Seasonal to Interannual Variations of the Salinity Fronts Under the Pacific Intertropical Convergence Zone

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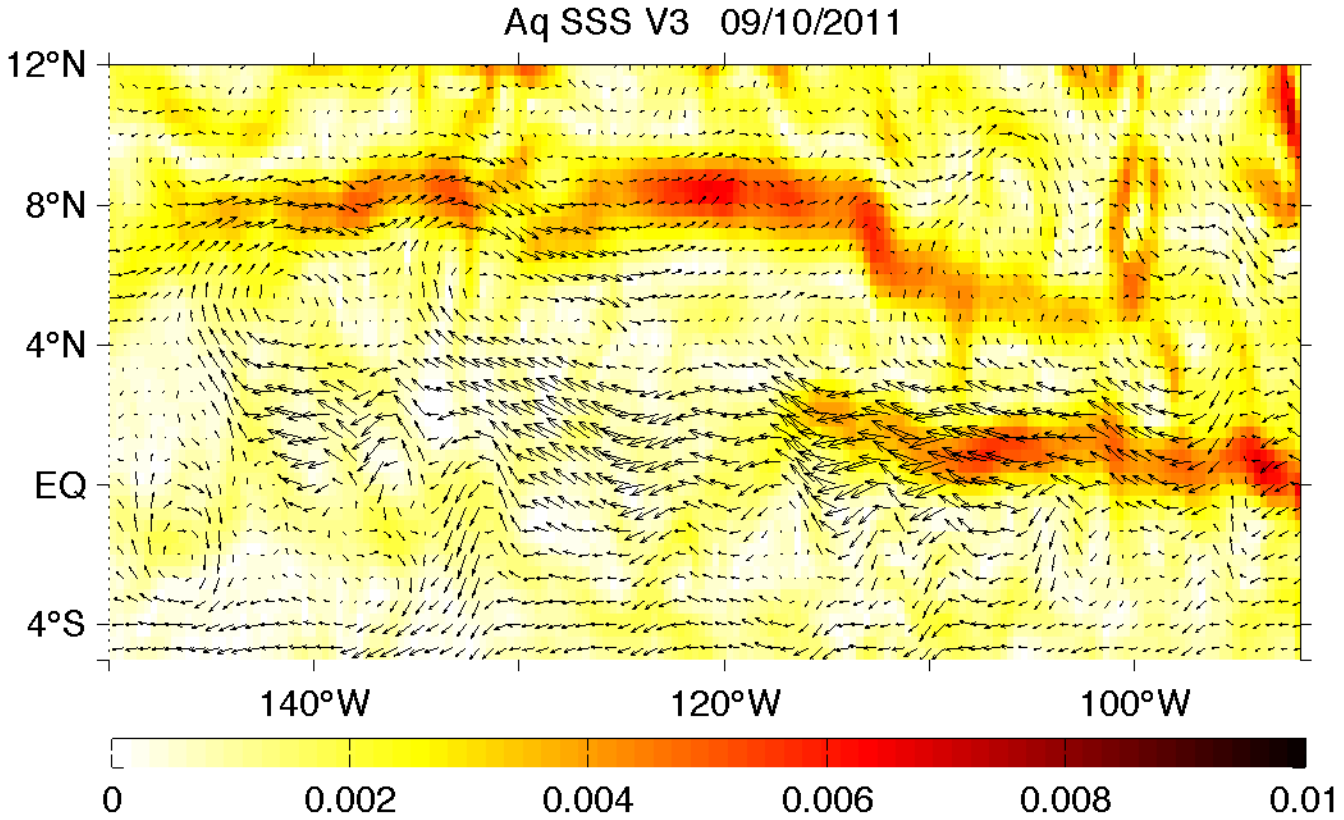
Seattle, WA

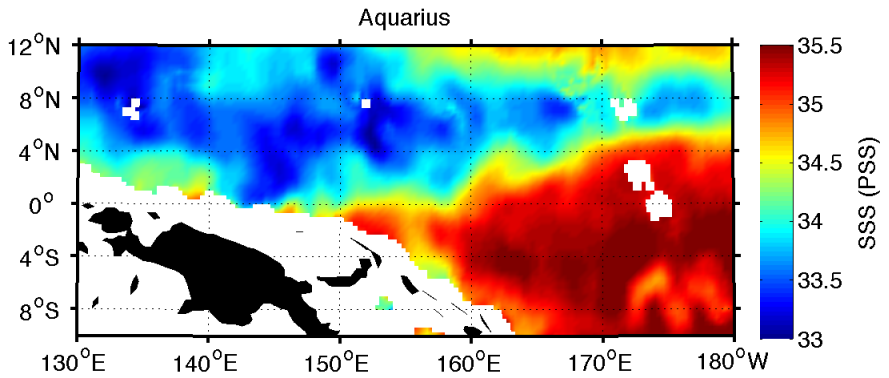
2014 Aquarius / SAC-D Science Team Meeting

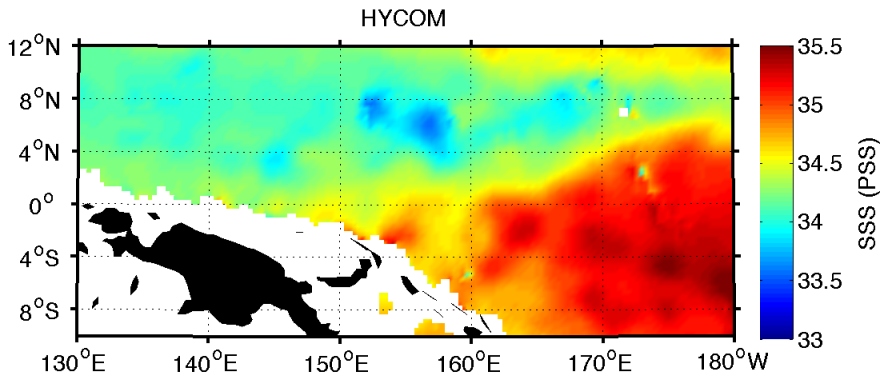
Animations of salinity gradients and the surface currents in the eastern Pacific

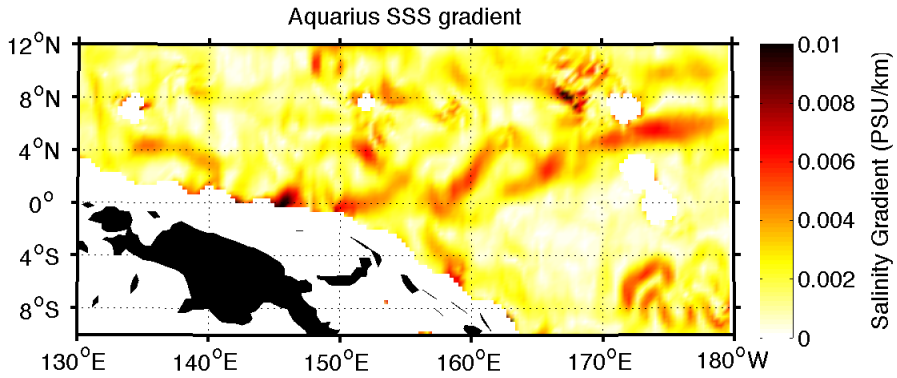


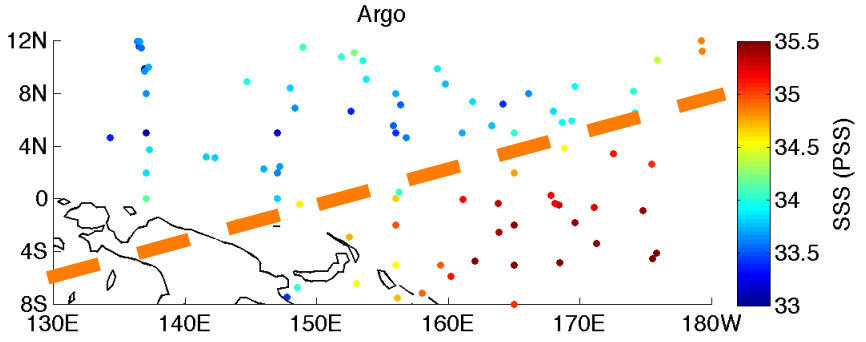
The strength of the salinity fronts show why the TIW signal from SSS is stronger at EQ, west of 120W.

Salinity fronts in Aquarius
1 week of data (10/3/2011-10/9/2011)

