The role of sea surface salinity of Indian Ocean in the onset of South Indian Summer Monsoon

Introduction

As ocean density is controlled by both temperature and salinity, evidences suggest that Sea Surface Salinity (SSS) could be an indicator of abrupt changes in ocean dynamic and air-sea interaction (Hénin et al. 1998) (Hénin et al. 1998). Salinity is related to the ocean gravity wave through density (Bulatov and Vladimirov 2013) and affect many aspect of ocean stability (Schiller et al. 1998), ocean dynamic variability (Stammer 1997) and complicate the air-sea interactions (Williams et al. 2010).

SSS dataset

SSS dataset: the Version 3 Aquarius Combined Active-Passive (CAP) product (2010/09-2014/12) officially released by the Aquarius project and the Argo product (2005/01-2014/12) provided by the International Pacific Research Center (IPRC) / Asian-Pacific Data-Research Center (APDRC) respectively.

Results

1 SSSA over the equatorial Indian Ocean change from negative to positive in May.
2 The EPA change from negative (positive) to positive (negative) over the south (north) Indian Ocean in May.
3 The ascend branch of atmospheric vertical circulation moves northward and the across equator currents appears in May.

Conclusion

The high SSS in the equator bring the SSSA+ advection to the north and south Indian Ocean, leading to the different response of atmosphere respectively. In the south Indian Ocean (SIO), the SSSA+ advection deepen the mixed layer depth, which providing a favorable environment for SSTA- to suppress the convection. Less freshwater (EPA) will be over the SIO. On the other hand, although the positive SSS advection deepen the mixed layer depth in the north Indian Ocean (NIO), the SST gets warmer due to the wind and the topography.

Therefore, the distribution of SST promotes the northward ITCZ to bring more freshwater into NIO. Moreover, in May, the ascending branch of the atmospheric vertical circulation extend to north hemisphere and there appears the across equator currents. Above all, the SSS can be a predictor to predict the onset of SASM.

