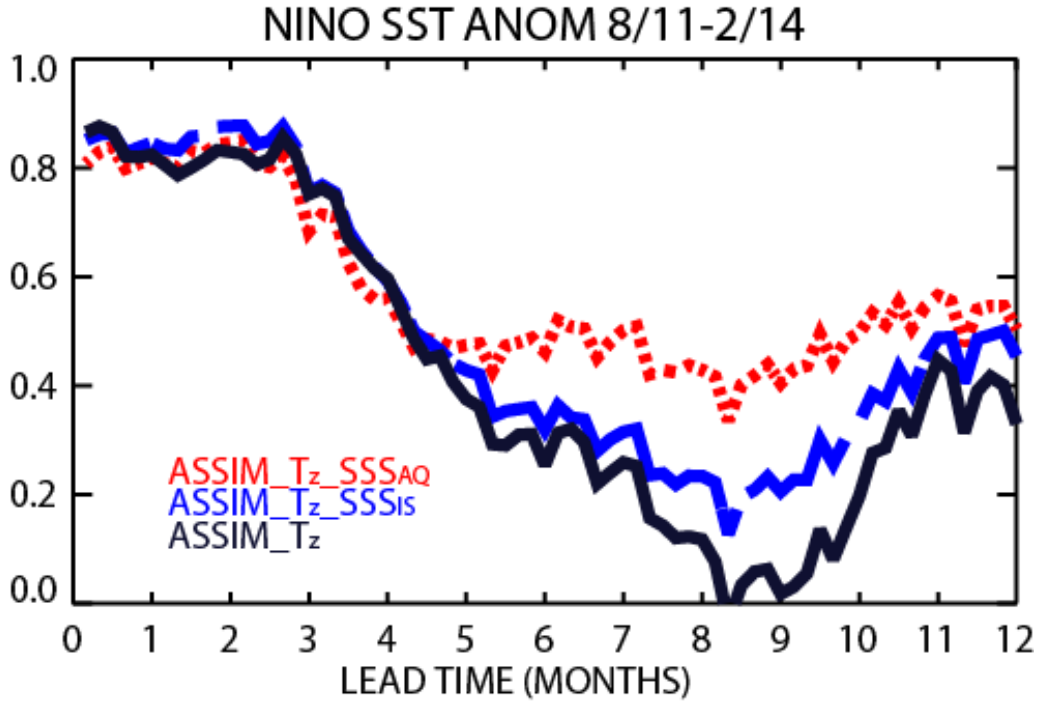
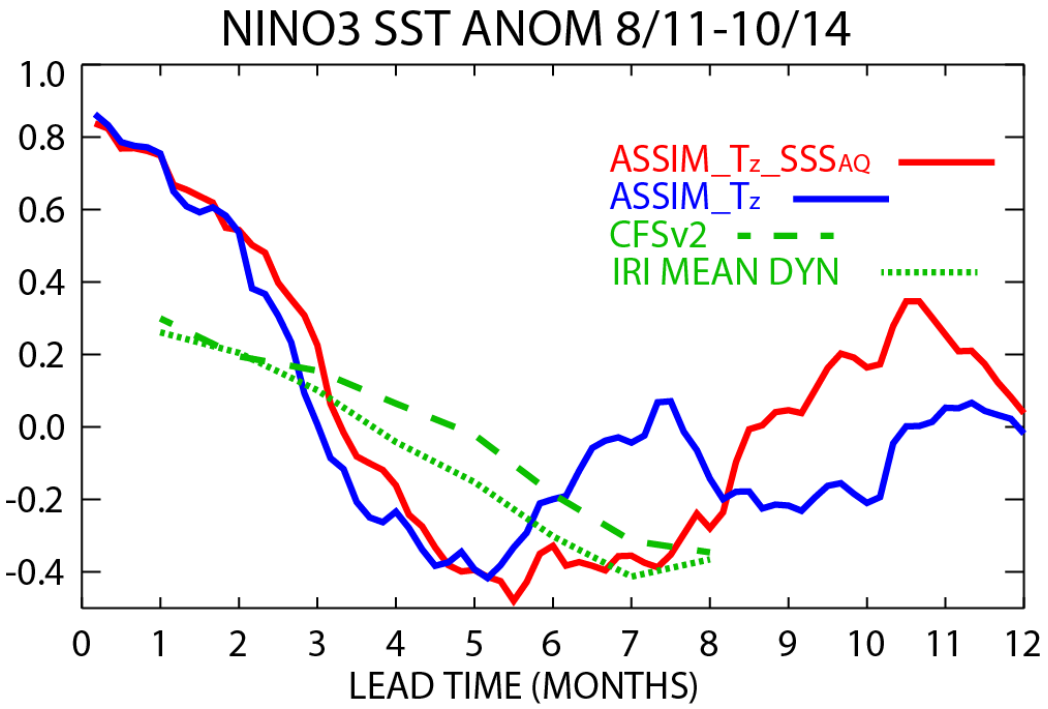
SSS assimilation improves Hybrid coupled forecasts and Aquarius assimilation outperforms in situ SSS due to both the quality and quantity of the satellite measurements .



