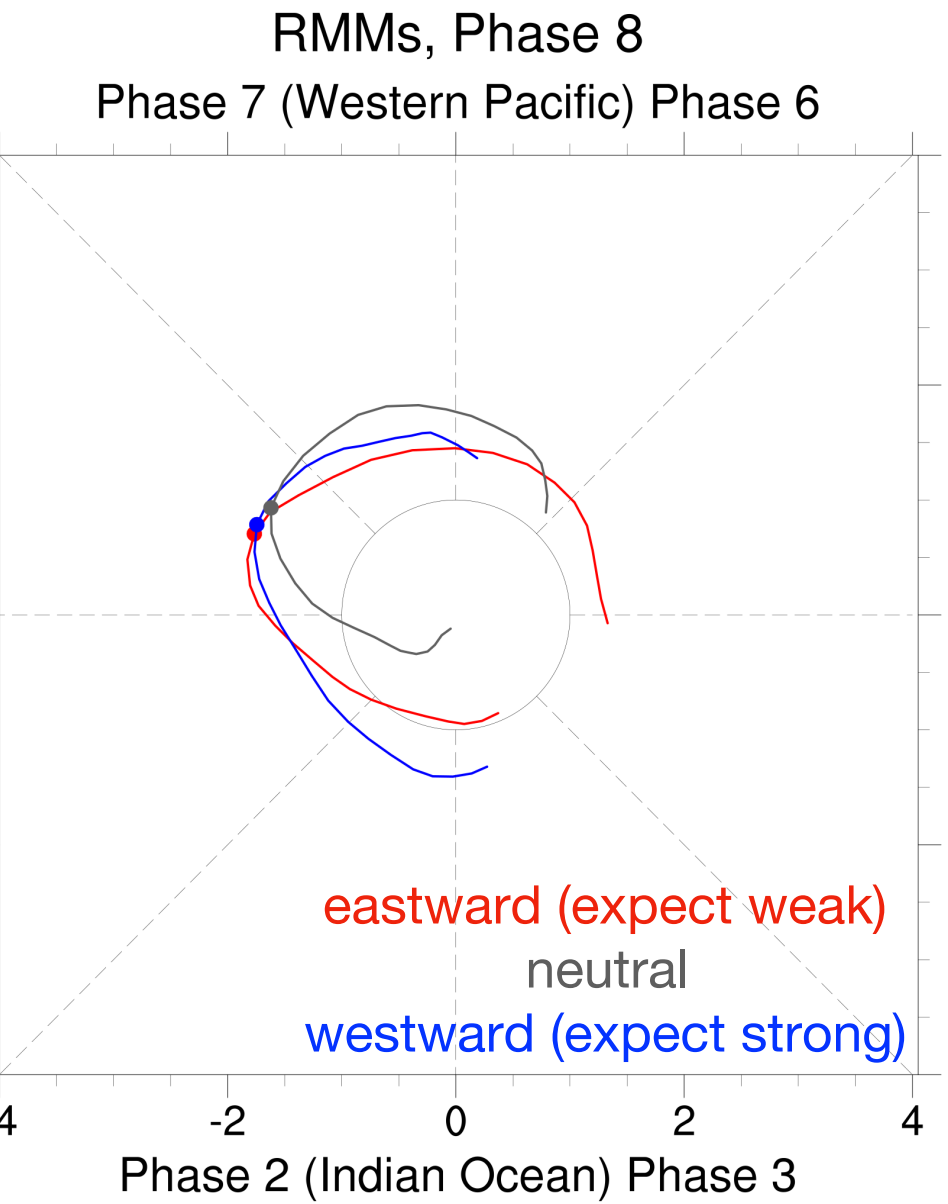
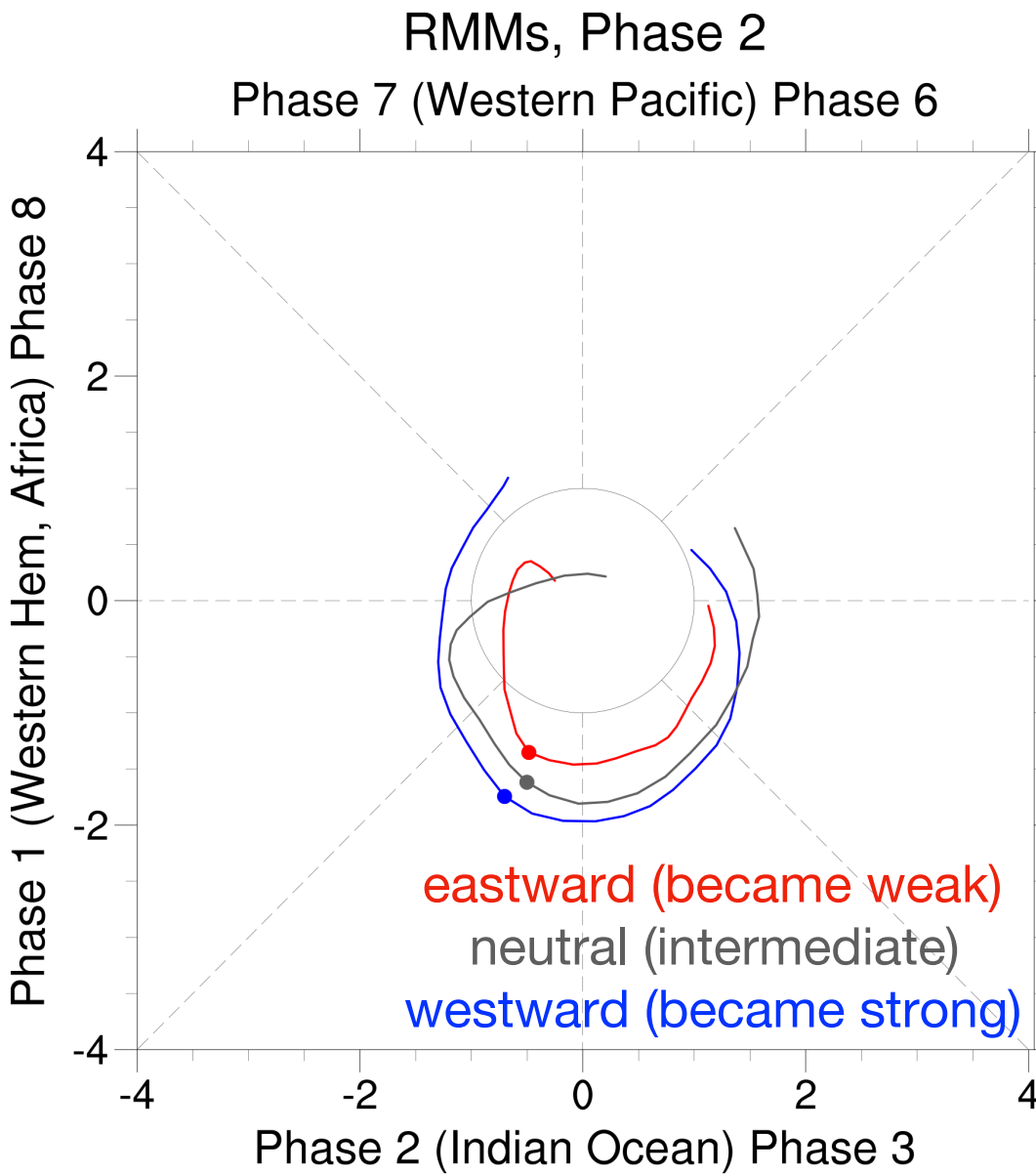
MJO propagation by current regime