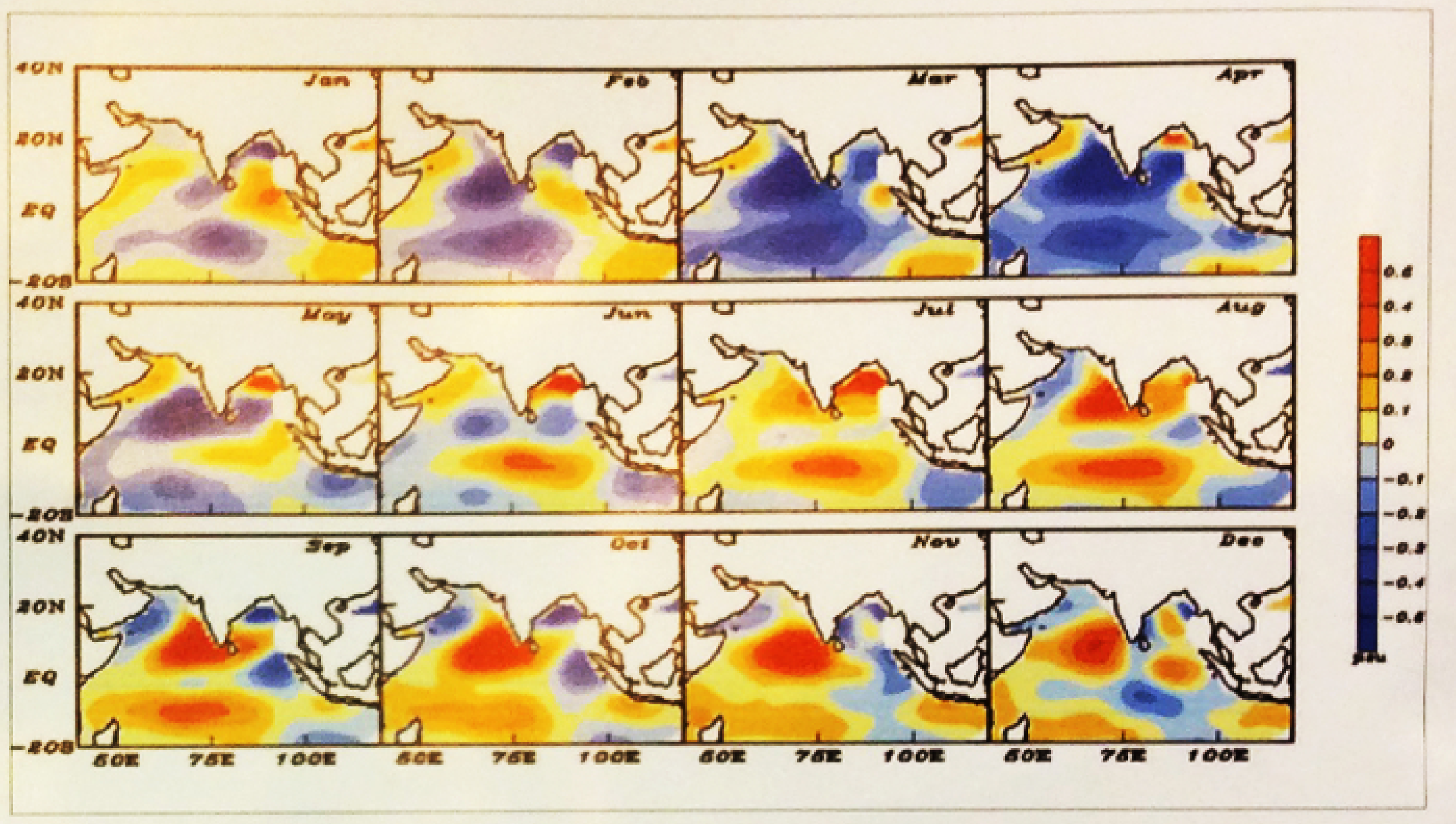

Fig.1. The annual cycle of SSSA in the Indian Ocean obtained by Argo dataset during 2005-2014

