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8-1-1999

Comments on "On the Utility and Disutility of JEBAR" - Reply

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Recommended Citation

Cane, M. A., Kamenkovich, V. M. (1999). Comments on "On the Utility and Disutility of JEBAR" - Reply. *Journal of Physical Oceanography*, 29(8), 2119-2119.

Available at: http://aquila.usm.edu/fac_pubs/4772

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Reply

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15 January 1999 and 24 February 1999

We do not agree with Mellor's (1999) interpretation of our results. We tried to make two points about JEBAR: (i) it can be a misleading conceptual tool and (ii) calculations with the formulation (1) in Mellor's comment on our note are likely to be error prone.

On the first point, a two-layer wind-driven ocean was offered as the simplest illustrative example that we could think of. While not a comprehensive model for the ocean circulation, it is hardly "strange." Our point was precisely that while the bottom torque term (BT) is nil because bottom topography has no influence on the solution, JEBAR is not small. Indeed, in the simple example we gave of a seamount 0.5 km high and $O(500$ km) wide JEBAR was many times larger than the wind stress term. Thus JEBAR gives a wrong impression of the importance of bottom relief. This example is relevant to the study of Greatbatch et al. (1991) and Krupitsky and Cane (1997), among others.

On the second point, we illustrated how inevitable errors in data make calculation with (1) hazardous. We recognize that the Sverdrup balance is an incomplete description of the ocean circulation, especially, as in Mellor's example, in the vicinity of western boundary currents. We don't say that calculation with (1) is *prima facie* wrong because it disagrees with Sverdrup balance. In our note we wrote: "The Eq. (1) with JEBAR is correct and can be used for the calculation. However,

the results here suggest that doing so amounts to finding the influence of topography on the vertically integrated transport from the difference of two large terms." This is a poor computational strategy since, if the two terms are not used consistently throughout the model calculation, it is likely to lead to imperfect cancellation and spurious transport values. Sampling problems and other data errors make such mismatches inevitable, as our paper illustrates. The earliest recognition of this problem that we are aware of is in Mellor et al (1982).

At the end of our paper we suggest a better computational strategy might be to use the form (2) and minimize BT "consistent with reasonable estimates of data errors." We didn't actually carry through this strategy for a real world example, but referred the reader to Godfrey (1989) and Bogden et al (1993) for closely related approaches.

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