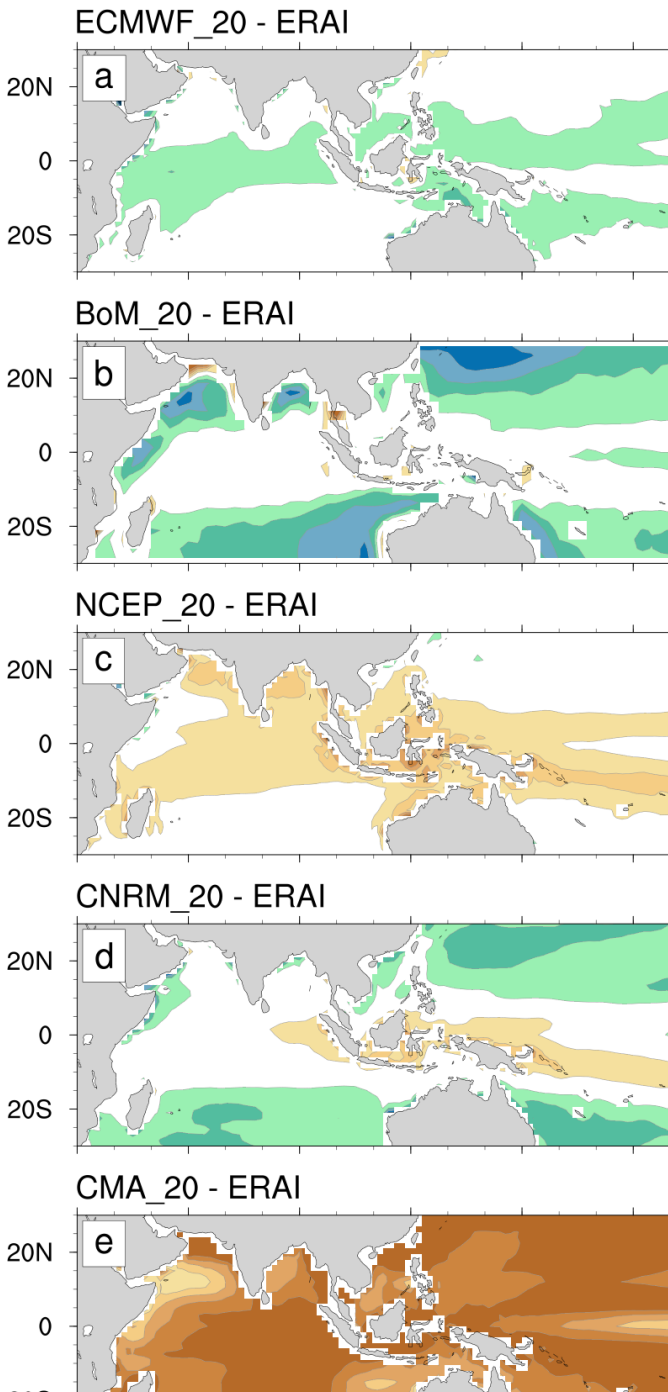




Sfc RH bias

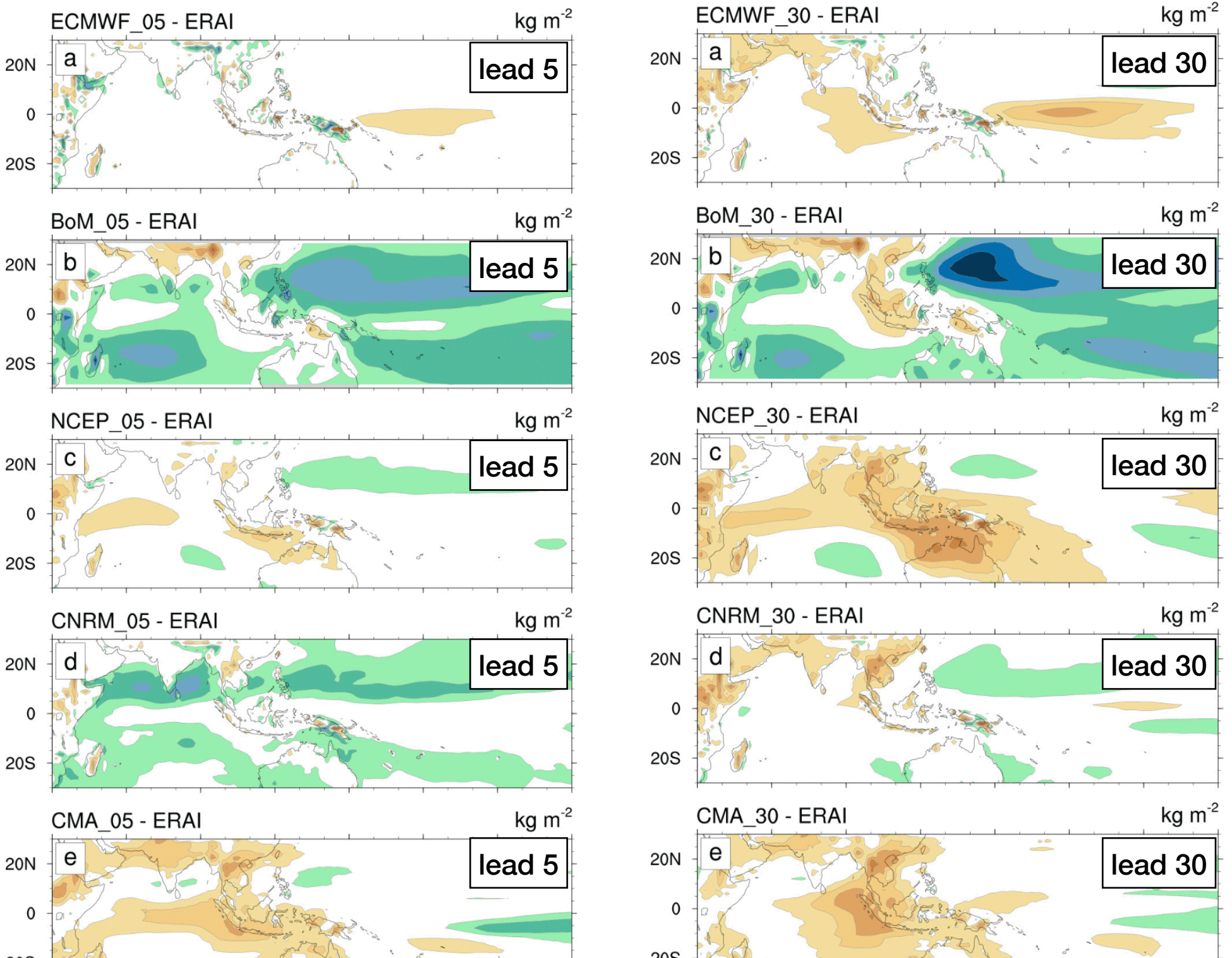
flux feedbacks to atmosphere may be muted

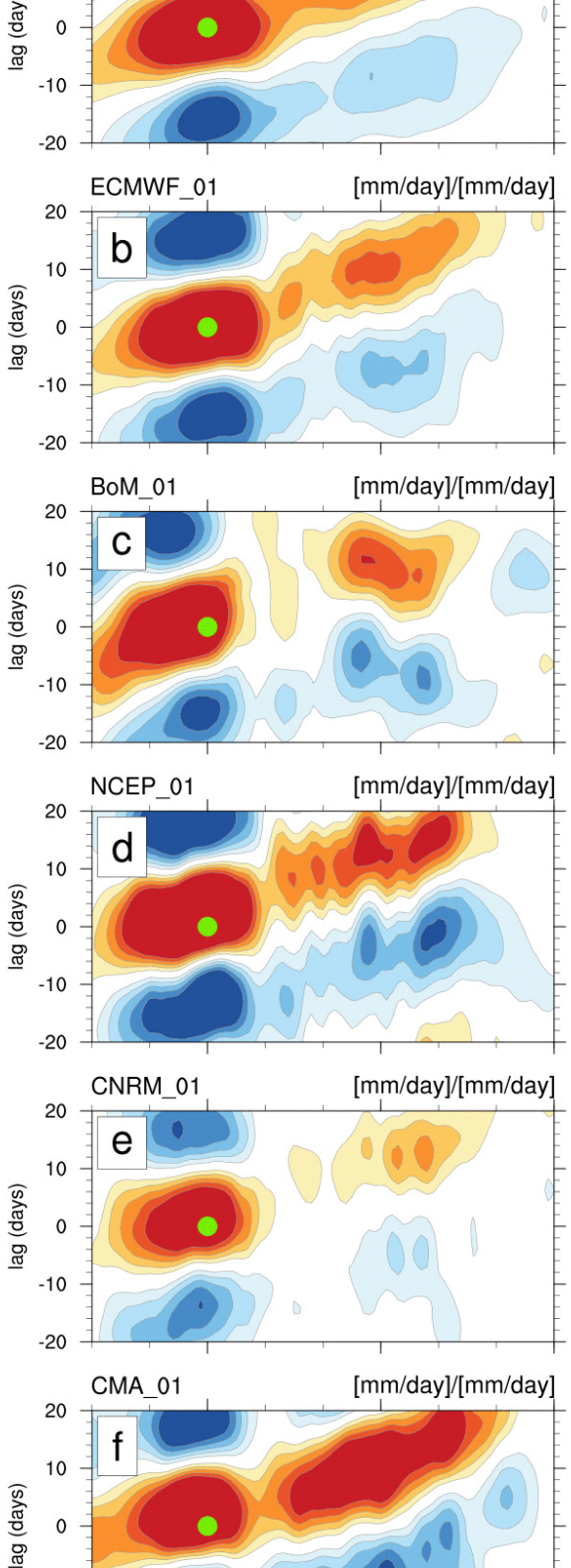
flux feedbacks to atmosphere may be exaggerated



more like coupled models

more like uncoupled models





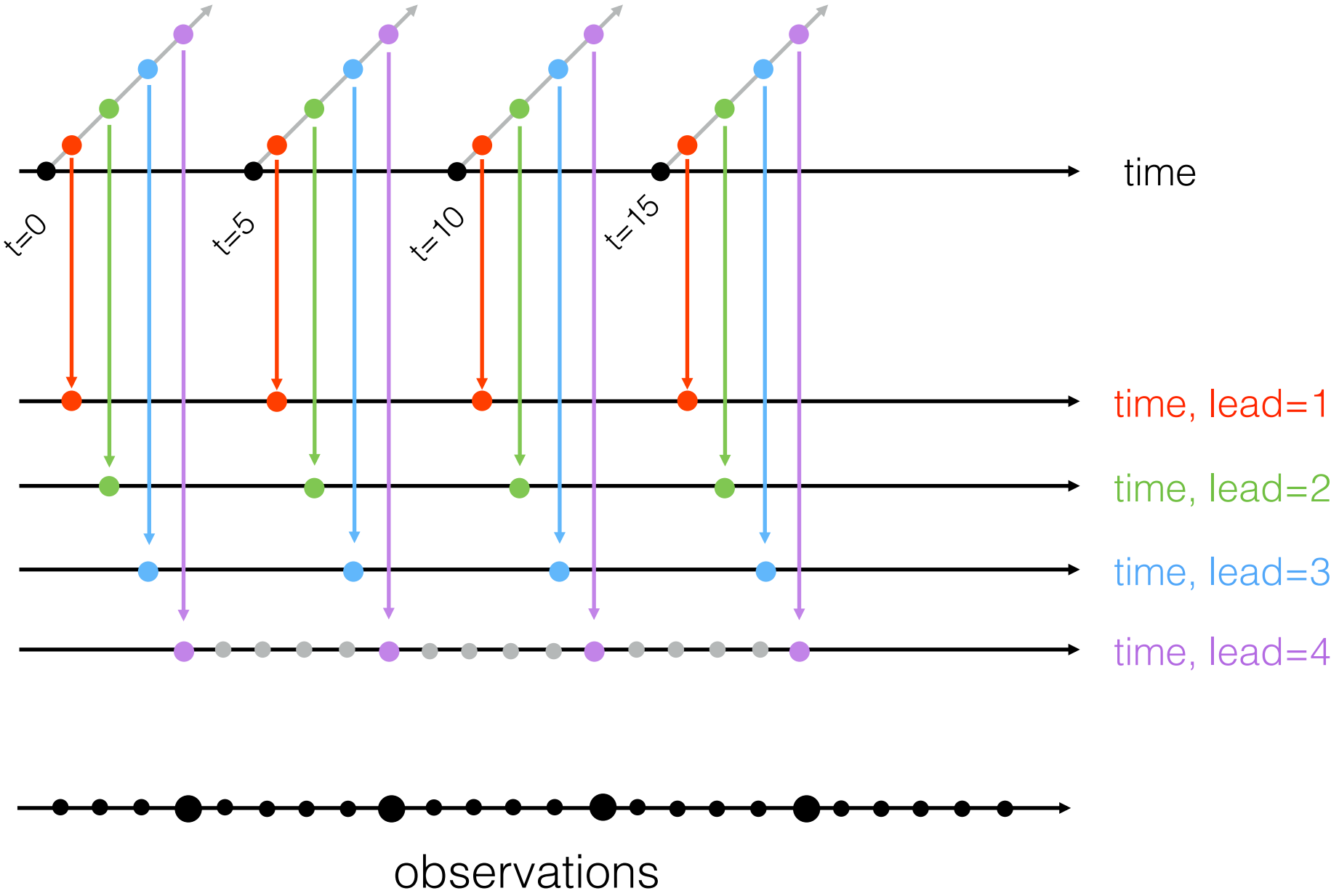
BoM ECMWF NCEP CNRM CM

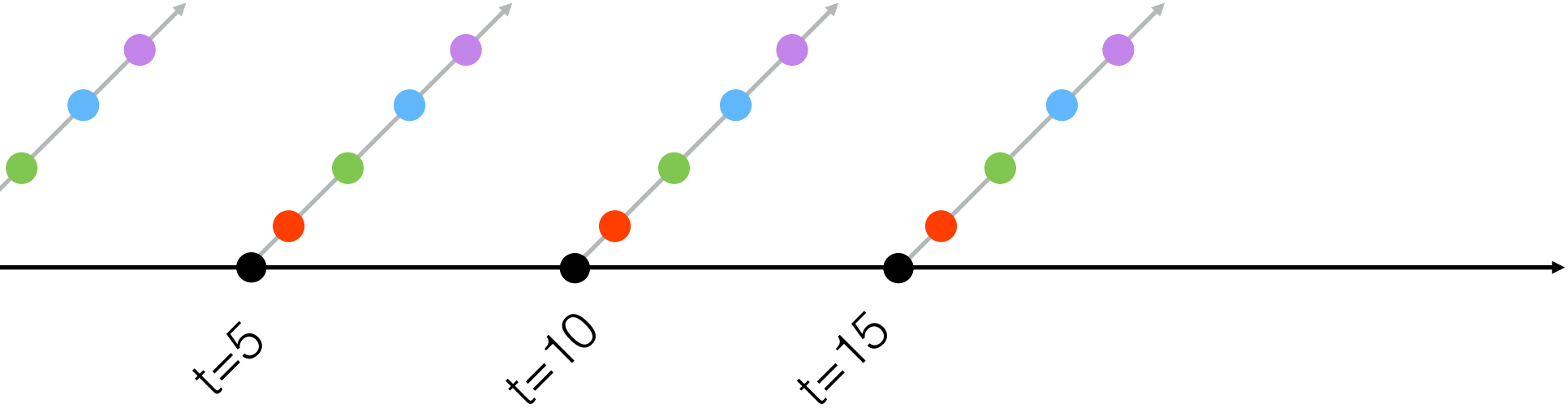
ntraseasonal surface fluxes in S2S models