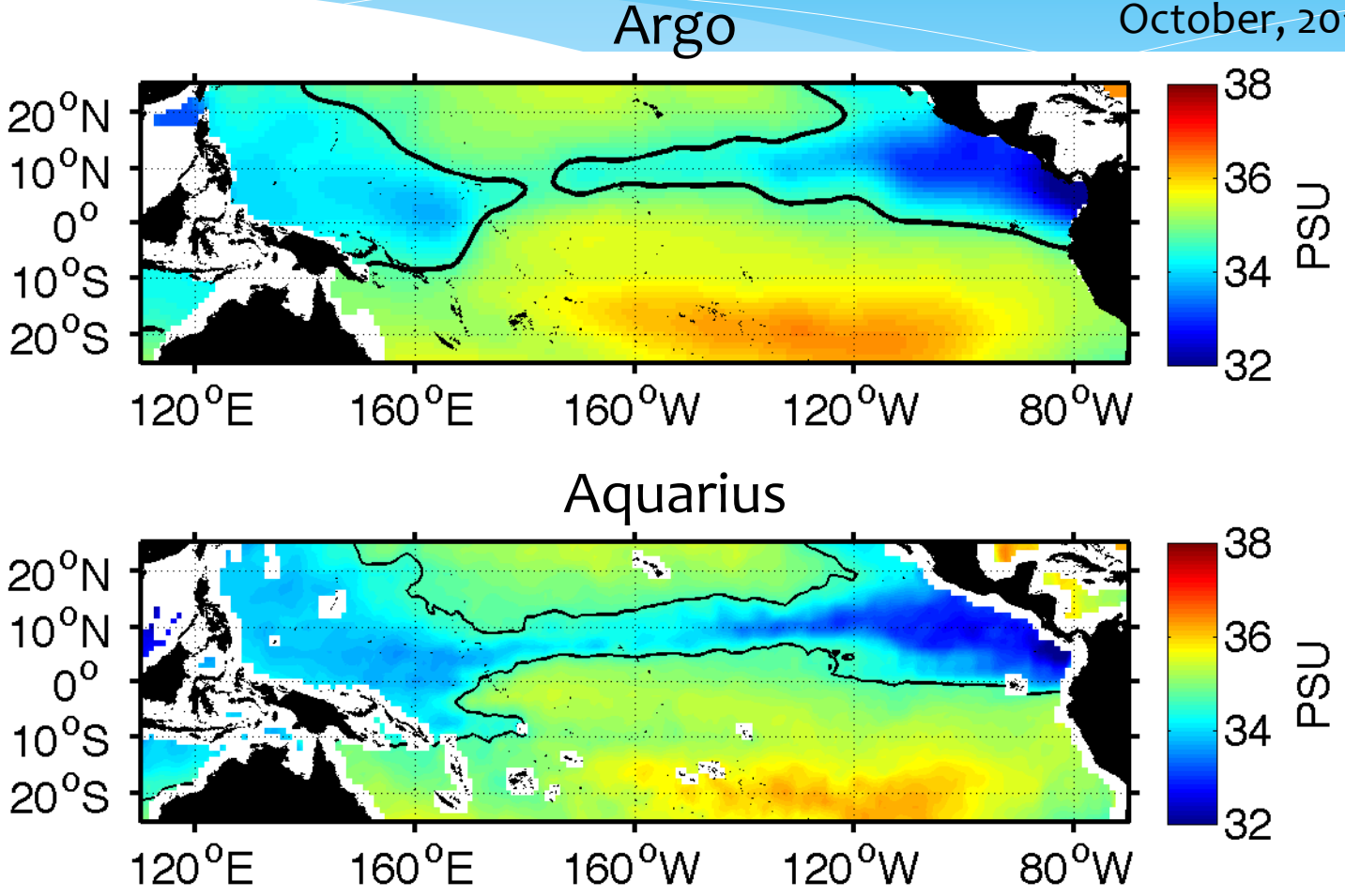








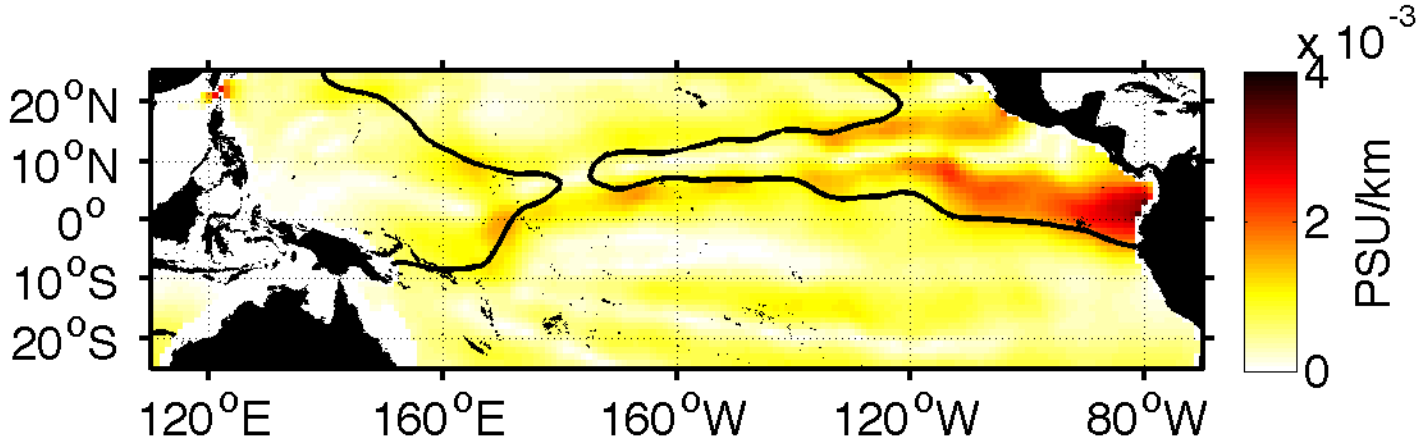
Monthly salinity maps



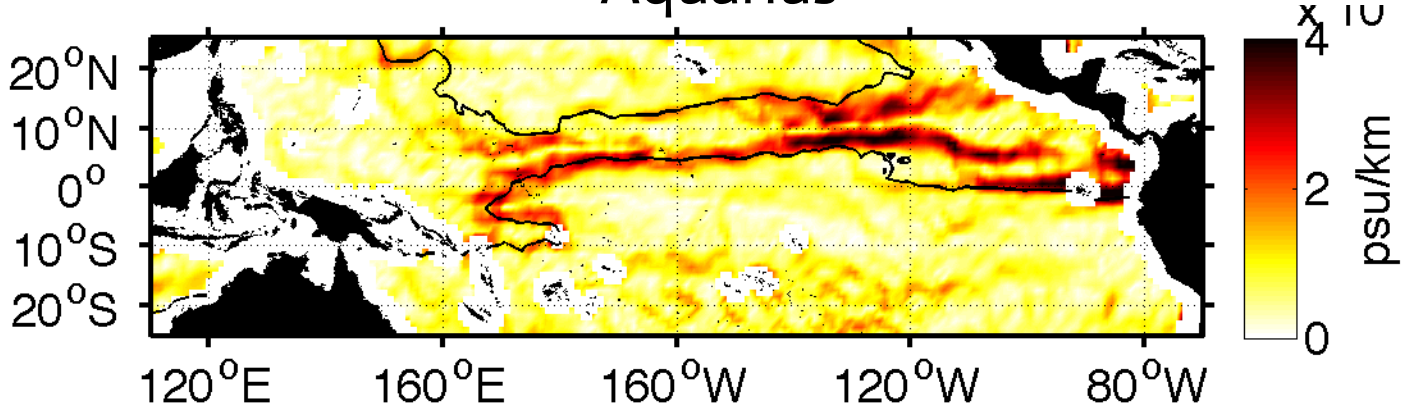
Monthly maps of salinity gradients

Argo

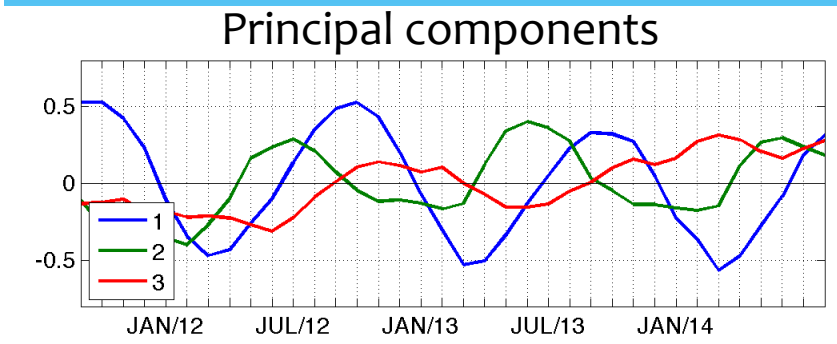
October, 2012

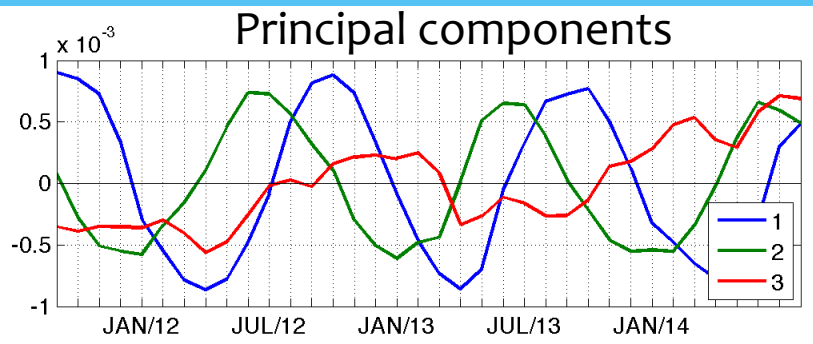


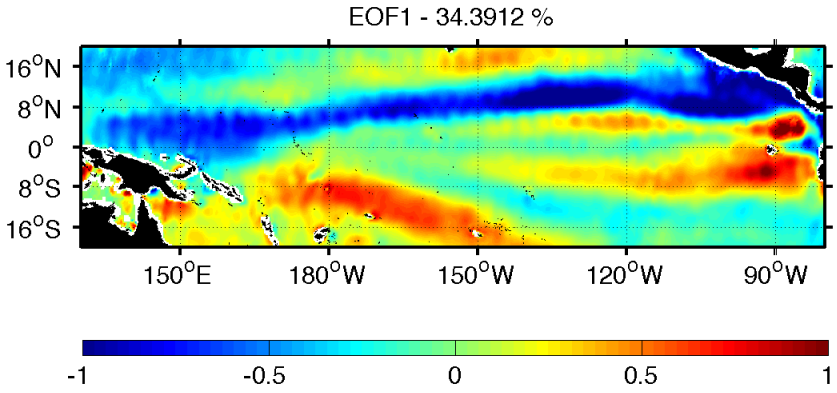
Aquarius

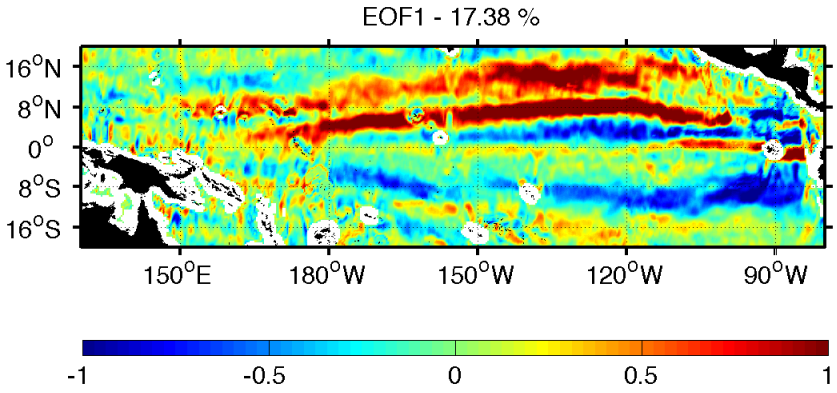


EOF1 of SSS and S grad



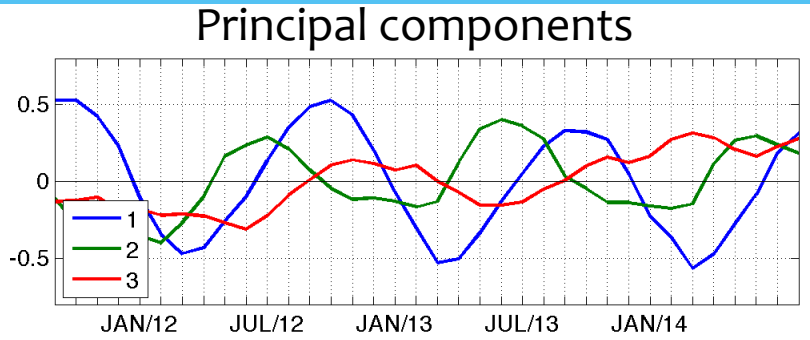


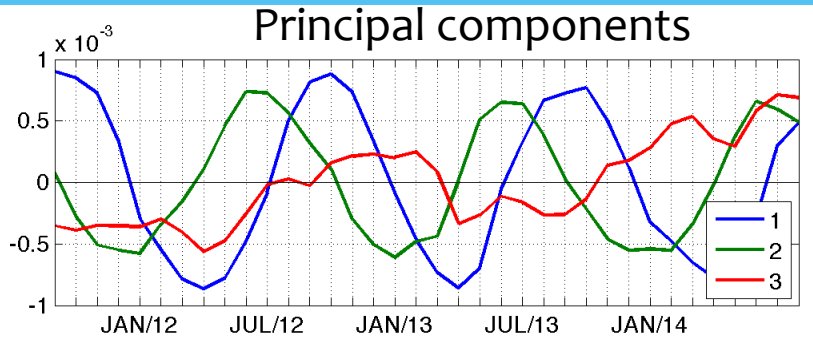


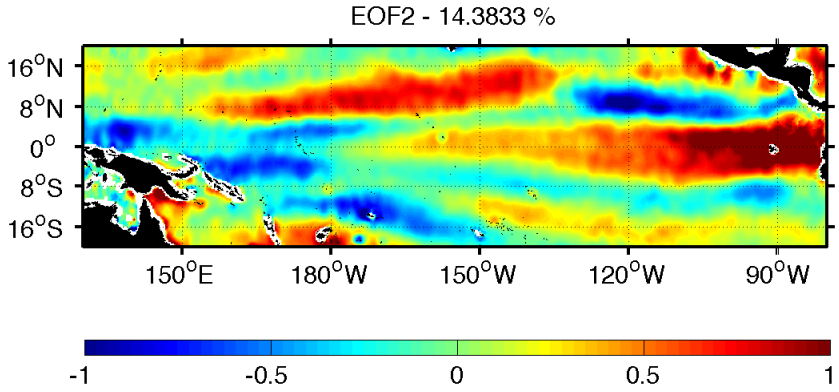


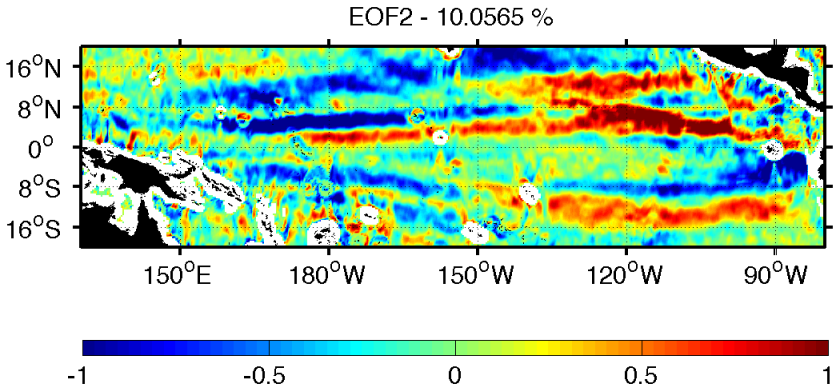
