

Inter-basin source for two-year predictability of the La Niña event in 2010-2012

Jing-Jia Luo^{1,2} (jingjia_luo@hotmail.com), Oscar Alves², Harry Hendon², and Toshio Yamagata³

¹Nanjing University of Science Information and Technology, Nanjing, China

²Australian Bureau of Meteorology, Melbourne, Australia

³APL, JAMSTEC, Yokohama, Japan

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1. Can La Niña be predicted at multi-year lead without the Pacific WWV precursor?

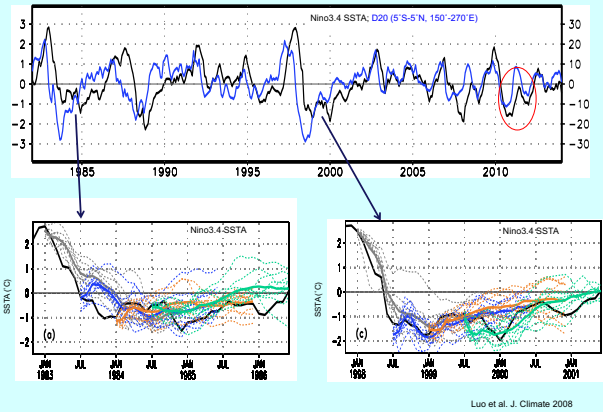
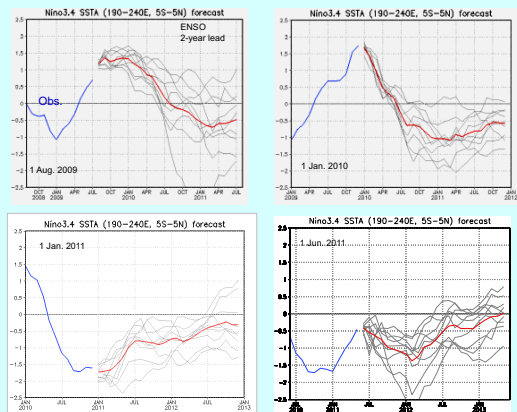


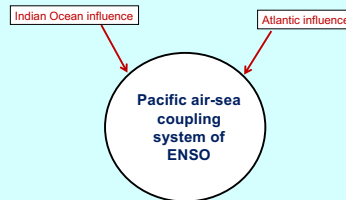
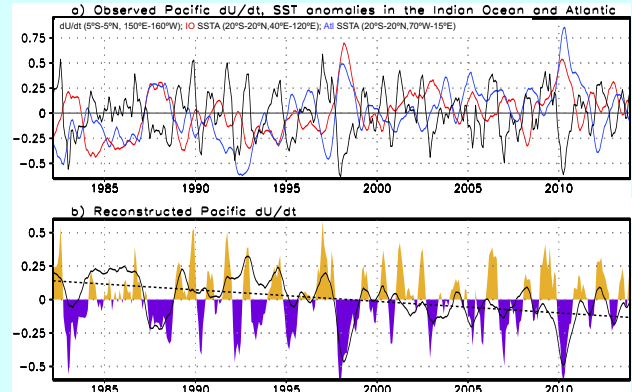
Fig. 1: Successful multi-year prediction of the La Niña events in 1983-86 and 1998-2001, following the two big El Niños, in accordance with the classic discharge concept. The doubled peak La Niña in 2010-12 caused severe floods and enormous socio-economic losses over many lands, which also led to a big drop of global mean sea level height. The lack of Pacific WWV precursor does not suggest that this La Niña may have a high predictability.

2. The 2010-12 La Niña was surprisingly well forecast at lead times up to two years

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



3. Possible contributions of the Indian and Atlantic Ocean



The central Pacific zonal wind tendency shows a high correlation with the SST anomalies in the tropical Indian Ocean and Atlantic. A multiple linear regression model built based on the inter-basin relation can realistically reproduce the Pacific wind growth, particularly in 2010. This indicates the importance of the Indian Ocean and Atlantic to the evolution of ENSO.

