Ocean Sci. Discuss., 4, S476–S477, 2008
www.ocean-sci-discuss.net/4/S476/2008/

Ocean Science Discussions

Interactive comment on "On the Indonesian throughflow in the OCCAM 1/4 degree ocean model" *by* U. W. Humphries and D. J. Webb

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Received and published: 23 June 2008

Following the reviewers' comments we have carried out some additional analysis and modified the paper accordingly.

The main change concerns the extra energy around six cycles per year that affects the northern straits when the model is forced by annually repeating winds. In the original manuscript submitted to Ocean Science Discussions, we suggested that it is due to wave motions which are filtered before reaching the less energetic southern straits.

Our additional analysis, prompted by the comments of reviewer #3, shows that the six cycles per year signal is strongest in an area extending from south-east of Mindinao westwards into the Celebes Sea and the mouth of the Makassar Strait. This region includes the Mindinao Eddy (or Retroflection) and the path of the eddies found in the

Celebes Sea.

We also found that the Makassar Strait transport drops when an eddy approachs its northern entrance and that the Molucca Sea transport also drops when the Retroflection Current approaches its northern entrance. As a result of this study we now believe that the extra energy near six cycles a year arises from the movement of the Retroflection Current and the Celebes Sea eddies in this version of the model.

The other main change concerns the throughflow via the South China Sea. In the OSD papear we suggested that the regular response observed with annually repeating winds was due to a local balance between wind stress and bottom friction.

Prompted by the comments of reviewer #4, we looked at the balance of terms near the Karimata Strait in more detail. During the south-east monsoon, sea level is fairly constant through the adjacent region and currents are small. However during the north-east monsoon we find that sea level is raised in the Gulf of Thailand and there a significant sea level drop between the Gulf and Thailand and the Java sea through the Karimata Strait. We also find that within the strait the main balance in the along stream direction is between the pressure gradient, produced by the difference in sea level, and bottom friction.

From this we now conclude that it is not strictly a local balance between the wind stress and bottom friction. Instead it is a regional balance, the north-east trades producing differences in sea level which are then balanced by bottom friction.

Finally, and to emphasise the point that models are not perfect, one 'unfortunate' result of our additional analysis is that we found an error in the model depths that affected the advective sill depth in some of the deeper straits. The error is documented in the revised paper submitted to Ocean Science but we do not believe it has a significant effect of any of the results presented in the paper.

Interactive comment on Ocean Sci. Discuss., 4, 325, 2007.