The freshwater under the ITCZ accumulate in spring and reach the peak around October. At the same time, strong SFs are also observed at the boundaries of the ITCZ.

EOF2 of SSS and S grad



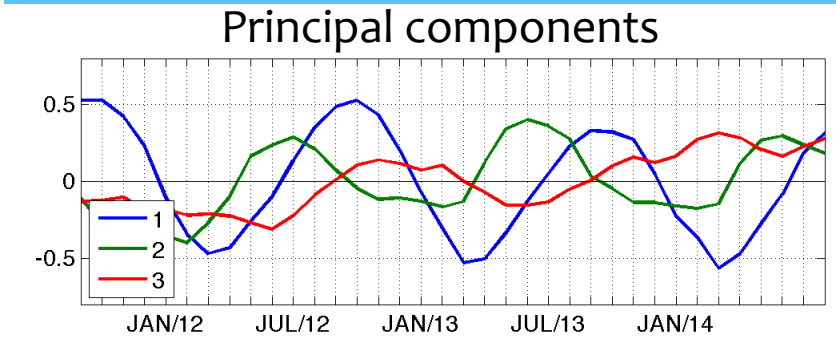


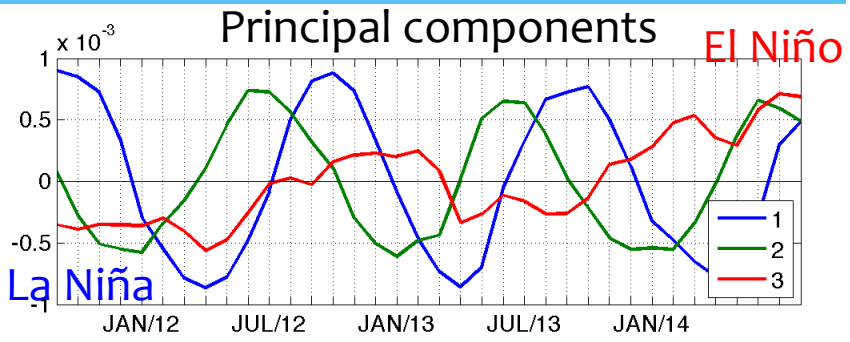


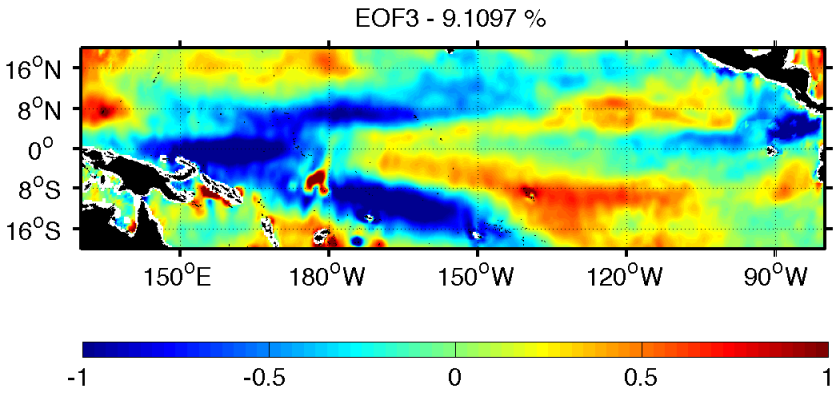


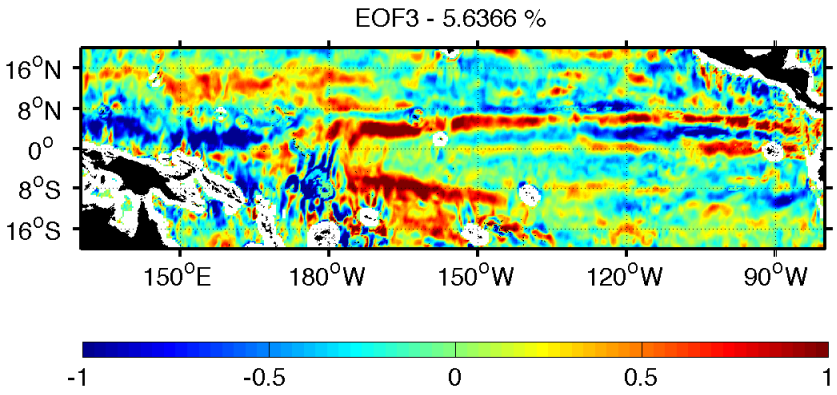
Another mode of seasonal variations orthogonal to the EOF1

EOF3 of SSS and S grad







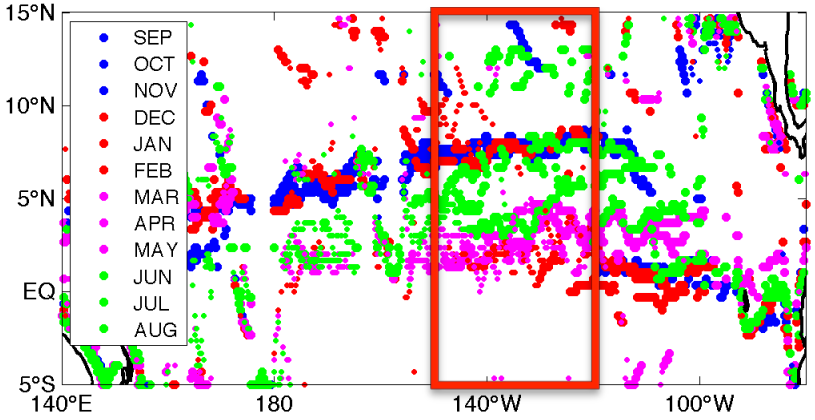


ENSO like variations -
enhanced salinity fronts at the eastern
edge of western Pacific fresh/warm pool

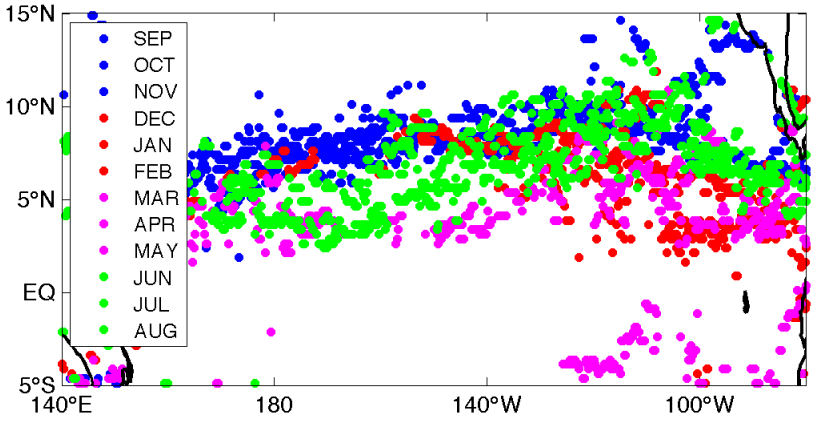
Seasonal migration of the salinity fronts
First Aquarius year (Sep, 2011 - Aug, 2012)