Way to check the inter-basin impacts:

- Existing studies: lead-lag relation of SST,...
- Here: dU/dt of the Pacific coupled system = remote forcing + ...

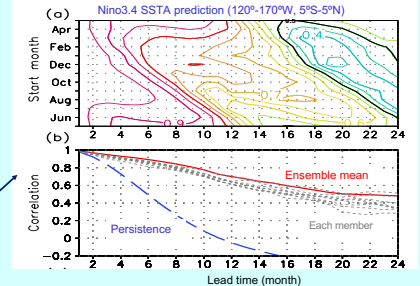
4. Model hindcast sensitivity experiment

Sensitivity prediction experiments using SINTEX-F (9 members, initiated from every month during Jan 2010-Dec 2011)

- IO SSTA impact
 - i) Specify observed SST in the Indian Ocean (20°S-20°N, 40°E-120°E)
 - ii) Specify observed climatological SST in the IO
- IO + Atlantic SSTA impact
 - i) Specify observed SST in both the IO and Atlantic (20°S-20°N, 70°W-15°E)
 - ii) Specify observed climatological SST in both the IO and Atlantic

The SINTEX-F prediction system shows useful skill in predicting ENSO at lead times up to two years

2-year lead ENSO prediction (SINTEX-F, 1982-2004):

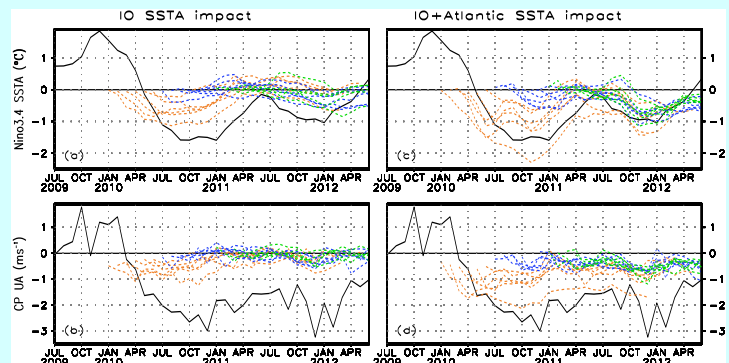


Luo et al., J. Climate, 2008.

A possible reason for the 2-year predictability of the 2010-12 La Niña:

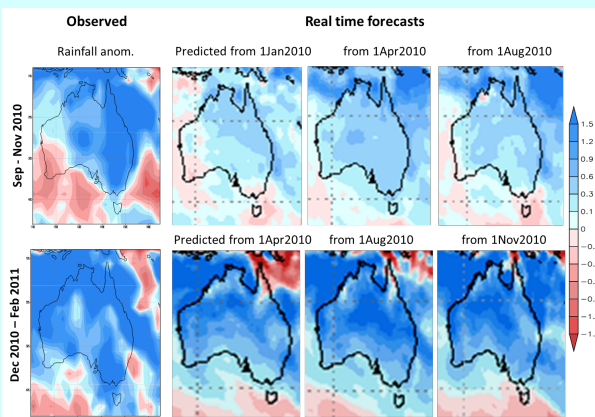
Impacts of warm IO SSTA on the La Niña prediction

Impacts of warm Atlantic-IO SSTA on the La Niña prediction



5. Summary

The prolonged La Niña in 2010-12 is mostly driven by the multi-yearly persistent warm SST anomalies in the tropical Indian Ocean and Atlantic that induced long-lasting easterly anomalies in the central Pacific. The skilful prediction of the warm SST anomalies in the other two basins contributes to the high predictability of the La Niña in 2010-12.



The evolution of the La Niña event in 2010-12 and its related severe floods over entire Australia were well forecast at lead times even up to two years. This surprisingly high predictive skill raises a curious question: what might have caused this prolonged La Niña? What is the underlying source for its high predictability?