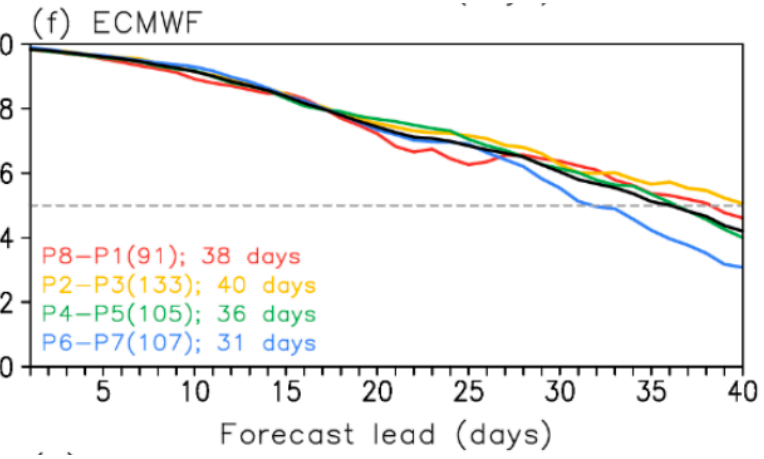
pper ocean surface currents and MJO prediction ski

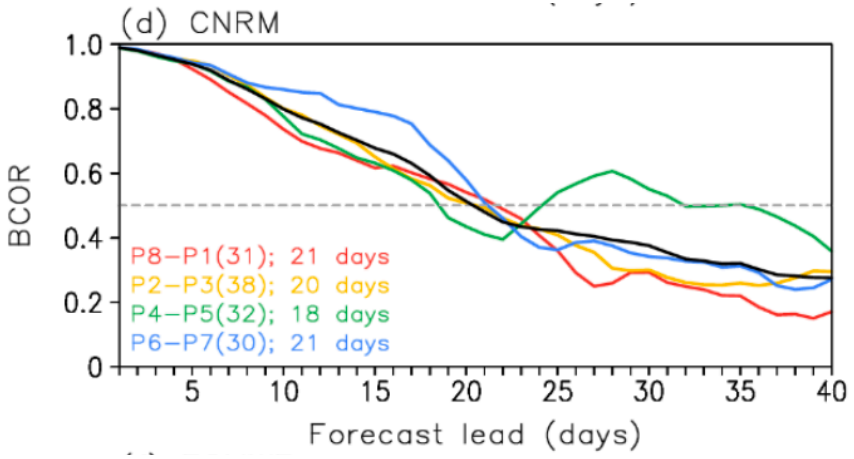
preview of modeling studies of ocean feedbacks to M
prediction

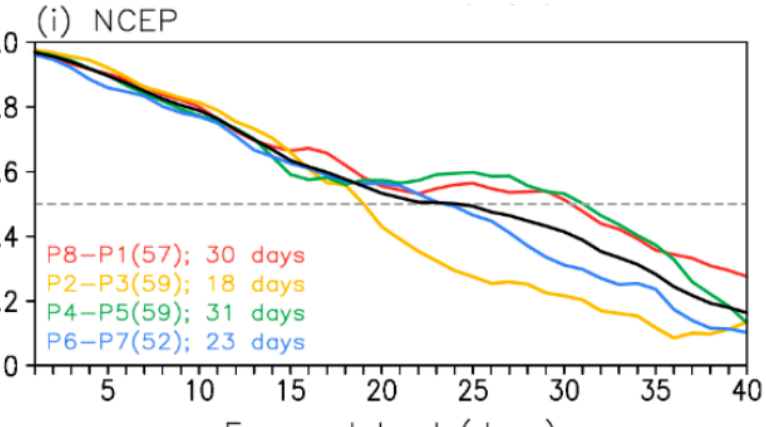
the NMME multi-model ensemble

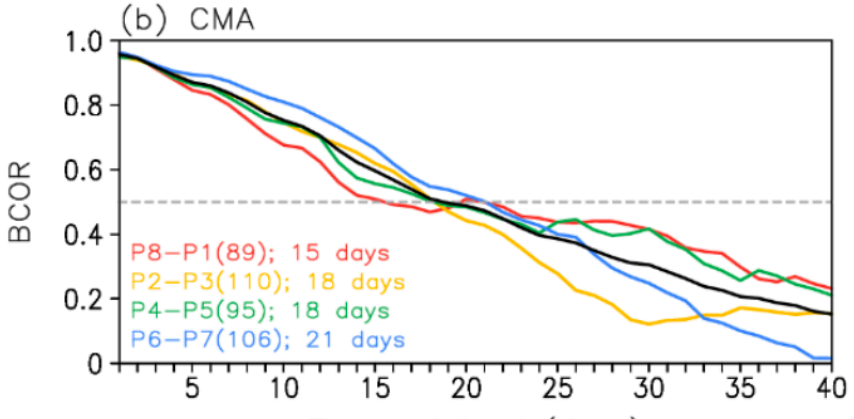



t=5
t=10
t=15
time

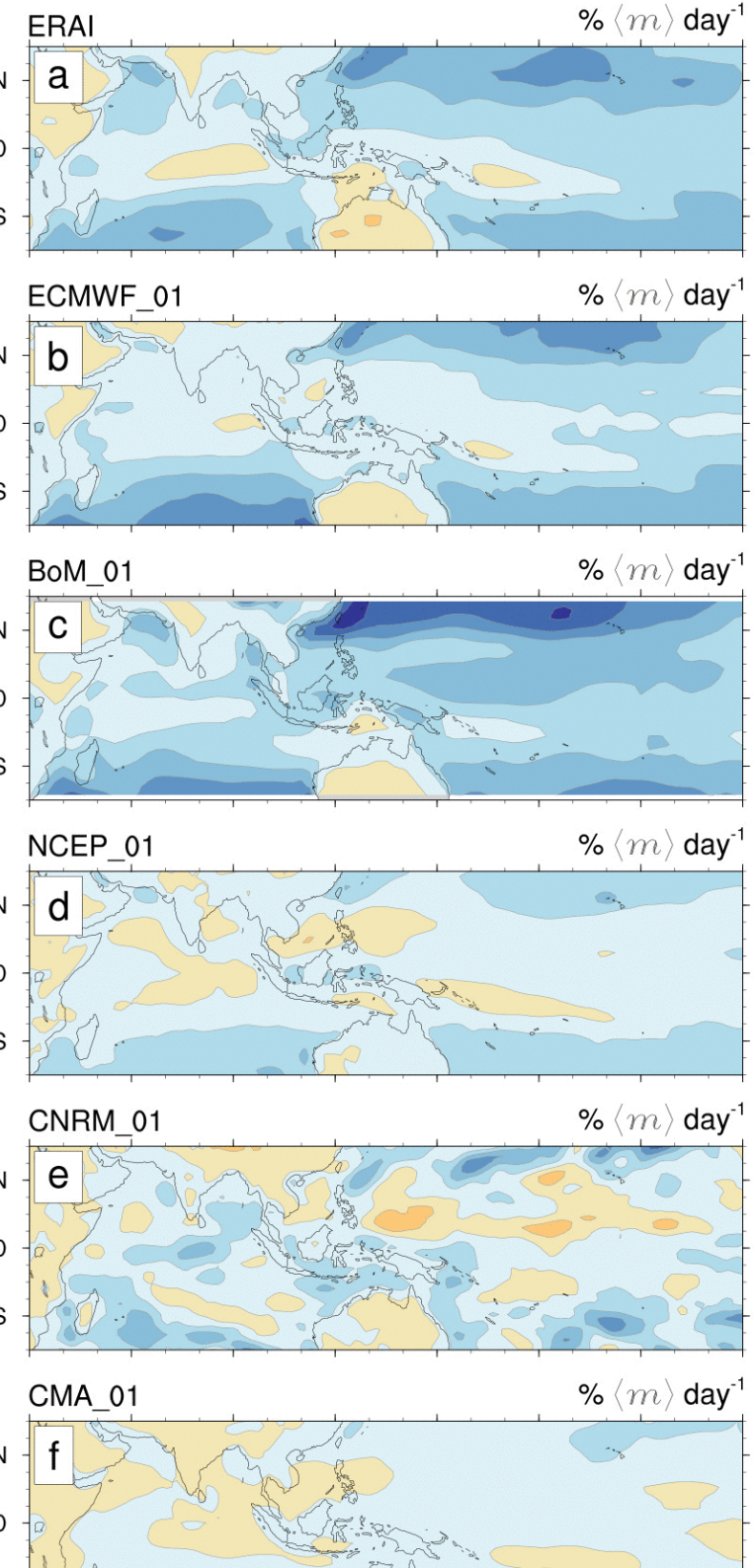

(f) ECMWF
P8–P1(91); 38 days
P2–P3(133); 40 days
P4–P5(105); 36 days
P6–P7(107); 31 days
Forecast lead (days)


(d) CNRM
BCOR
P8–P1(31); 21 days
P2–P3(38); 20 days
P4–P5(32); 18 days
P6–P7(30); 21 days
Forecast lead (days)


(i) NCEP
P8–P1(57); 30 days
P2–P3(59); 18 days
P4–P5(59); 31 days
P6–P7(52); 23 days


(b) CMA
BCOR
P8–P1(89); 15 days
P2–P3(110); 18 days
P4–P5(95); 18 days
P6–P7(106); 21 days

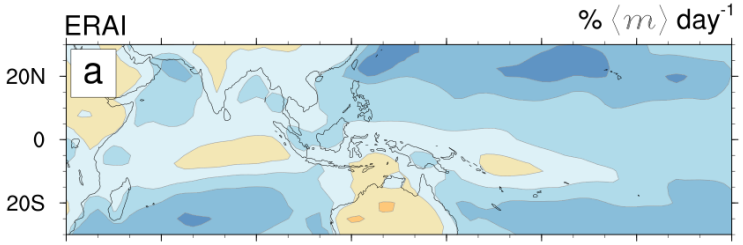
Lim et al. 201

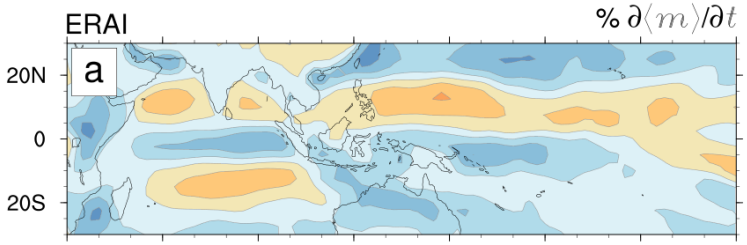


increasing reliance on surface fluxes with lead time (most models).