- Latitude of the maximum value at each longitude is labeled for each month

S grad (y) Max

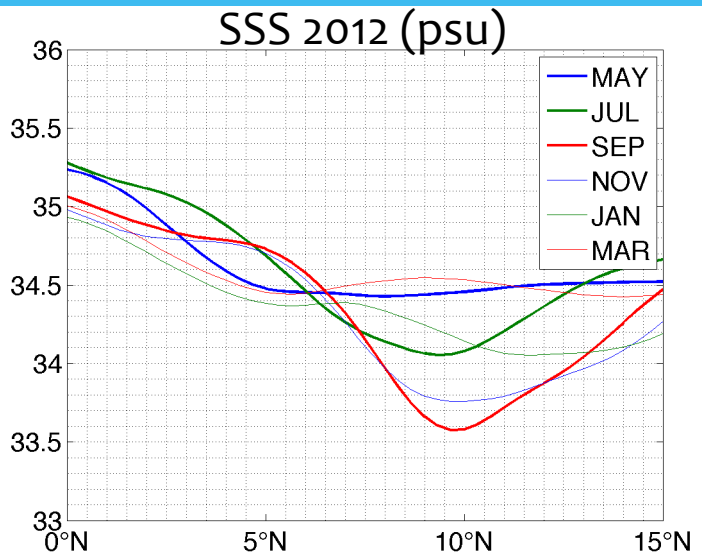


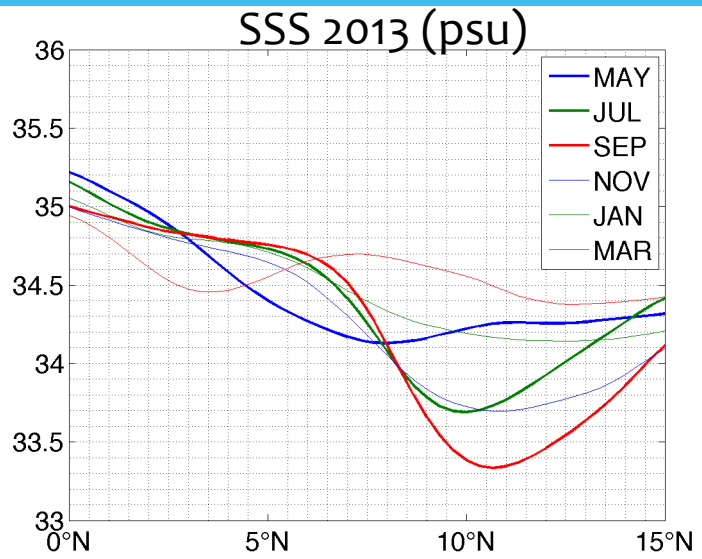
Precipitation Max

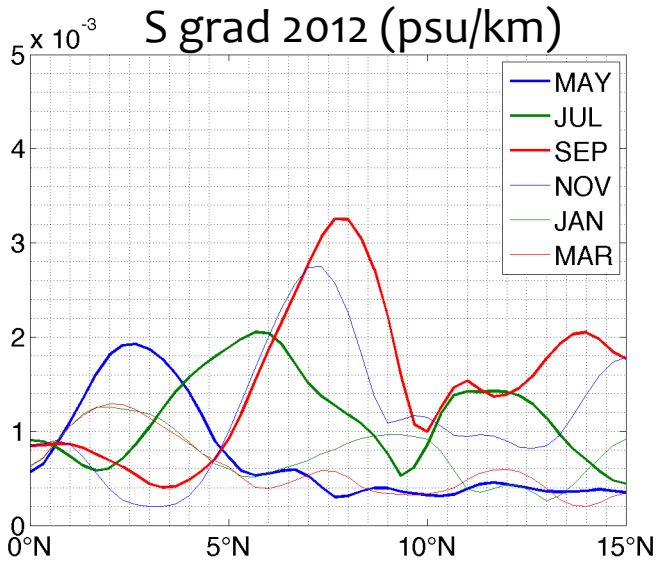


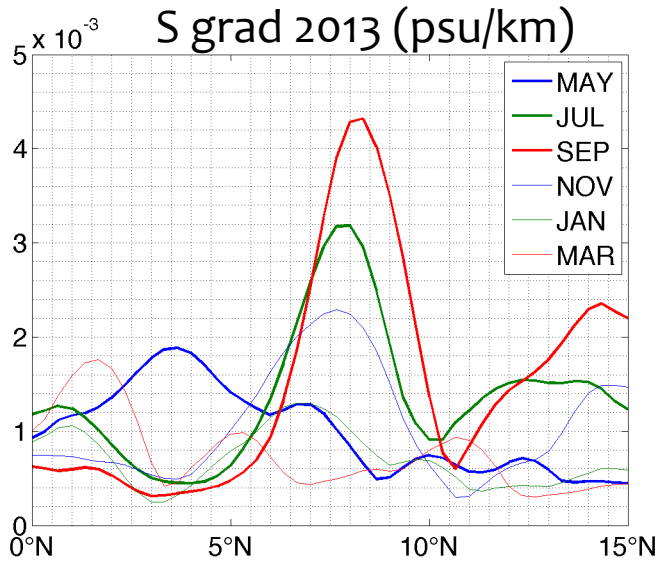
Migrate northward in Fall and southward in April.

Quantification of the salinity fronts



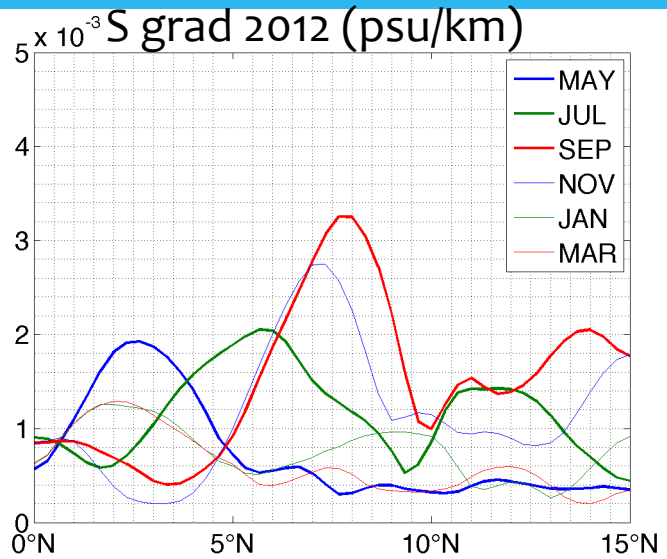


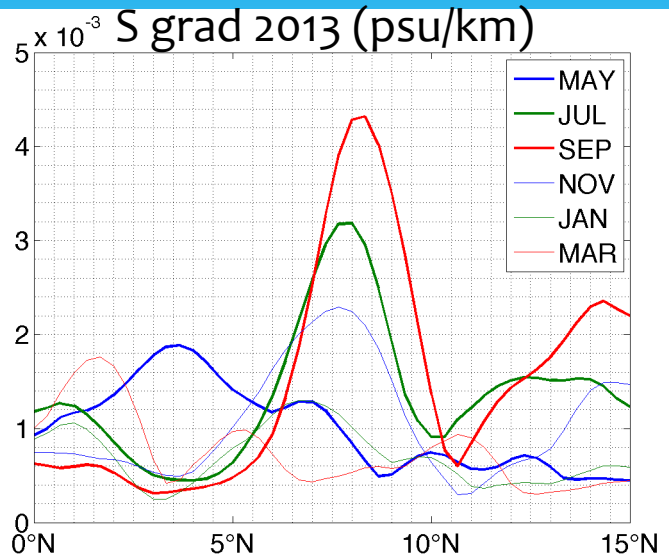


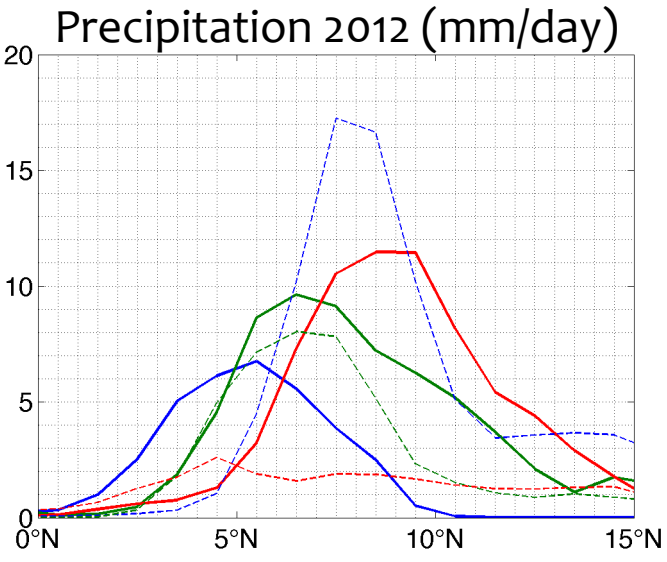


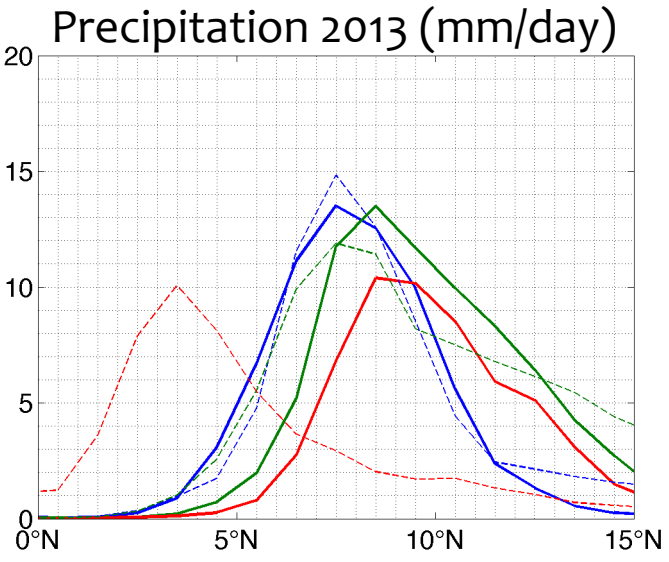
The salinity fronts is mainly the results of freshening at 10°N