- Coupled experiments performed to test impact of SSS assimilation using OGCM and statistical atmosphere
- Baseline – assimilate only Tz
- Optimal interpolation of near-surface in situ salinity observations improves coupled forecasts
- Aquarius improves coupled forecasts with respect to both in situ OI and baseline

Hackert, E., A. Busalacchi, and J. Ballabrera-Poy (2014), Impact of Aquarius sea surface salinity observations on coupled forecasts for the tropical Indo-Pacific Ocean, Journal of Geophysical Research, Oceans, 119. (DOI: 10.1002/2013JC009697)

Aquarius SSS assimilation also improves coupled forecasts when using a dynamic coupled atmosphere (SPEEDY).



- Similar set of experiments but now using OGCM coupled to SPEEDY
- Again baseline is coupled results initialized using Tz assimilation only
- Aquarius improves coupled forecasts for 2-5 and 8-12 month lead times
- Results put into context of CFSv2 and IRI mean of all dynamic forecasts

Forecasts using full assimilation (SL_SST_SSS_Tz_Sz) –

- Mar 2014 => Slightly negative SST by summer
- Nov 2014 => Cooling in spring
- Apr 2015 => Weak warming (similar to IRI DYN Mean)

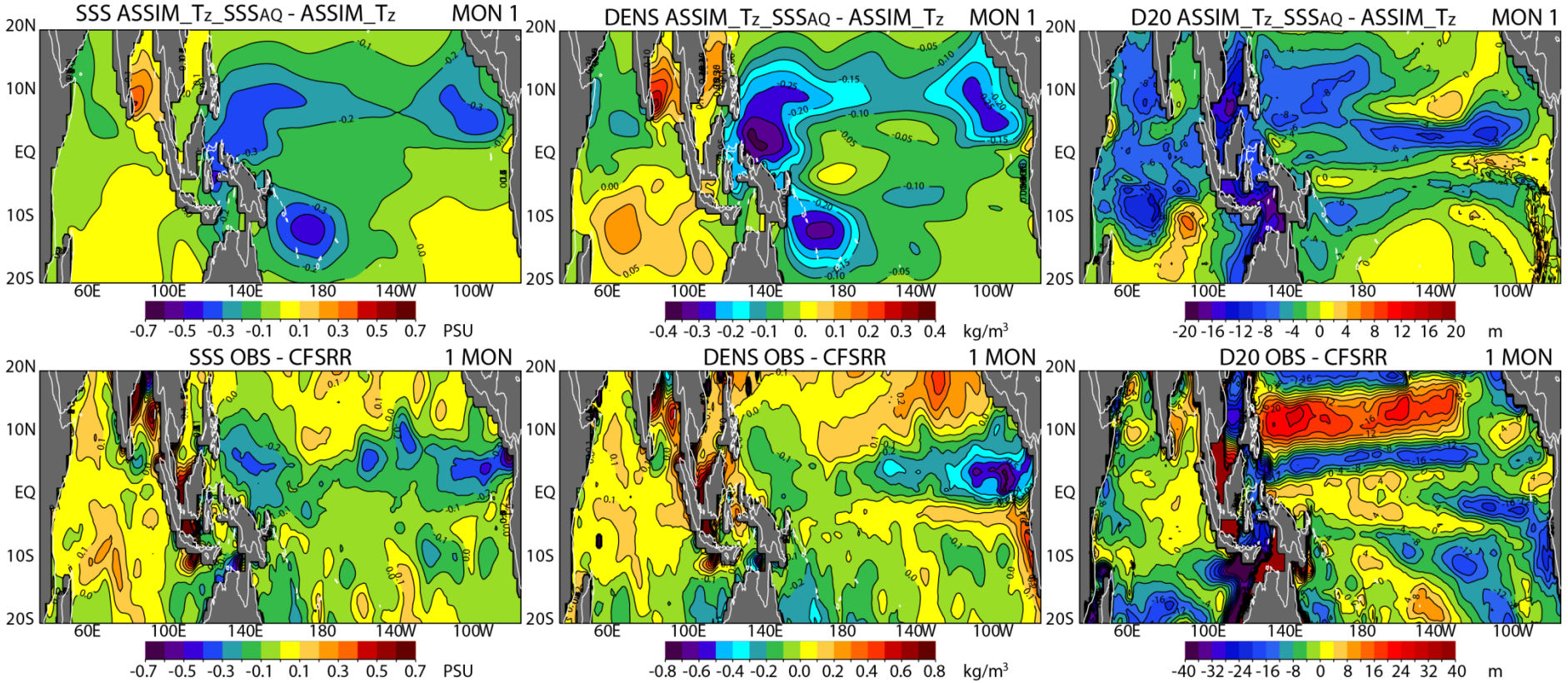
Hackert, E., A.J. Busalacchi, "Impact of Aquarius SSS on coupled dynamics for the tropical Indo-Pacific" http://essic.umd.edu/~ehackert/Fall AGU poster 2014.pdf

Summary

- Statistical ENSO prediction showed potential for SSS to improve long-lead forecasts – ***used to help justify science benefit of Aquarius mission*** *(Ballabrera-Poy et al., 2002, JGR Oceans)*