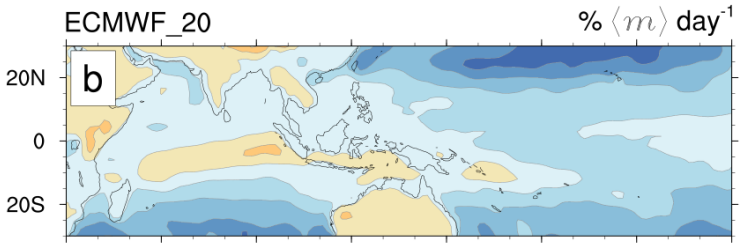
LH projection onto $\langle m \rangle$, Nov-Apr

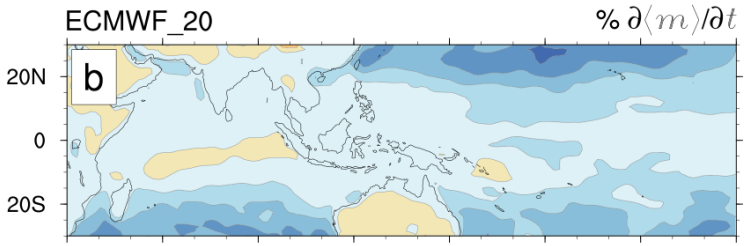
LH projection onto $\partial\langle m \rangle/\partial t$, Nov-Apr



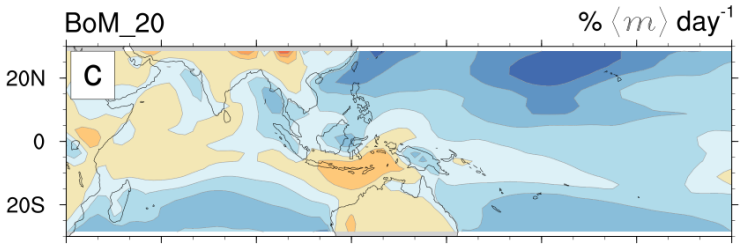


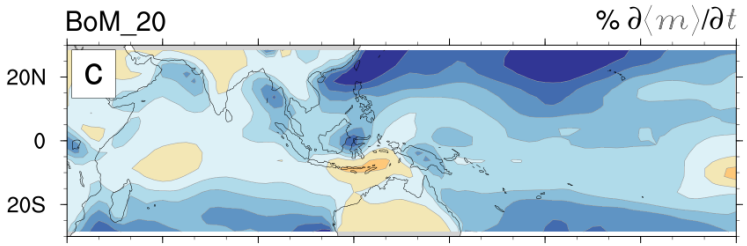
(reanalysis)



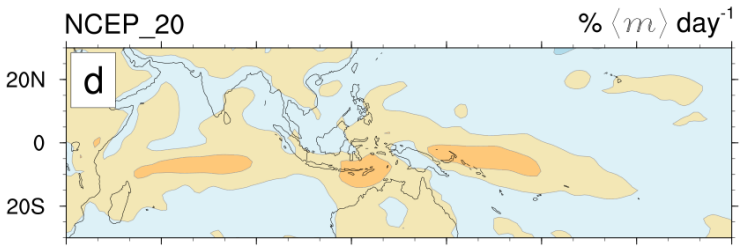


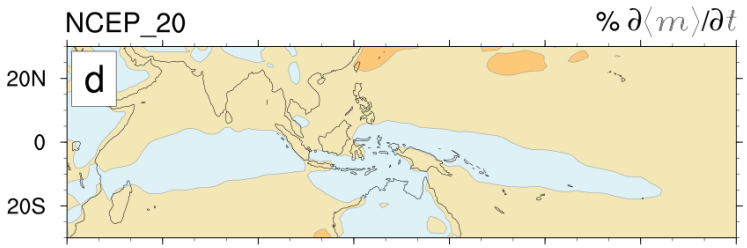
L: about right
R: too weak



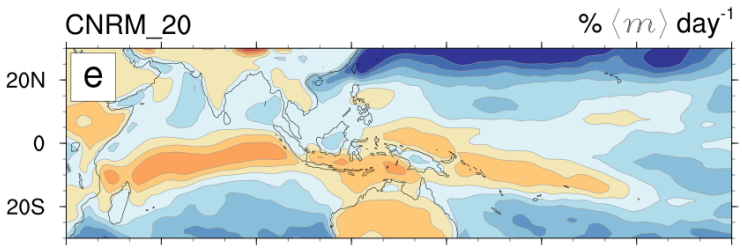


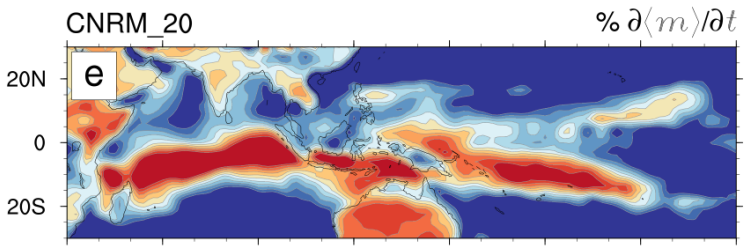
MC “bridge”



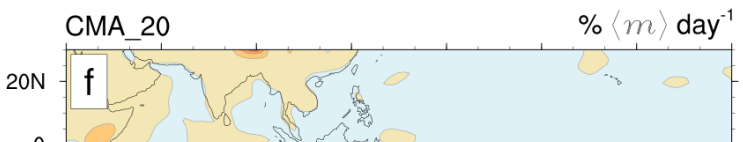


MJO maintenance
“crutch”



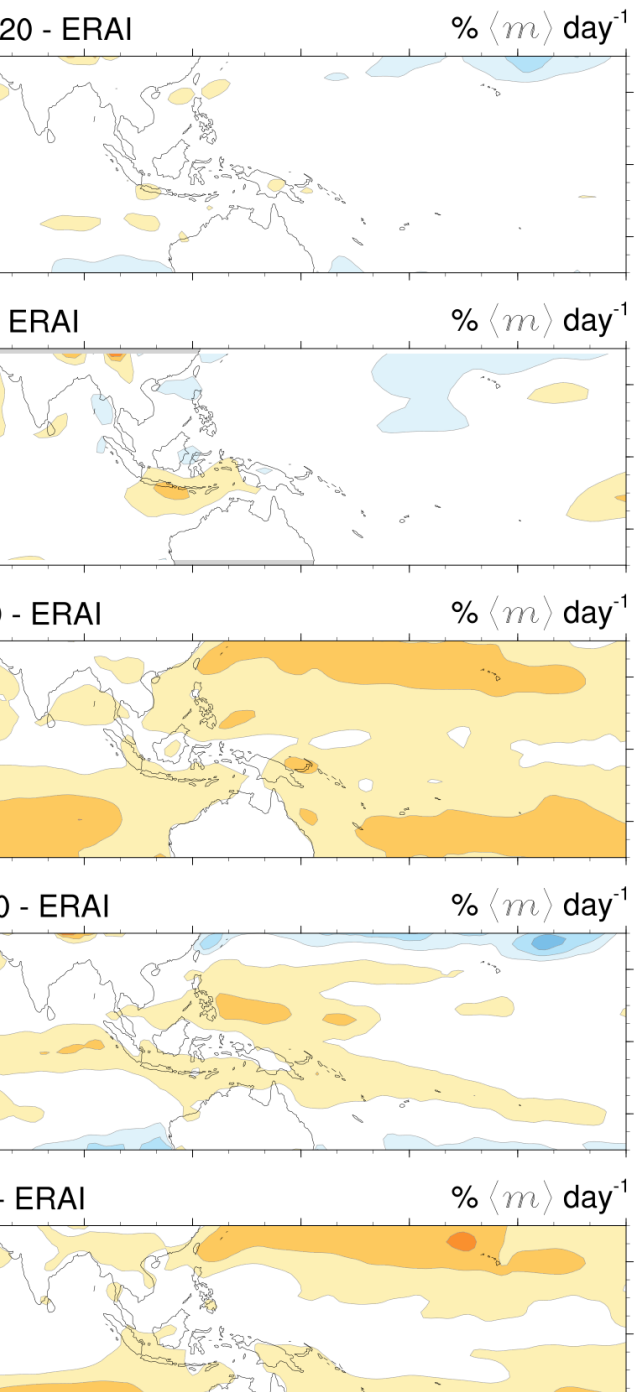


maintenance and
propagation
“crutch”