Salinity fronts and the rainfall



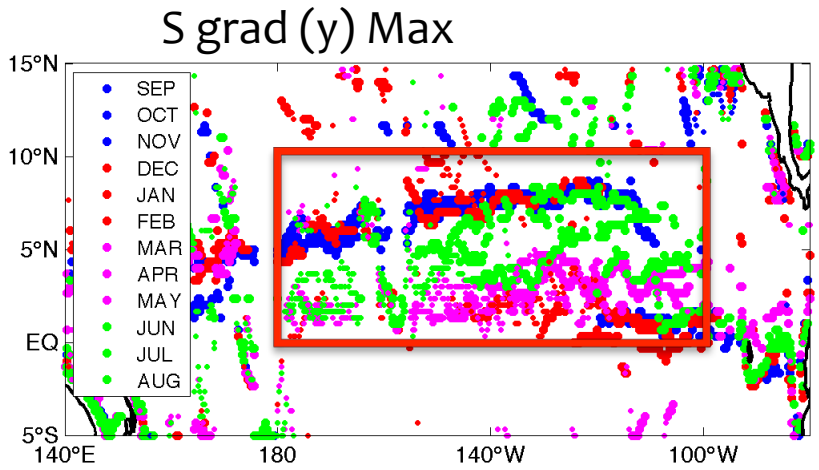


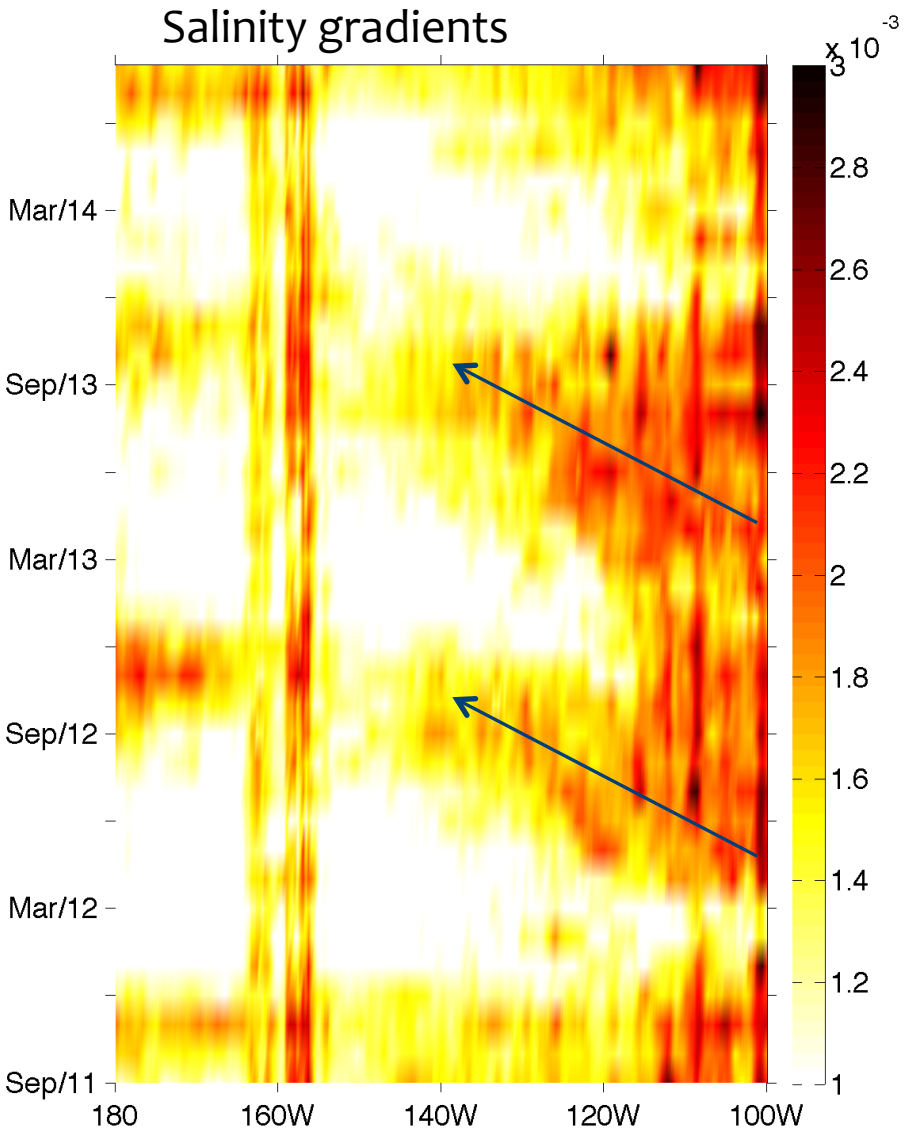




The precipitation is stronger and more northward in May and July in 2013, and it results in stronger salinity fronts in September 2013.

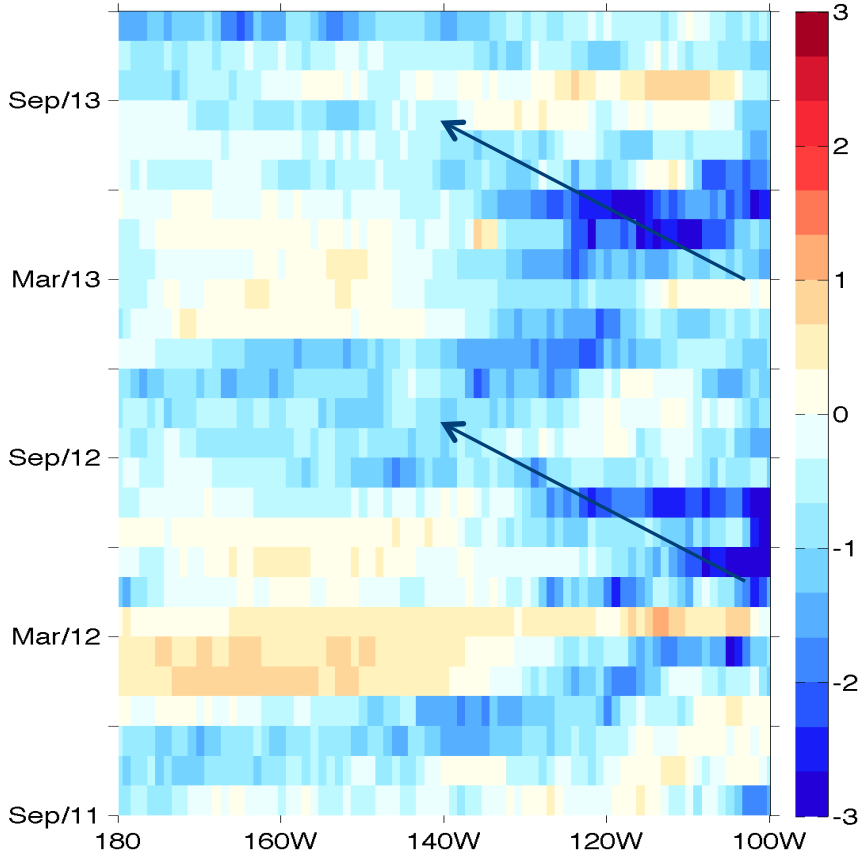
Evolution of the salinity fronts between EQ and 10N