- OI of in situ SSS improves coupled forecasts – off equatorial SSS improves equatorial density via subduction pathways and improves spring prediction barrier (*Hackert et al., 2011, JGR Oceans*)
- Aquarius SSS assimilation improves the zonal and meridional density gradient negating the warm tendency of forecasts for this period (*Hackert et al., 2014, JGR Oceans*)
- Biases between observations and CFSRR results (e.g. SSS and D20) are similar to biases with and without Aquarius assimilation suggesting potential to improve CFSv2 forecasts
- *Hackert, E., A.J. Busalacchi, "Impact of Aquarius SSS on coupled dynamics for the tropical Indo-Pacific"* *http://essic.umd.edu/~ehackert/Fall AGU poster 2014.pdf*

Backups

Similarities between the impact of SSS assimilation and Observation/CFSRR biases foreshadow potential improvements to the CFS.



Top panels show differences of Aquarius assimilation minus baseline for left) SSS, middle) mixed layer density, and right) depth of the 20°C isotherm. Bottom panels show corresponding values for observations minus CFSRR forecasts. Even though the periods are different, (August 2011 to October 2014 for top and Jan. 1993-March 2011 for bottom) our coupled model differences look similar enough to CFSRR biases to encourage potential improvements to the CFSv2 brought about by SSS assimilation.

Hackert, E., A.J. Busalacchi, "Impact of Aquarius SSS on coupled dynamics for the tropical Indo-Pacific" http://essic.umd.edu/~ehackert/Fall AGU poster 2014.pdf