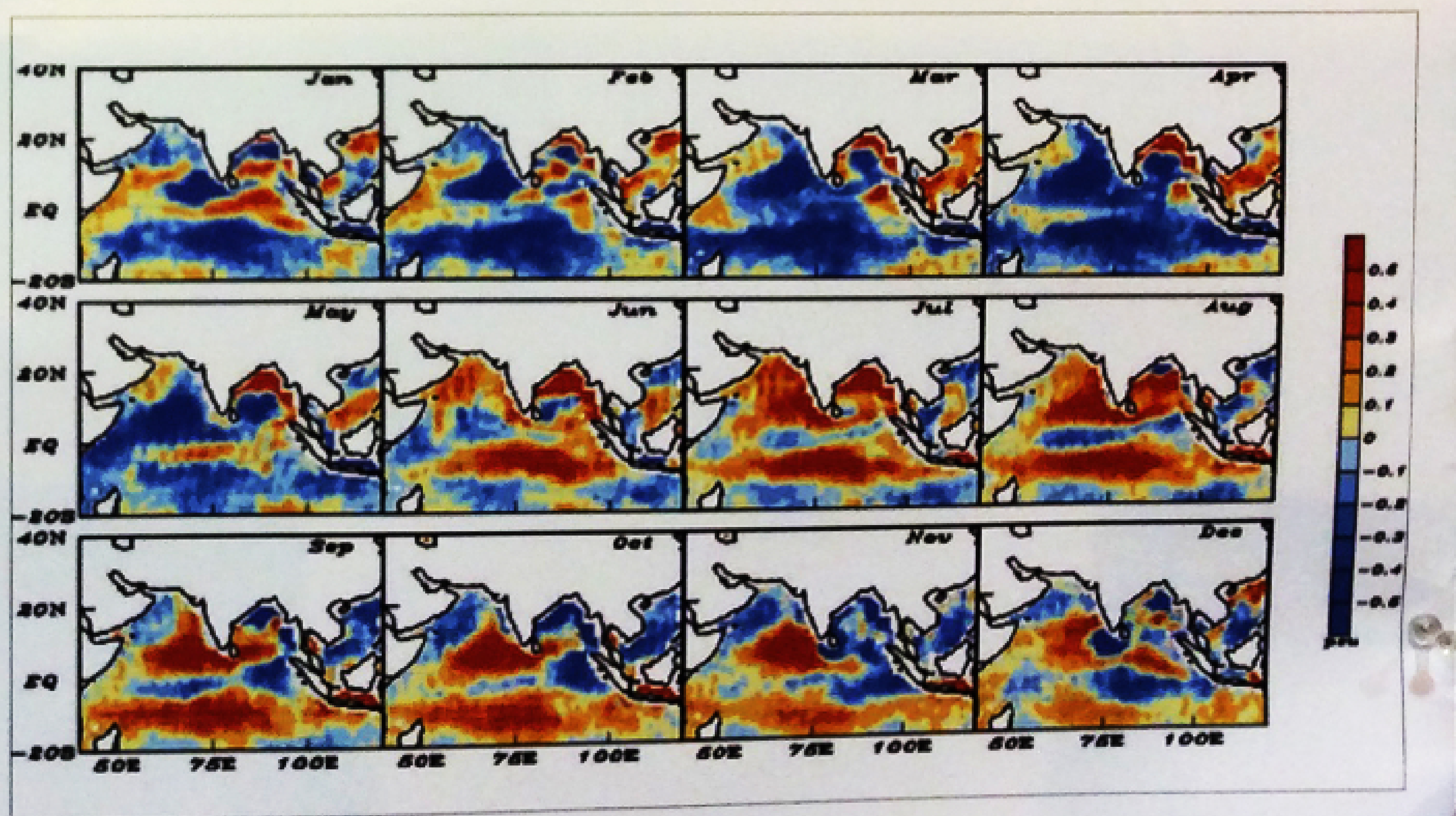

Fig.2. Same as Fig.1 but by Aquarius SSS data from 2012 to 2014.