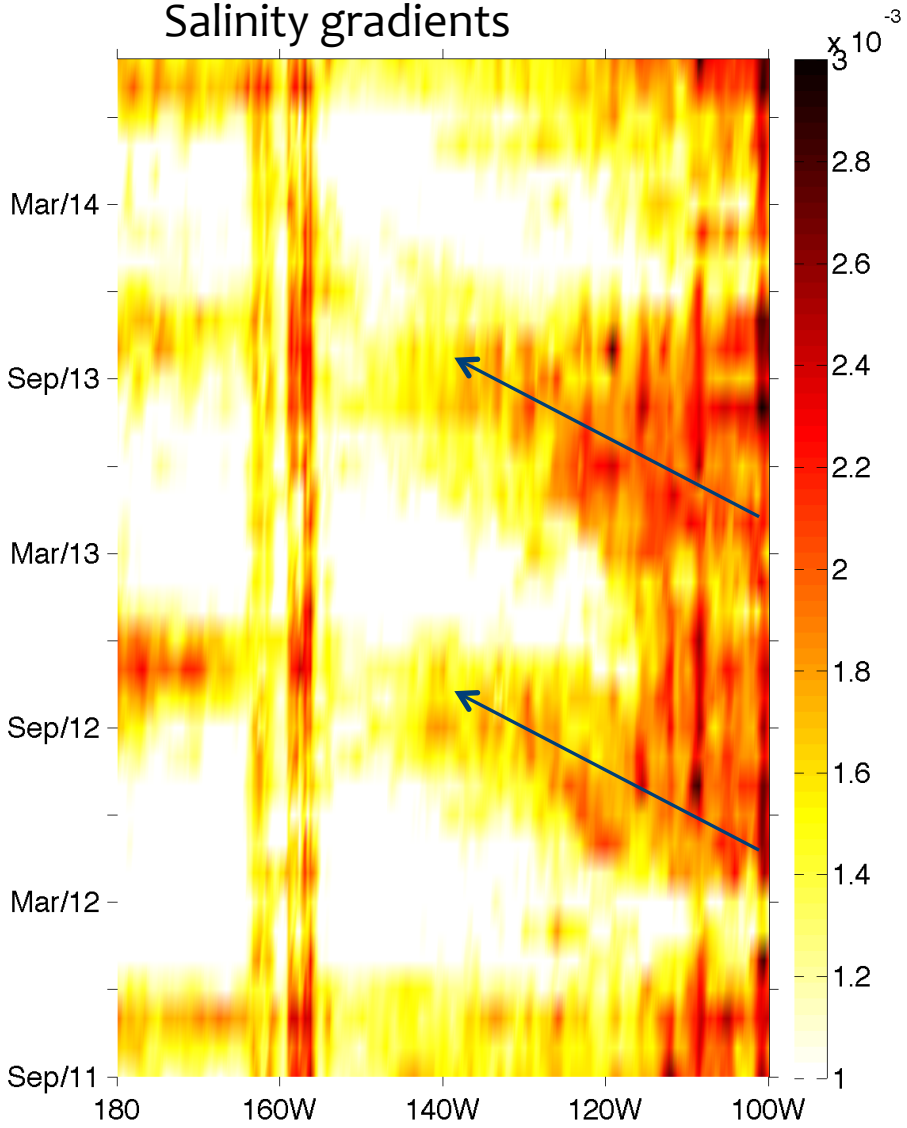


Evolution of the salinity fronts and the freshwater flux between EQ and 10N

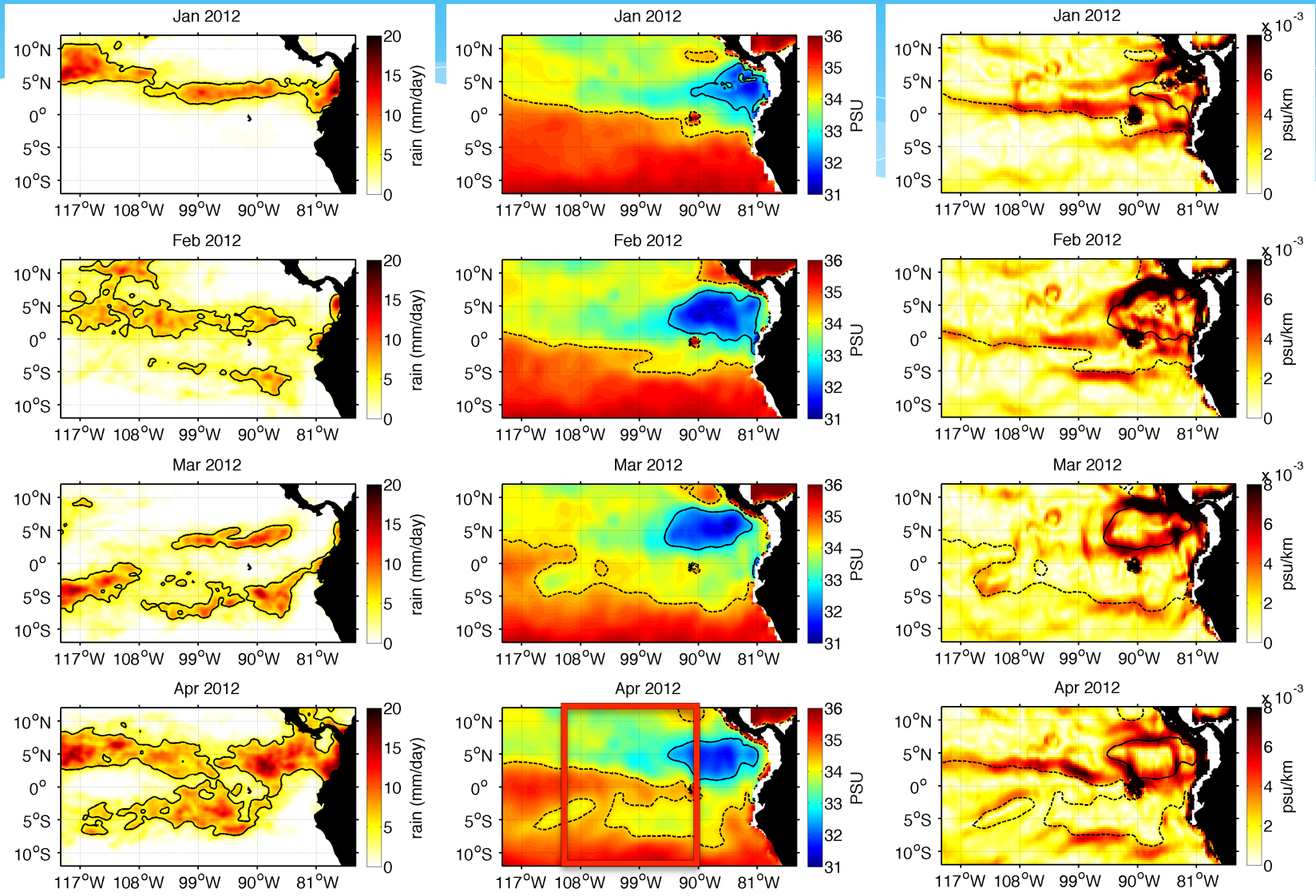
Freshwater flux $S_o(E-P)/H$



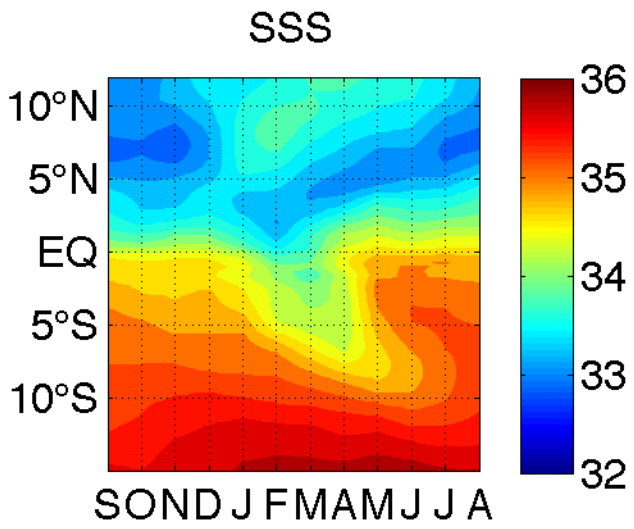
Salinity gradients

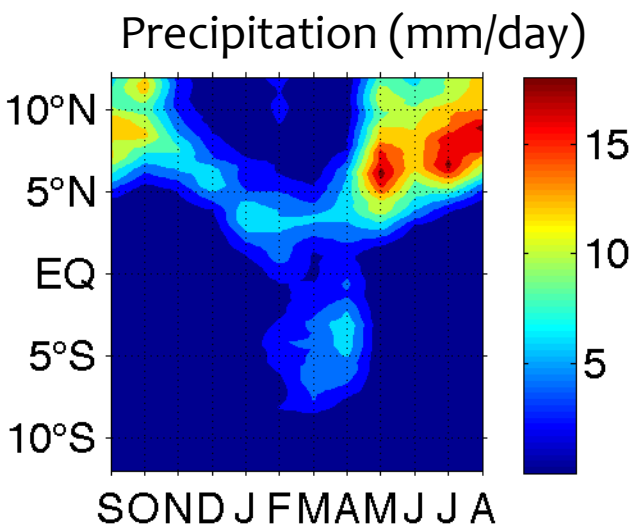


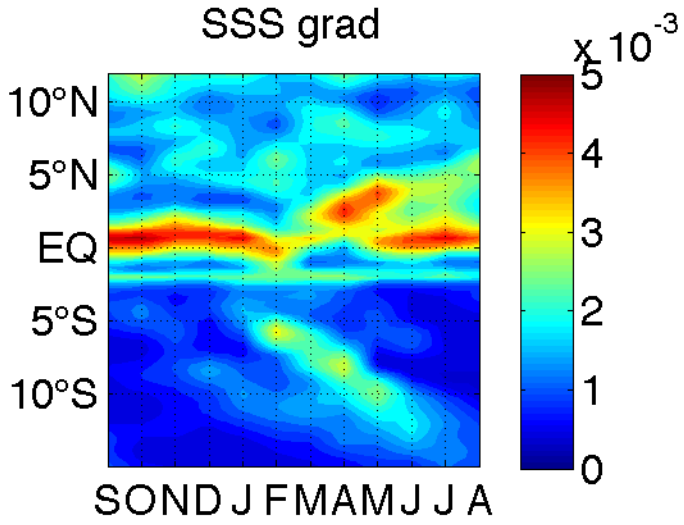
Secondary ITCZ in the eastern Pacific fresh pool

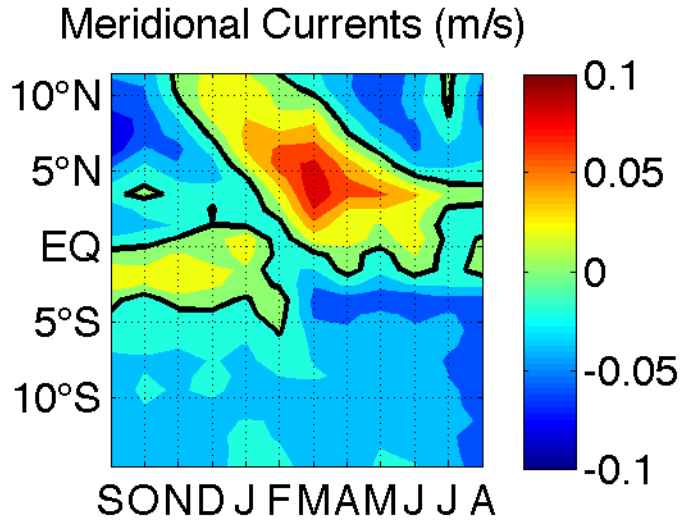


Hovmöller diagrams of SSS, SSS gradient, precipitation, and meridional currents in the eastern Pacific averaged between 90-110°W in 1st Aquarius year. Sep/2011-Aug/2012