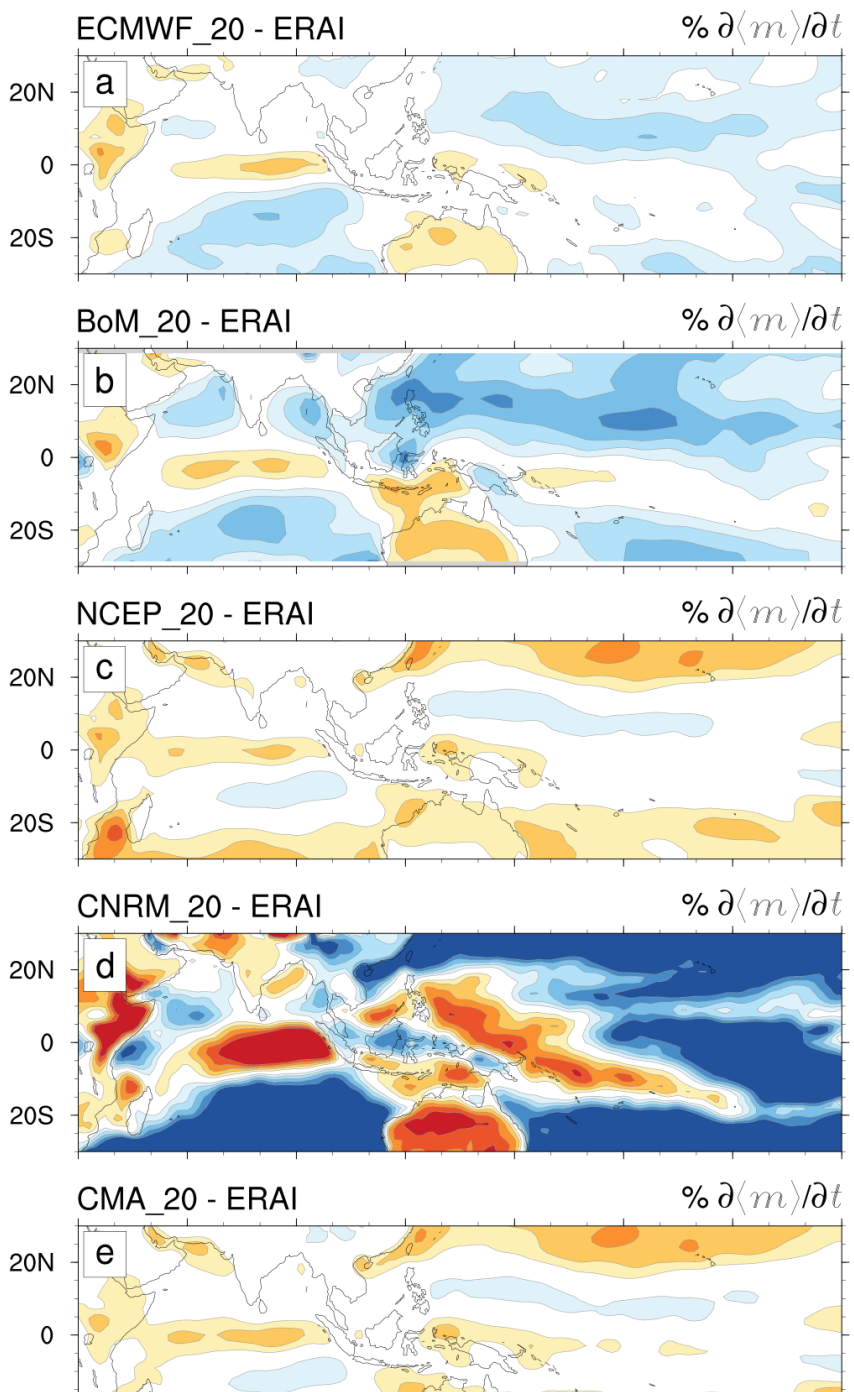


propagation

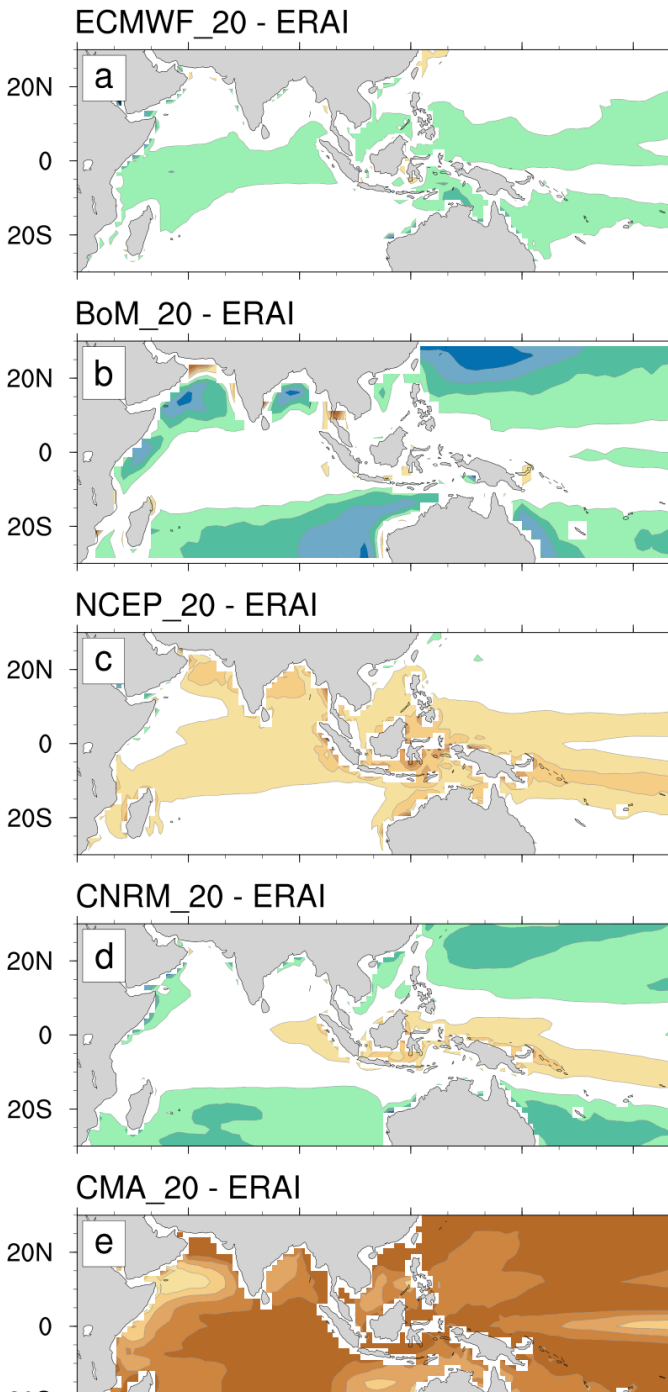
LH:MSE bias



LH:dMSE/dt bias



Sfc RH bias



ummary of coupled feedbacks in E3SM

MJO propagation is present, but convection develops
oo slowly.

host models are over reliant on surface fluxes for MJ
haintenance and/or propagation.

xaggerated surface flux feedbacks are rooted in
tmospheric biases.

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ARTICLE

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Ocean feedback to pulses of the Madden–Julian Oscillation in the equatorial Indian Ocean

James N. Moum[1], Kandaga Pujiana[1,2], Ren-Chieh Lien[3] & William D. Smyth[1]

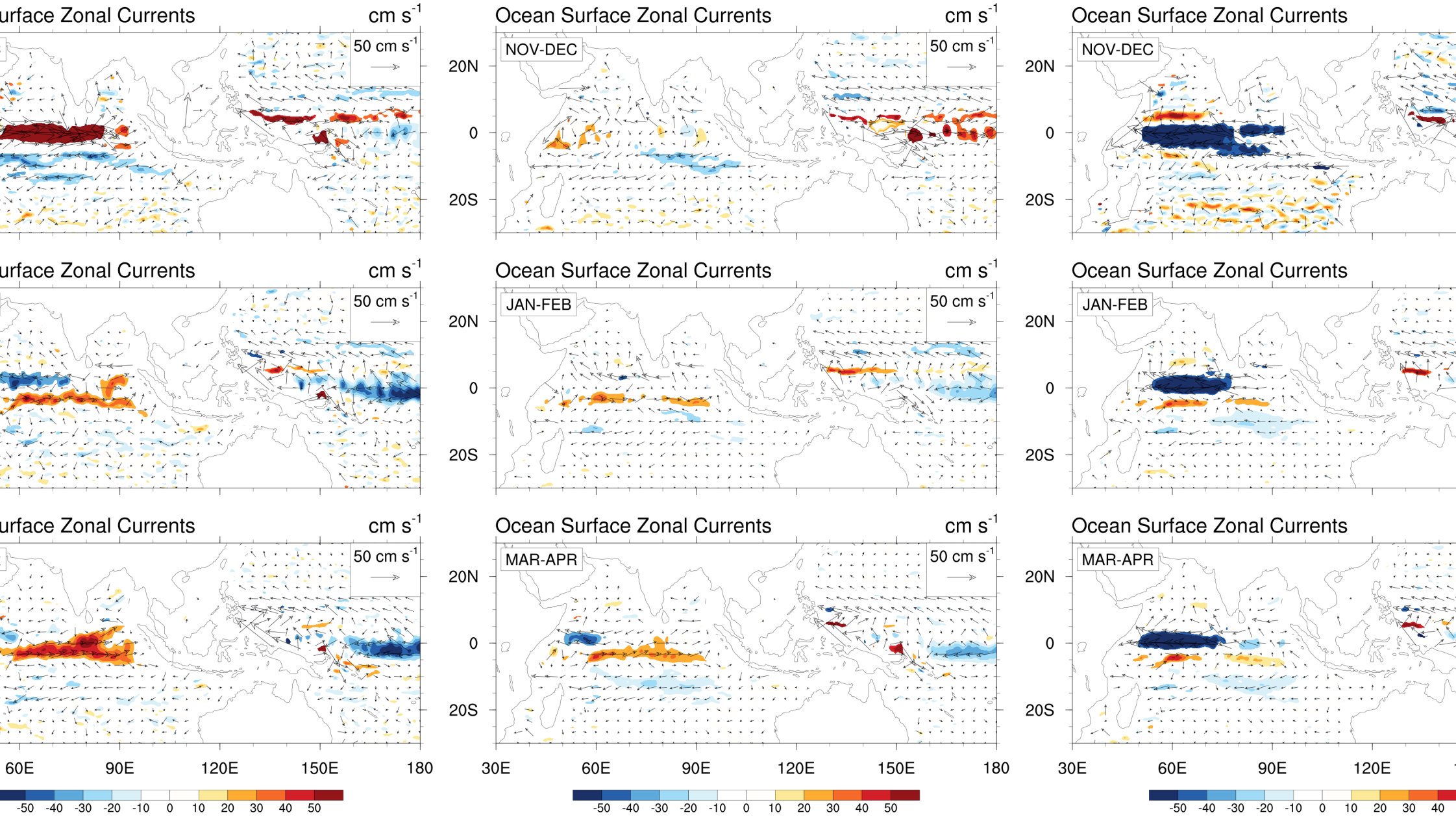
MJO westerlies drive persistent eastward equatorial surface currents.
enhanced current-driven ocean mixing reduces upper ocean heat content available to next MJO event.
Significant tendency for weak MJO events to be followed by strong MJO events and vice versa.