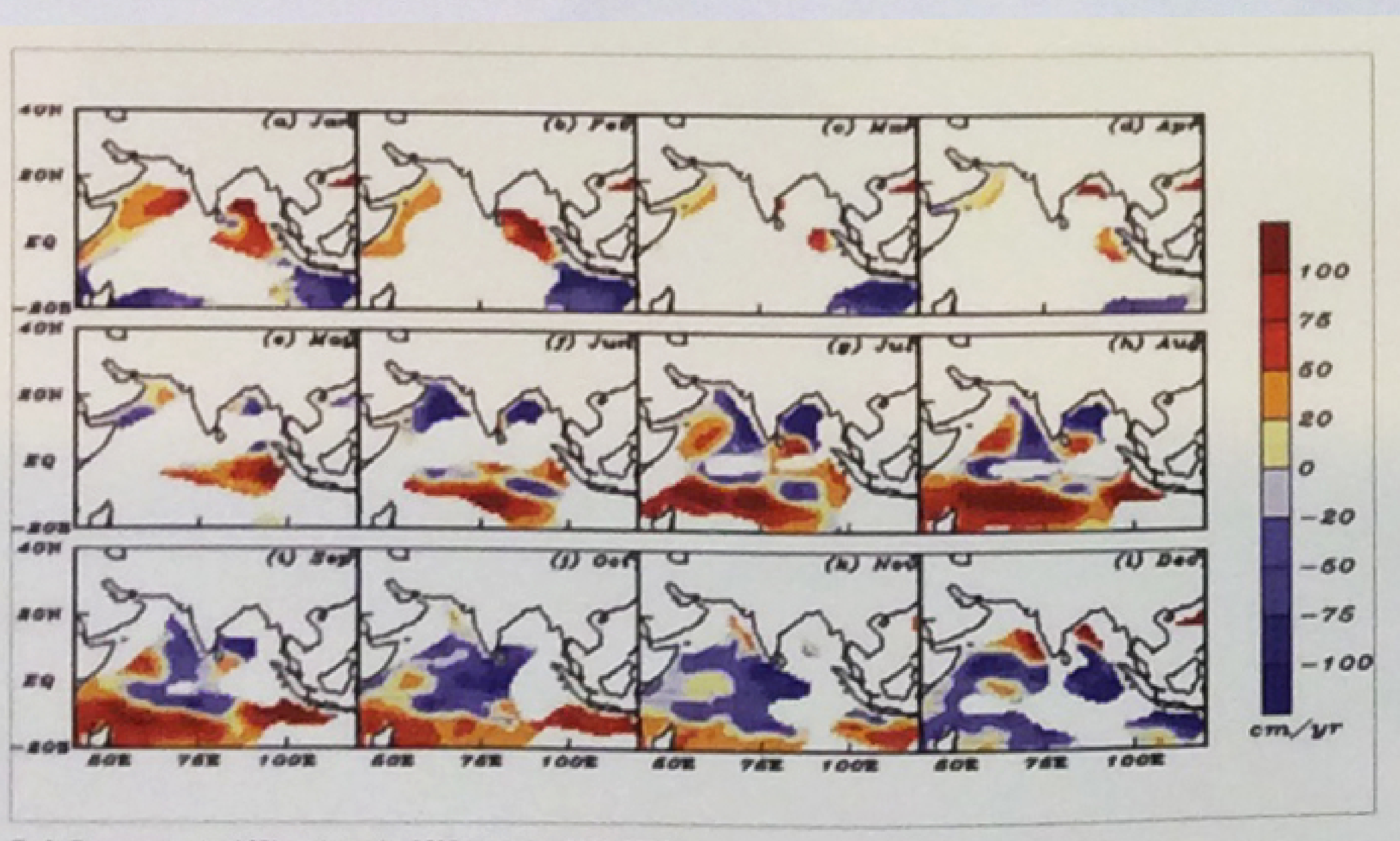

Fig.3. The annual cycle of EPA on the grids of SSSA+ during 2005-2014

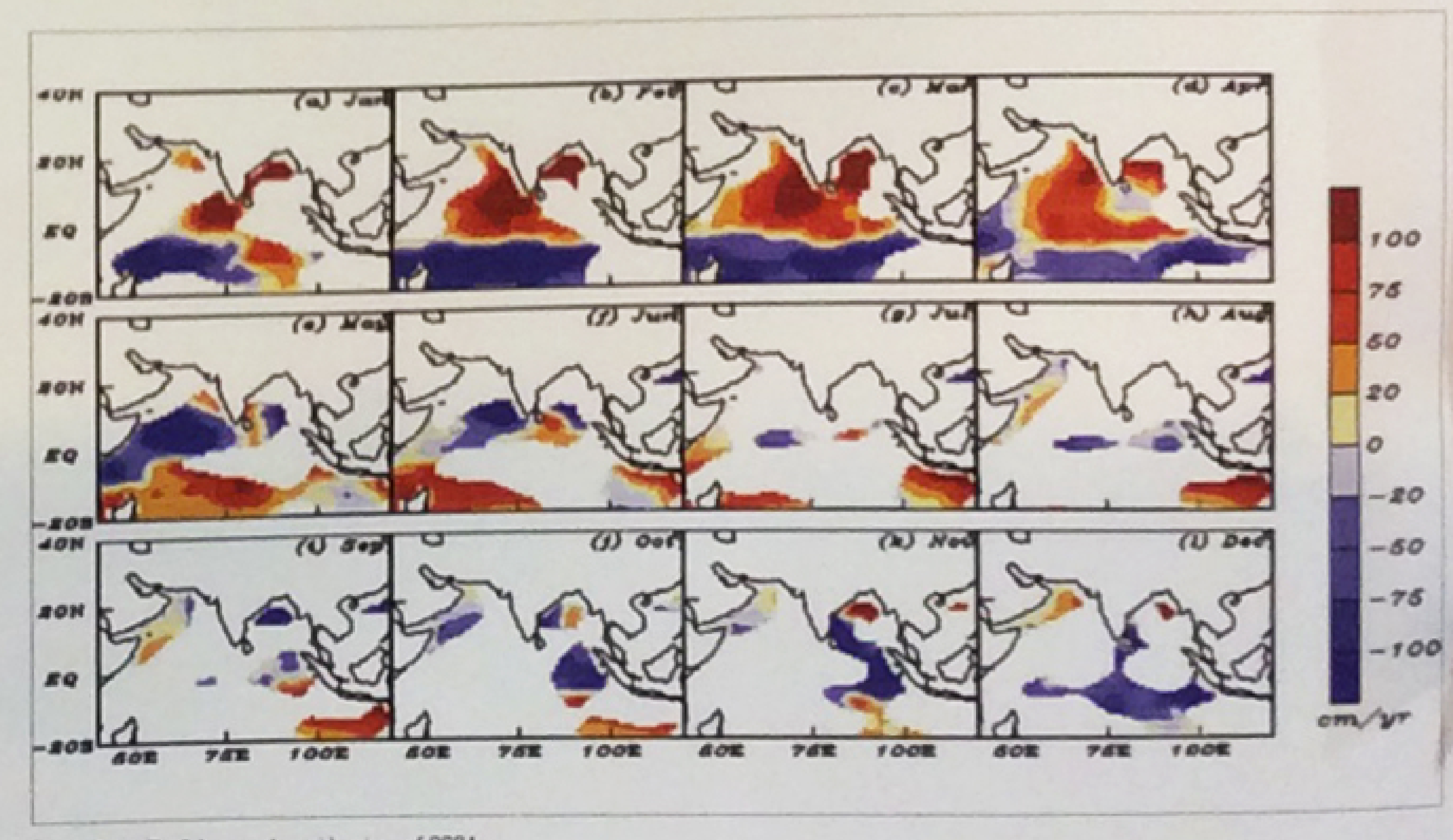

Fig.4. As in Fig 3 but on the grid points of SSSA-.

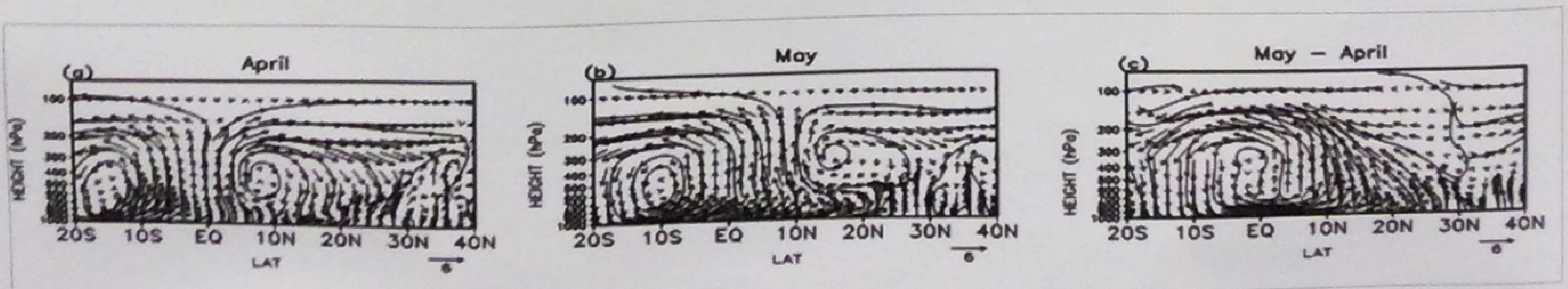

Fig.5. Height-latitude sections along 400E-1200E in April (a) and May (b) respectively. Its difference presents in (c).

References

Bulatov, V.V. & Vladimirov, Y.V. (2013). The dynamics of internal gravity waves in the ocean: theory and applications. [illegible]

Hénin, C., du Penhoat, Y. & Ioualalen, M. (1998). Observations of sea surface salinity in the western Pacific fresh pool: Large-scale changes in 1992-1995. Journal of Geophysical Research, 103, 7523.

Schiller, A., Mikolajewicz, U. & Voss, R. (1998). The stability of the North Atlantic thermohaline circulation in a coupled ocean-atmosphere general circulation model. [illegible]

Stammer, D. (1997). Global characteristics of ocean variability estimated from regional TOPEX/POSEIDON altimeter measurements. Journal of physical oceanography, 27, 1743-1769.

Williams, P.D., [illegible] (2010). The role of ocean surface salinity in climate. Dynamics of Atmospheres and Oceans, [illegible]

For more information

Xu Yuan*, Mhd. Suhyb Salama and Zhongbo Su

x.yuan@utwente.nl Department of Water Resources, Faculty of Geo-information Science and Earth Observation (ITC), University of Twente, P.O. Box 217, 7514AE, Enschede, The Netherlands

UNIVERSITY OF TWENTE.

ITC