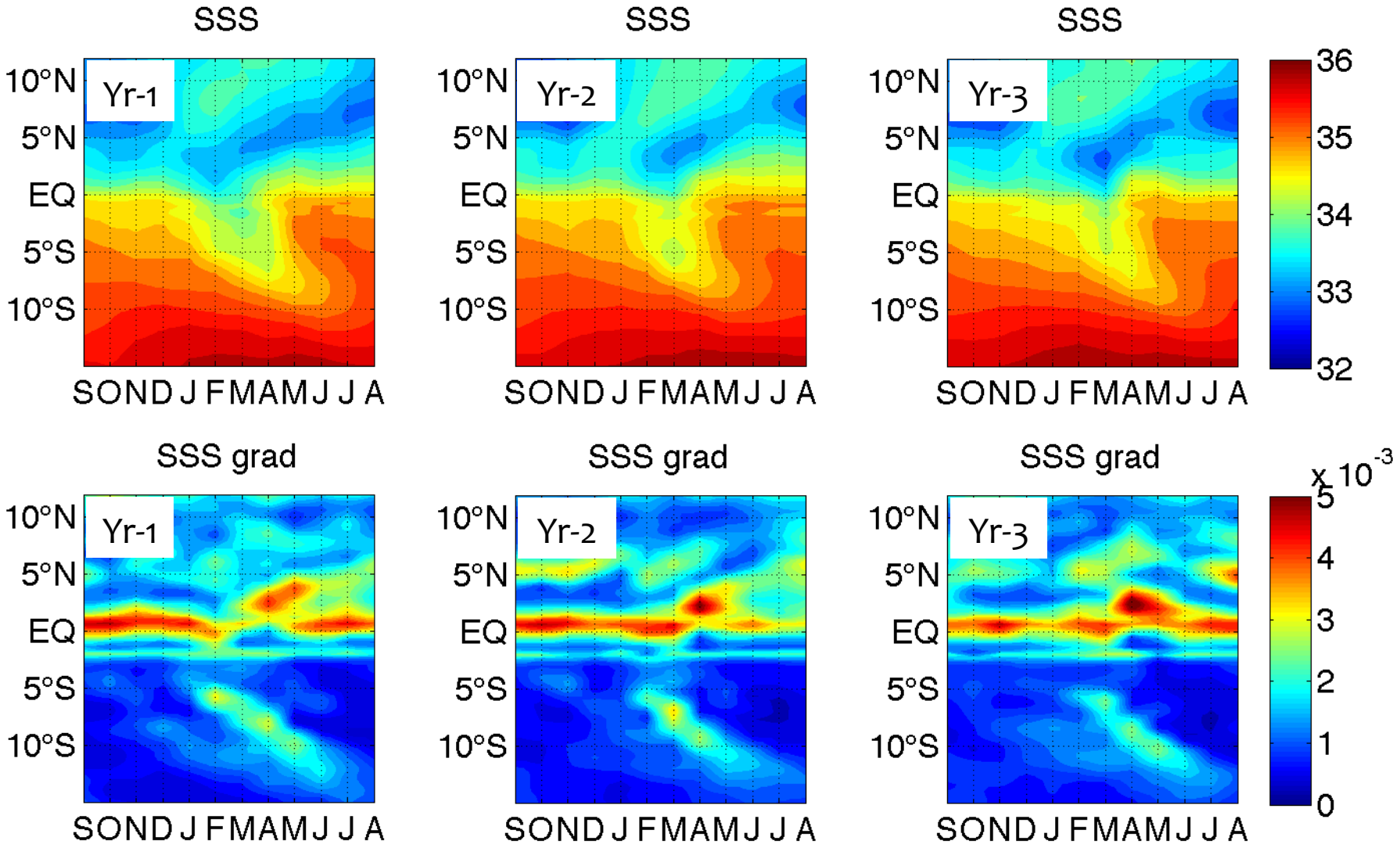








Southward propagation of freshwater and salinity fronts

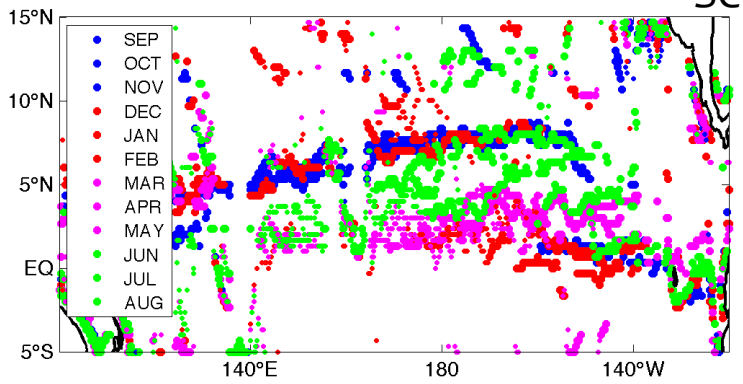


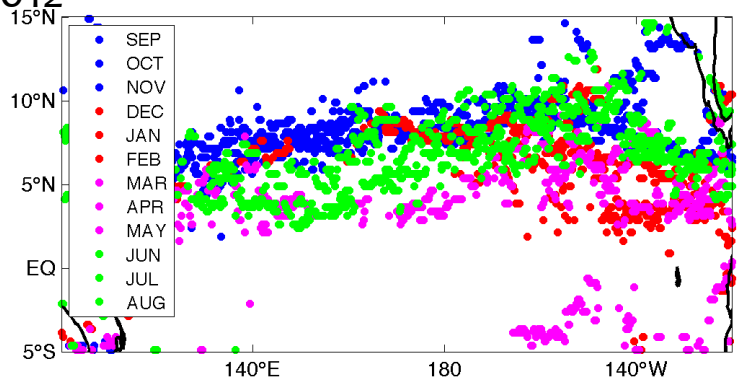
Summary

* Salinity fronts under the ITCZ develop and migrate northward from May and reach the peak in October
* Freshening at 10N by the rainfall is the major cause of the strong salinity fronts
* Southward propagation of the second ITCZ in the eastern Pacific is a robust feature caused by the regional rainfall and southward surface currents

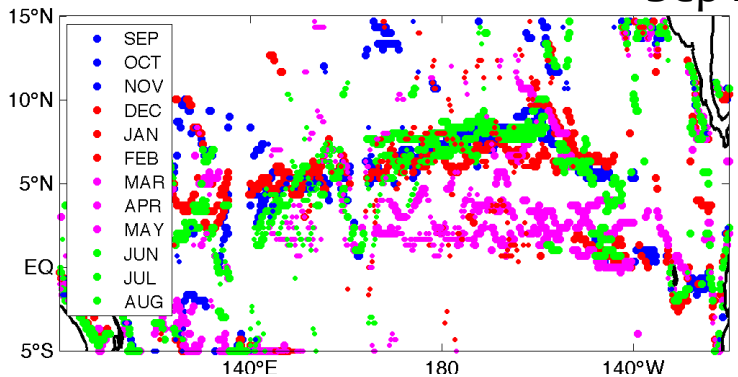
Thank you!

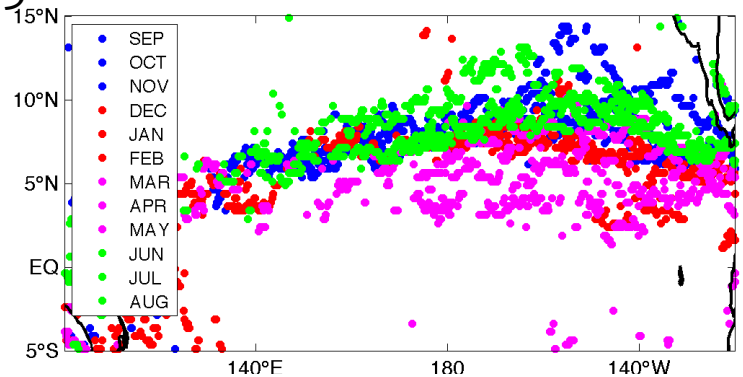
Sep 2011 – Aug 2012



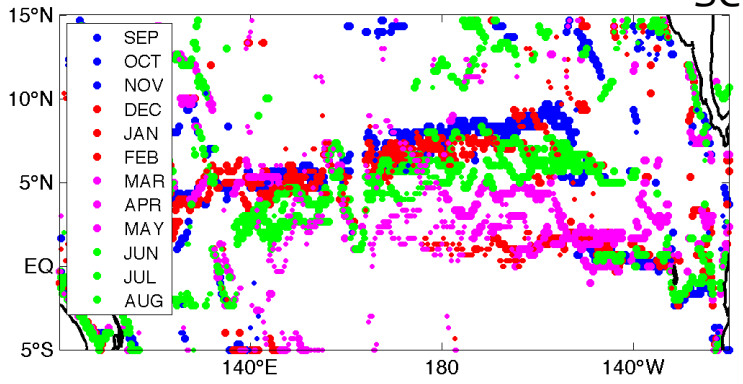


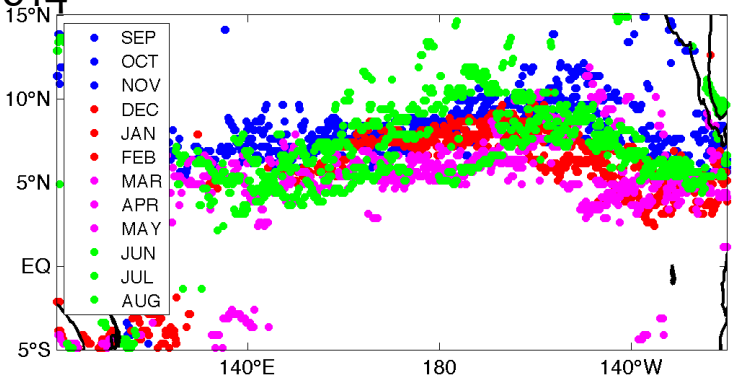
Sep 2012 – Aug 2013

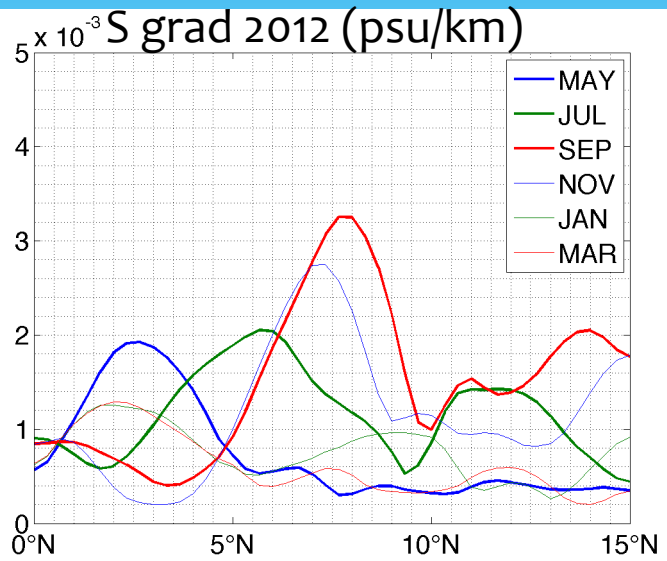


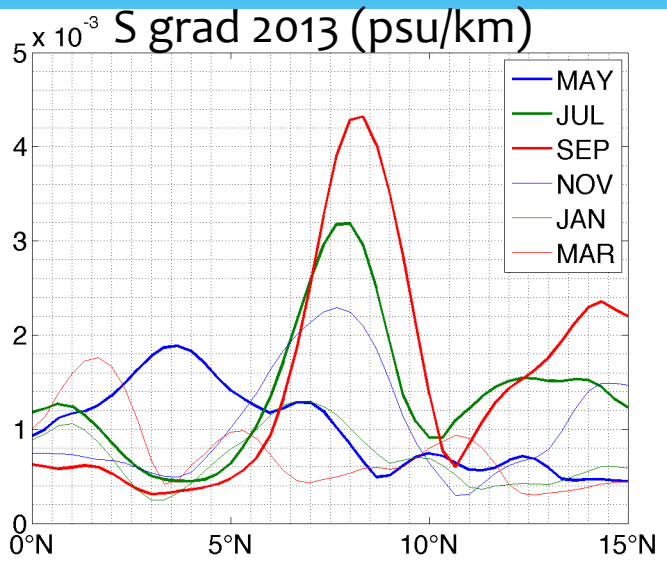


Sep 2013 – Aug 2014






x 10^-3 S grad 2012 (psu/km)
MAY
JUL
SEP
NOV
JAN
MAR
5
4
3
2
1
0
0°N
5°N
10°N
15°N