identifying surface current regimes

eastward

neutral

westward

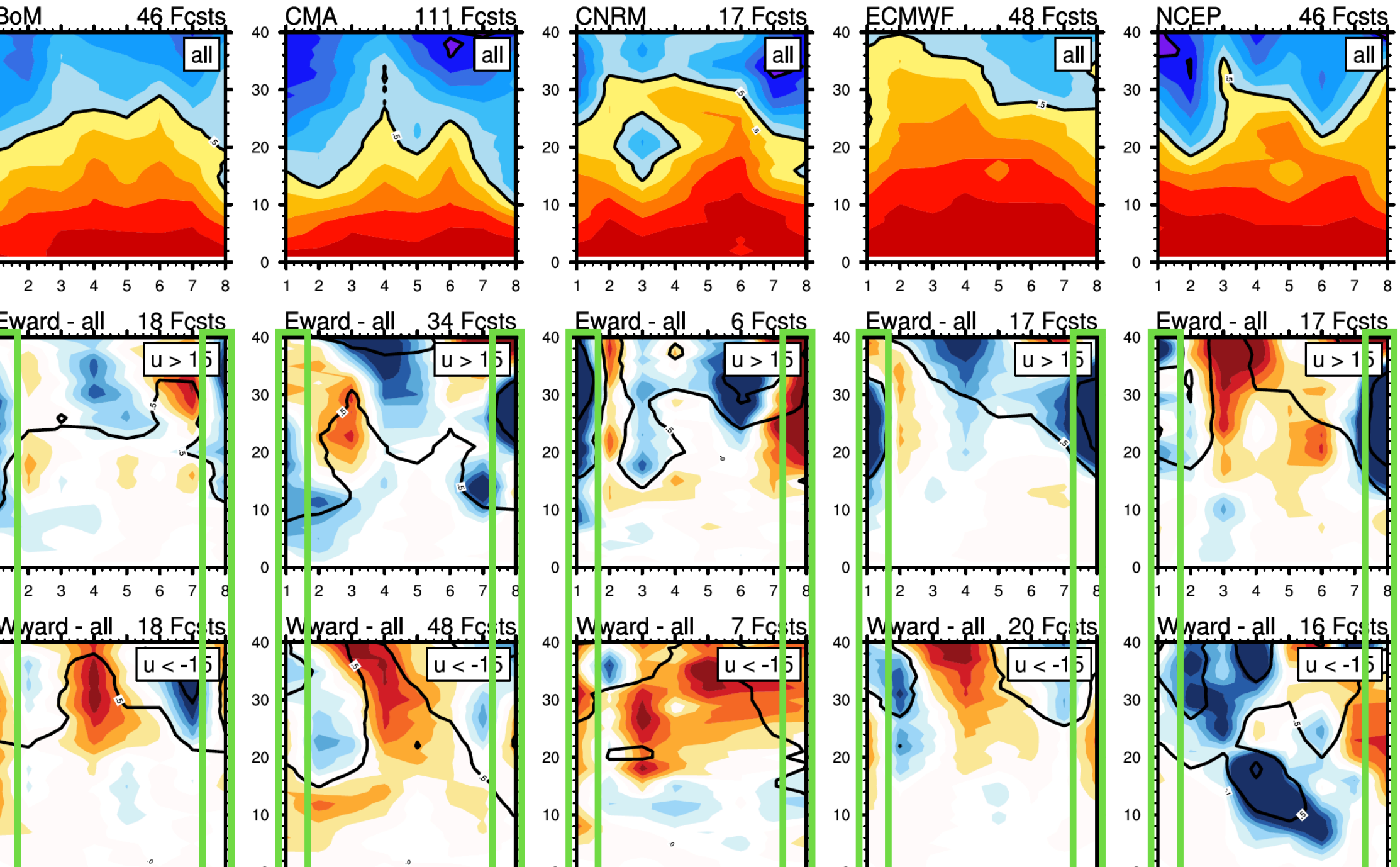


expect weak MJO

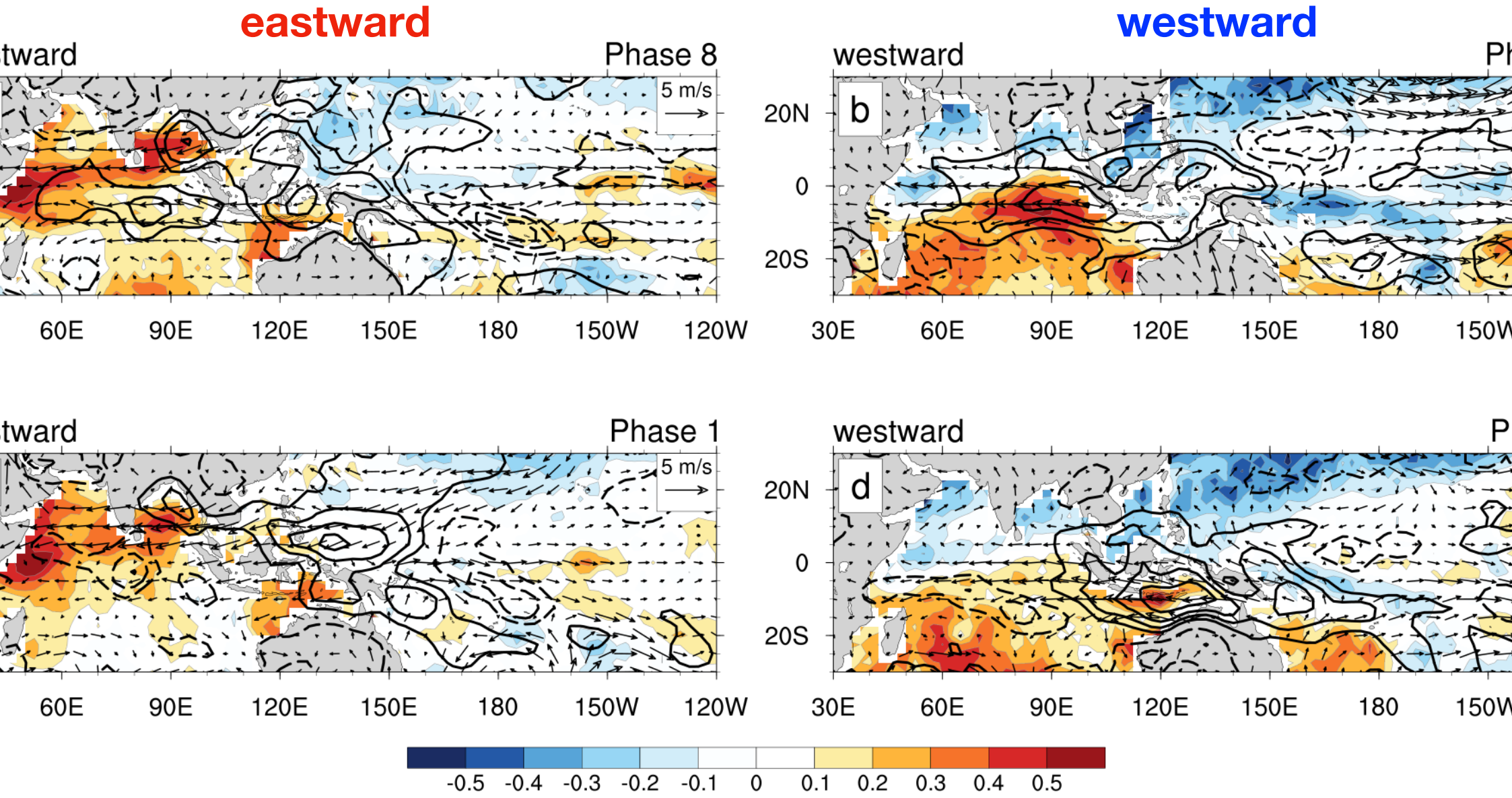
??

expect strong MJ

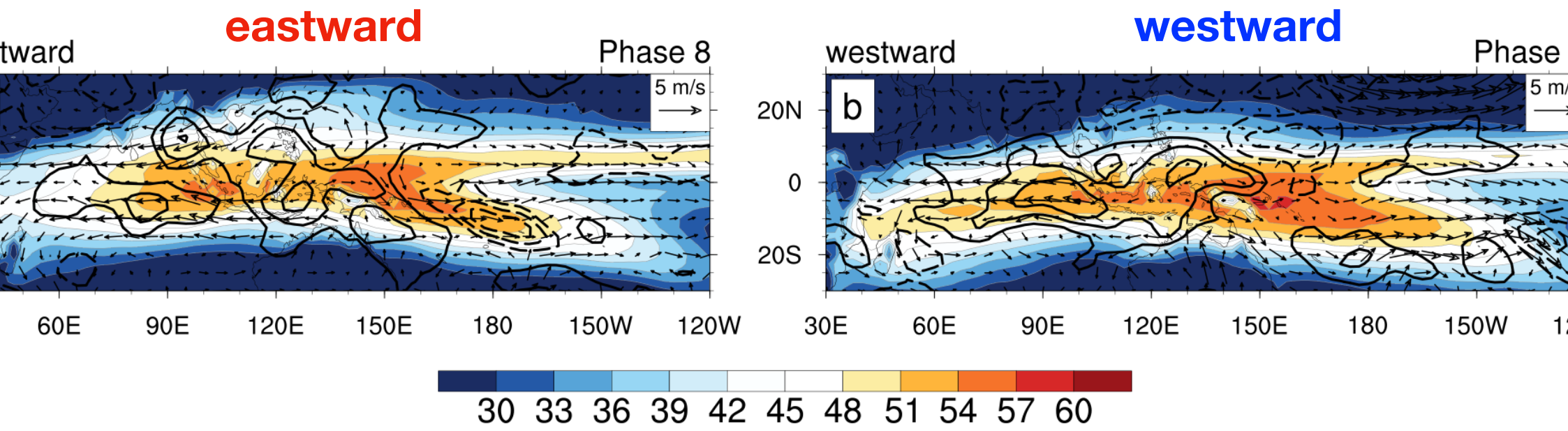
bivariate correlation (ENSO-neutral conditions)



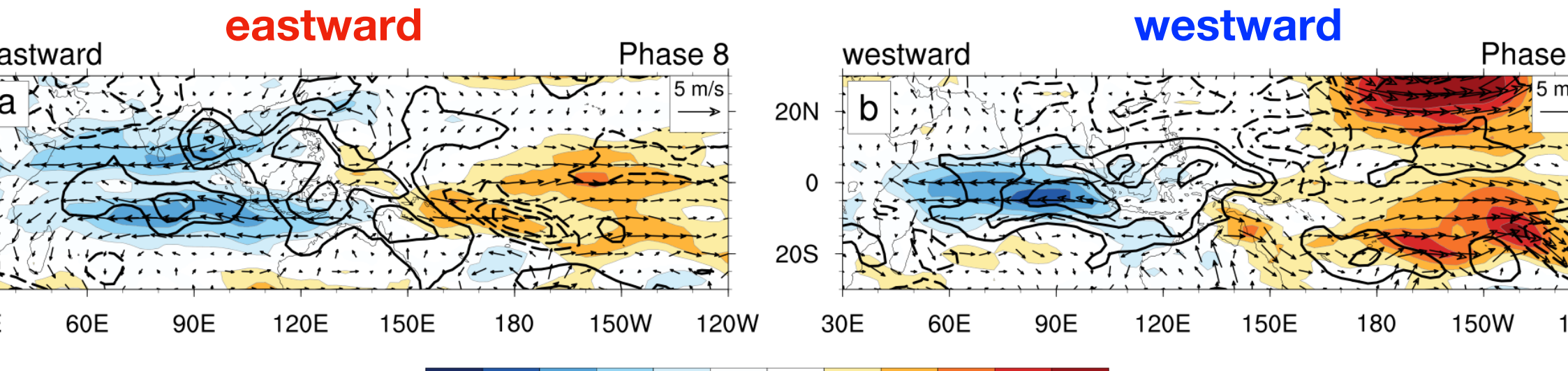
SST, OLR, 850 hPa winds



CWV, OLR, 850 hPa winds



u850, OLR, 850 hPa winds



MJO simulation biases, including those associated wi
ocean feedbacks, are (first order) rooted in atmospher
biases.

oceanic sources of predictability (i.e., surface currents
may be overwhelmed by atmospheric sources of
unpredictability (i.e., weak suppressed phase,
unfavorable mean moisture state or winds).

ow can we hope to understand ocean feedbacks to
MJO and its prediction?

n general, atmospheric biases dominate MJO predict
kill shortcomings.

pparent ocean feedbacks to MJO prediction skill ma
e rooted in boundary layer dry biases—the “ocean
rutch”

