OBSERVATIONS and SIMULATIONS of the ROLE of I.'tlc! INDO- PACIFIC THROUGHFLOW on the INDIAN . CLIMATE VARIATIONS in 1993-1994.

C M Perigaud (CALTECH/Jet Propulsion Laboratory, Pasadena, CA91109; 818-354-8203; e-mail: cp@pacific.jpl.nasa.gov)
P Delecluse (LODYC, Universite Pierre et Marie Curie, 75252- Paris V, France; e-mail: pna@hermes.lodyc.jussieu.fr)
G Meyers (CSIRO, Hobart, Tasmania, 7001, Australia: e-mail: Gary.Meyers@ml.csiro.au)

Between early 1993 and late 1994, TOPEX/POSEIDON indicate a sea level rise on the NW coast of Australia and a sea level drop on South Java coast. Integrated over 200m and over a line between these two coastal points, the corresponding geostrophic transport has an annual increase of about 10Sv to the west with a peak in July-August and a strong interannual increase of about 25 Sv between January 1993 and August 1994. These altimetric variations are well correlated to the geostrophic transport computed from XBT data across this line.

Model and data are then used to analyze if these variations are forced by the atmospheric conditions over the Indian Ocean or if they are remotely forced from the Pacific. First, we used Indian Ocean models with the assumption that the boundary is closed with the Pacific ocean. We ran a shallow-water model or a 3D model forced by various winds over 1985-1994 (FSU, Arpege) or over 1992-1994 (ERS1) and various air-sea fluxes (Oberhuber or Arpege). All the simulations reproduce variations over the Indian Ocean which agree to some extent with TOPEX observations. The simulated annual signal of the Throughflow is also fairly well reproduced, but none of the simulations is able to reproduce the 1993-1994 increase of the throughflow as observed. Simulations reproduce the sea level lowering along Java, but not the sea level rise on the Australian coast.

Then, models were run over the Indian and the Pacific oceans between 45S and 45N with the communication between the two oceans allowed or not. Models were forced by the Arpege atmospheric conditions over 1985-1994. Simulations with the shallow-water model agree poorly with observations except in the vicinity of the equator, and the simulated impact of the opening of the boundary is highly dependant on the width of the Indonesian passages. With the 3D model, simulations agree reasonably well over the Indian Ocean between 20S and 20N. Moreover, when the communication with the Pacific is allowed, the sea level is affected by as much as 8 cm in the Arabian sea or in the 10 S-20S band and the model data misfit is reduced. For the transport, between Java and NW Australia, the 3D model simulates fluctuations which agree fairly well with the observed ones although the interannual increase in 1993-1994 is weaker .

These experiments suggest that the variations of the transport between NW Australia and Java are partly remotely forced from the Pacific. TOPEX data indicate that a sea level rise traveled westward in the Southern Pacific along 10S, and propagated along the Papou - New Guinea coast before entering the Indian Ocean along the NW coast of Australia.