x 10^-3 S grad 2013 (psu/km)
MAY
JUL
SEP
NOV
JAN
MAR
5
4
3
2
1
0
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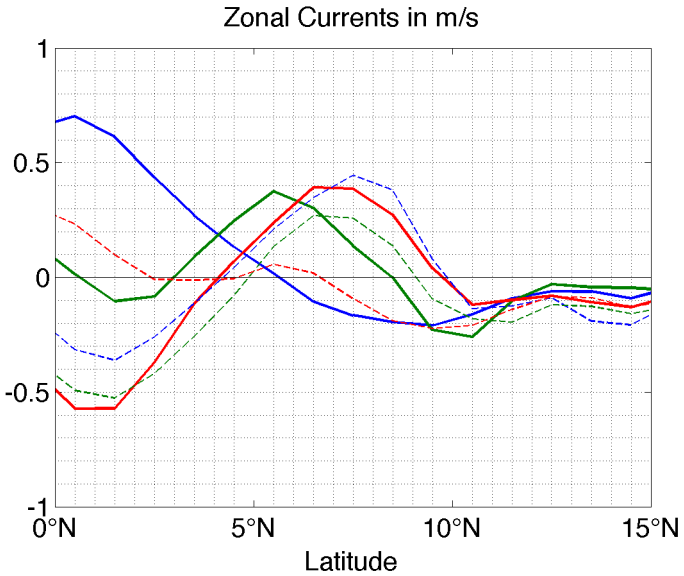
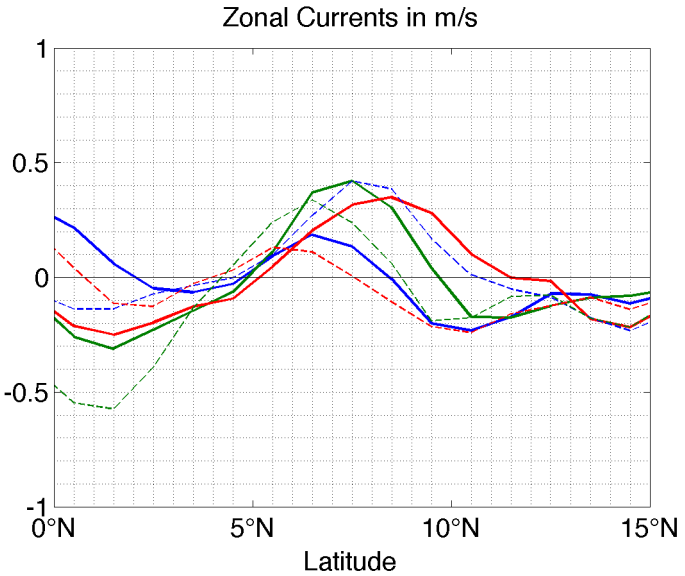
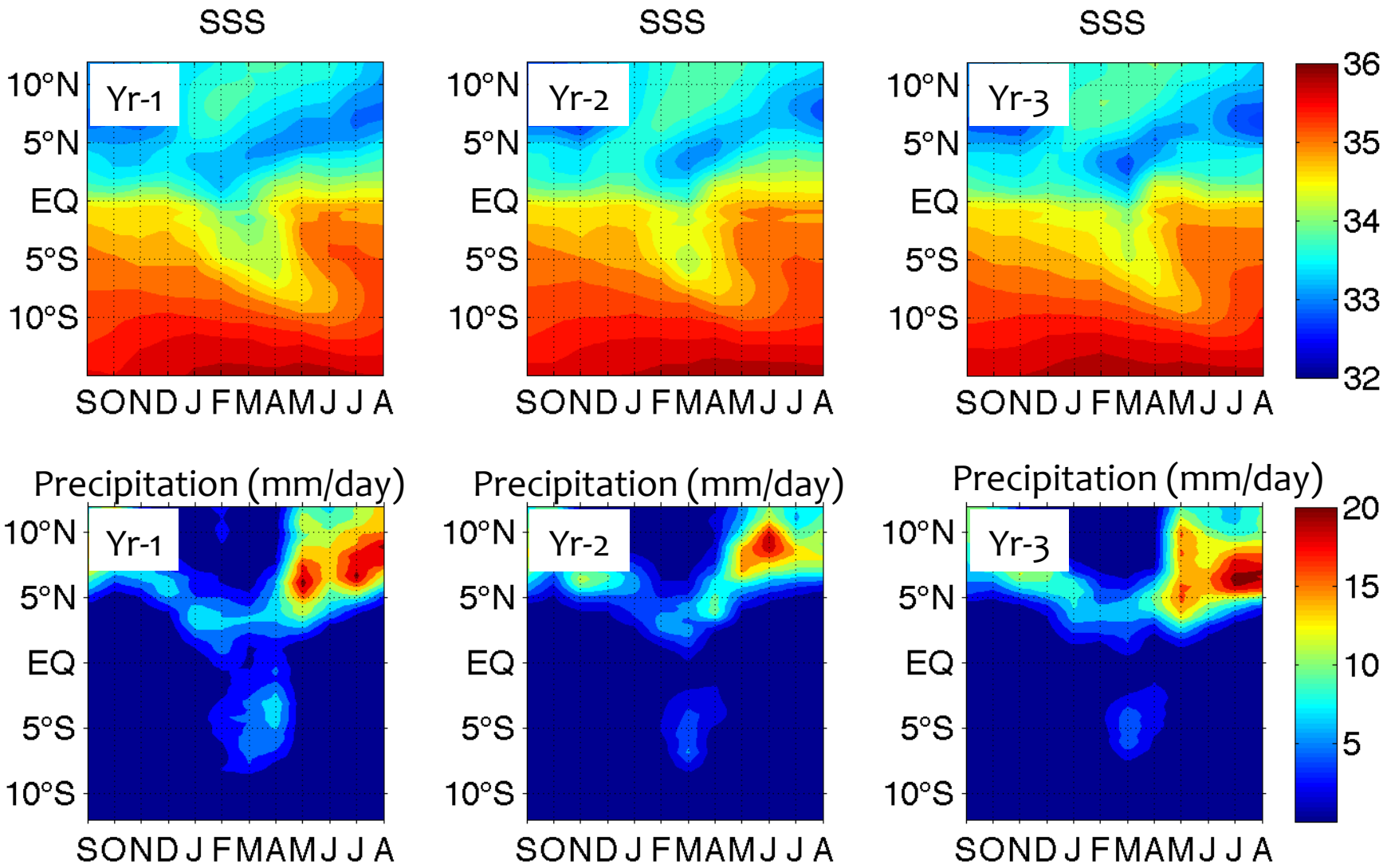
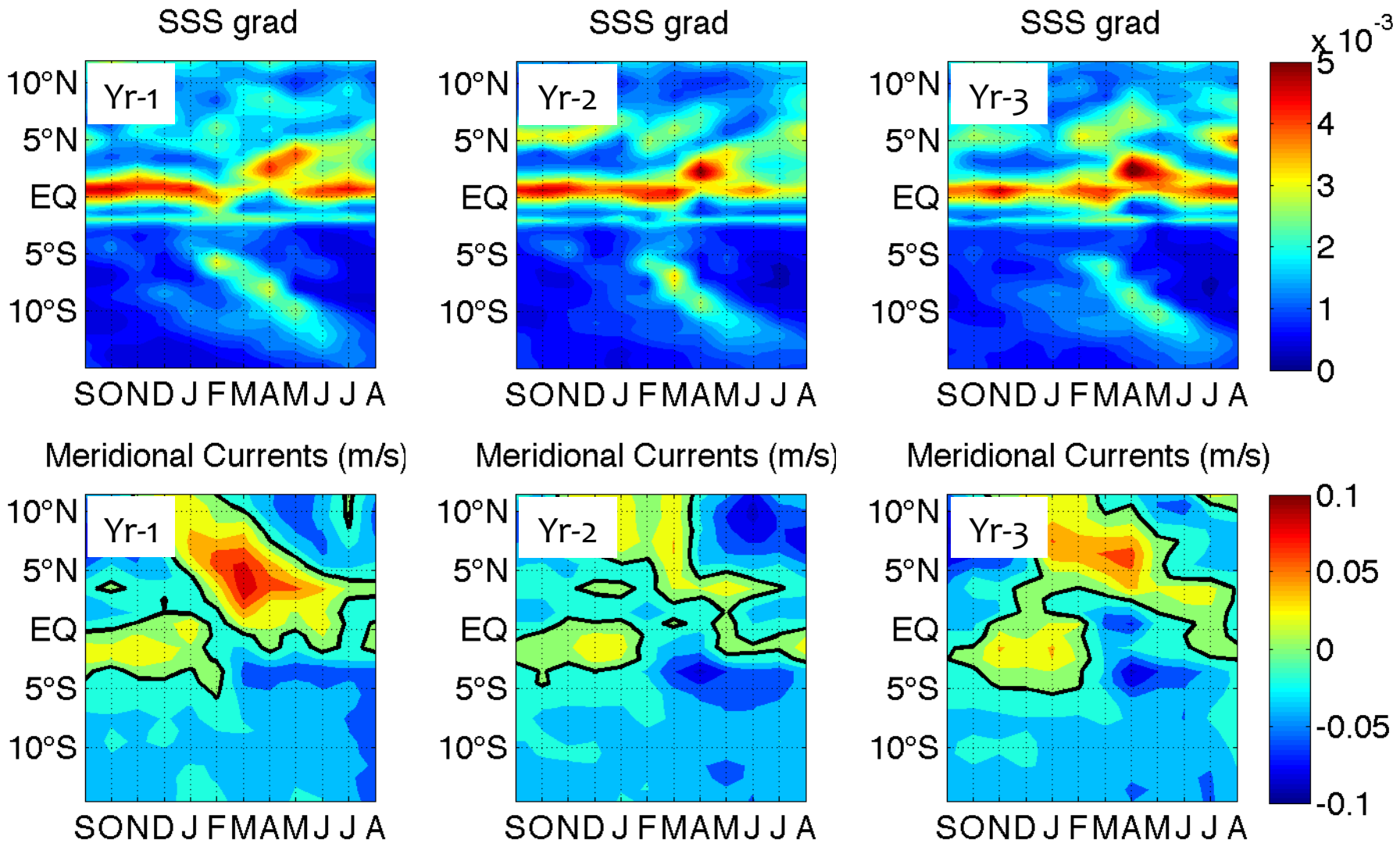
5°N
10°N
15°N


Zonal Currents in m/s
1
0.5
0
-0.5
-1
0°N
5°N
10°N
15°N
Latitude


Zonal Currents in m/s
1
0.5
0
-0.5
-1
0°N
5°N
10°N
15°N
Latitude


SSS
SSS
SSS
10°N
5°N
EQ
5°S
10°S
Yr-1
Yr-2
Yr-3
SOND J FMAMJ J A
36
35
34
33
32
Precipitation (mm/day)
Precipitation (mm/day)
Precipitation (mm/day)
20
15
10
5


SSS grad
SSS grad
SSS grad
x 10^-3
Yr-1
Yr-2
Yr-3
10°N
5°N
EQ
5°S
10°S
SOND J FMAMJ J A
5
4
3
2
1
0
Meridional Currents (m/s)
Meridional Currents (m/s)
Meridional Currents (m/s)
0.1
0.05
0
-0.05
-0.1