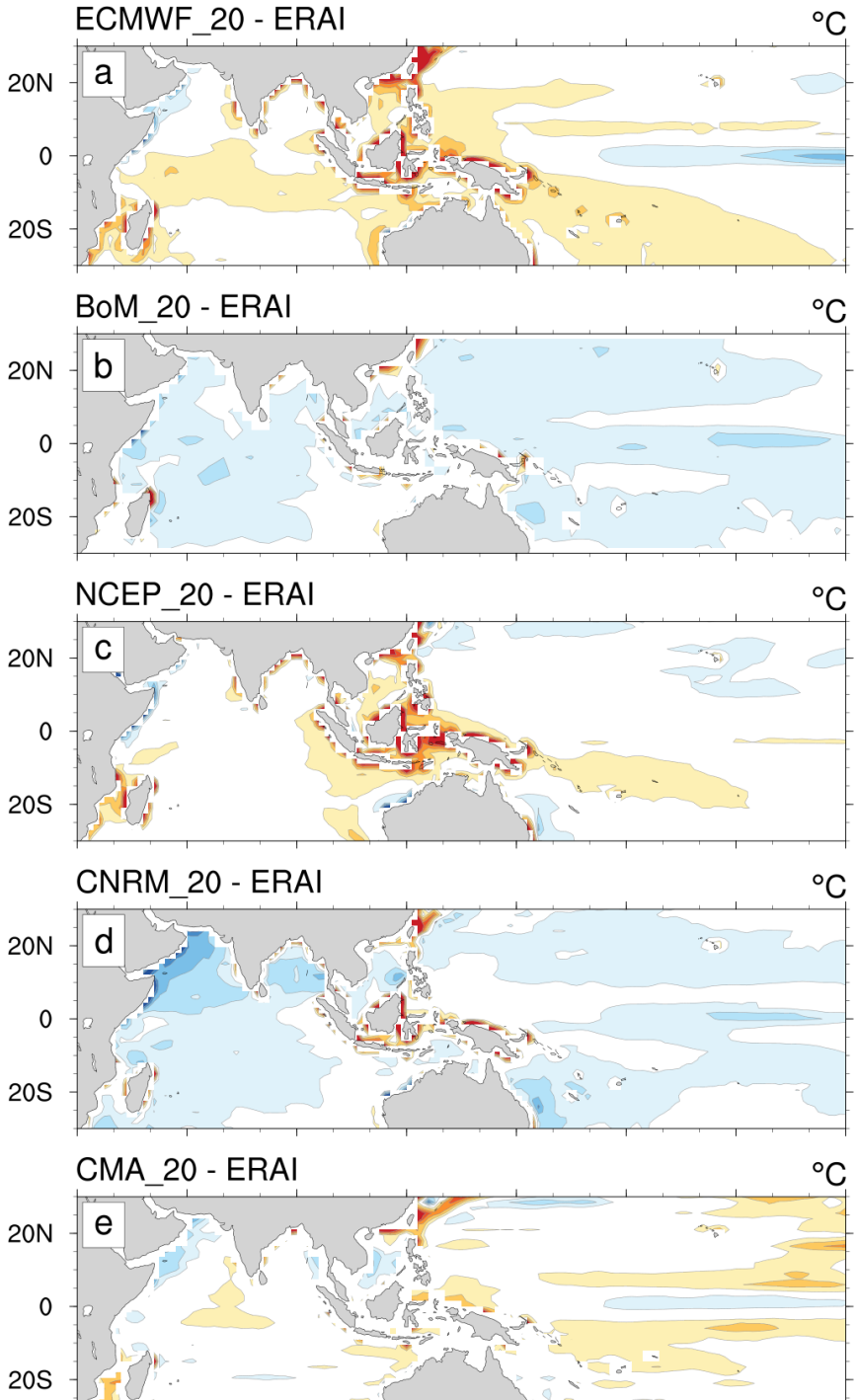
ensitivity experiments using a model with “reasonabl
MJO-surface flux interactions can help quantify which
ocean feedbacks are most important to MJO predictio

esults of model experiments can provide guidance on
ow to most effectively improve ocean or atmospheric

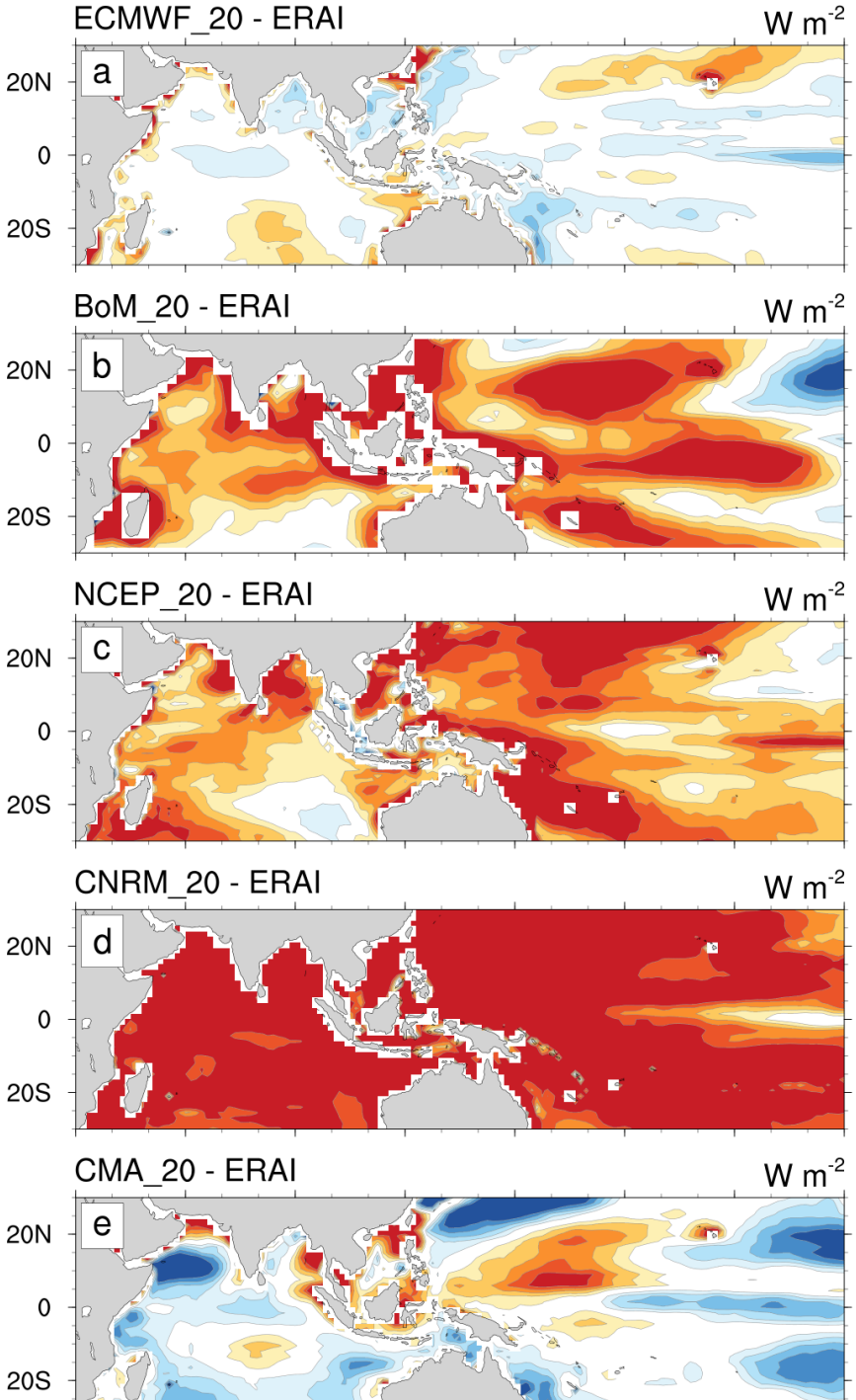
extra slides

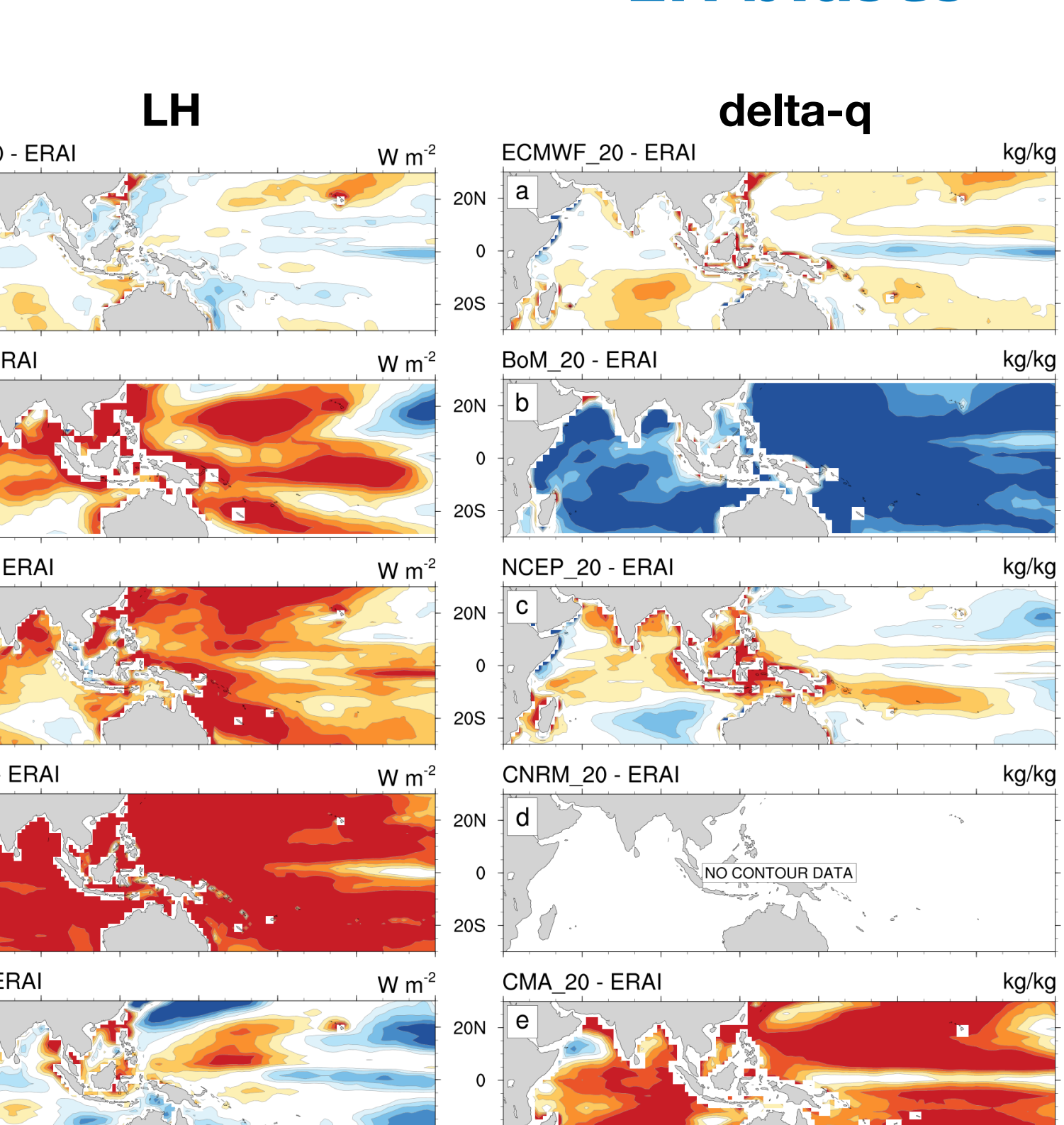
Ocean fluxes

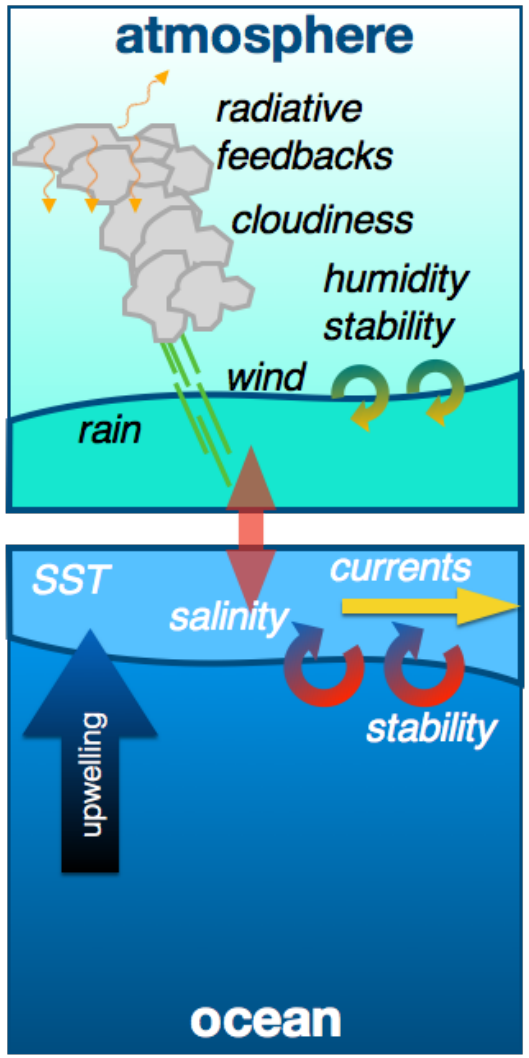
SST

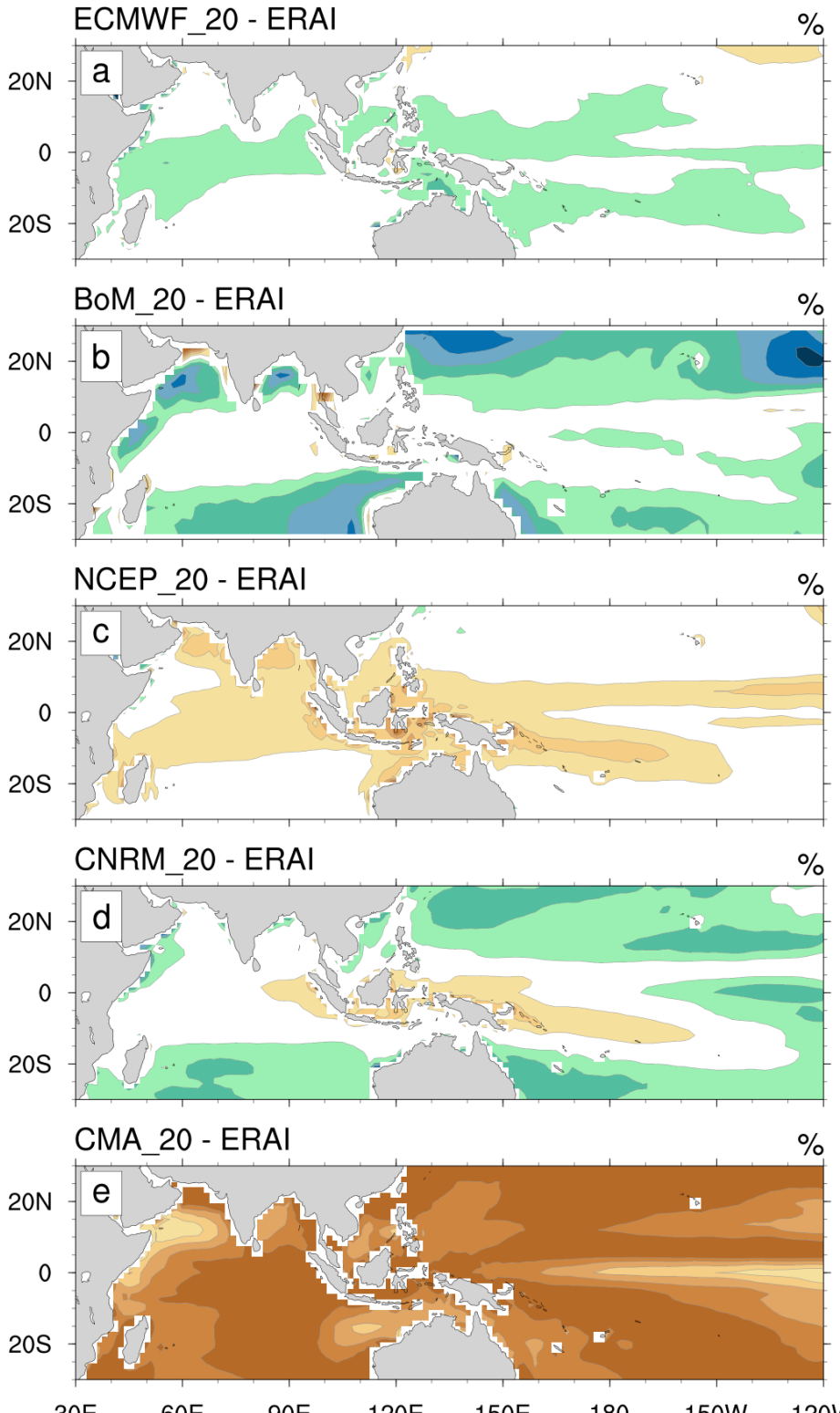


LH

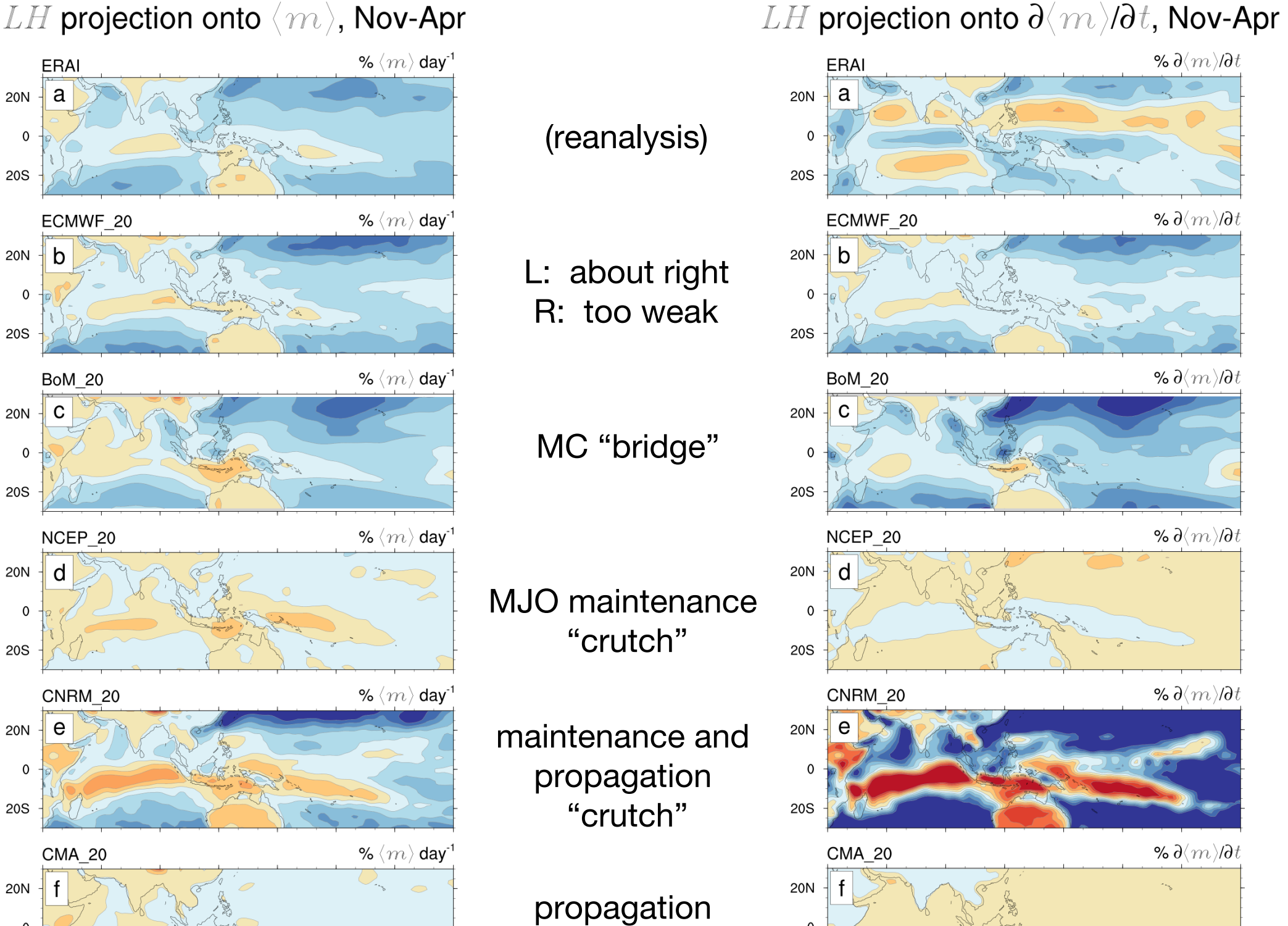



LH
delta-q
- ERAI
W m-2
ECMWF_20 - ERAI
kg/kg
a
20N
0
20S
RAI
W m-2
BoM_20 - ERAI
kg/kg
b
20N
0
20S
ERAI
W m-2
NCEP_20 - ERAI
kg/kg
c
20N
0
20S
ERAI
W m-2
CNRM_20 - ERAI
kg/kg
d
NO CONTOUR DATA
20N
0
20S
ERAI
W m-2
CMA_20 - ERAI
kg/kg
e
20N
0





biases in 5 S2S forecast models at 20-day lead


LH projection onto $\langle m \rangle$, Nov-Apr
LH projection onto $\partial\langle m \rangle/\partial t$, Nov-Apr
ERAI
% $\langle m \rangle$ day^{-1}
% $\partial\langle m \rangle/\partial t$
a
ECMWF_20
b
BoM_20
c
NCEP_20
d
CNRM_20
e
CMA_20
f
20N
0
20S
(reanalysis)
L: about right
R: too weak
MC “bridge”
MJO maintenance
“crutch”
maintenance and
propagation
“crutch”
propagation