Earth Syst. Dynam. Discuss.,
https://doi.org/10.5194/esd-2017-52-AC1, 2017
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Earth System Dynamics
Discussions

Interactive comment on "Atmospheric Torques and Earth's Rotation: What Drove the Millisecond-Level Length-of-Day Response to the 2015–16 El Niño?" *by* Sébastien B. Lambert et al.

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Received and published: 5 September 2017

The orography is certainly an important parameter for computing the mountain torque, thus taking, or not, the best mountain representation as possible is a key issue.

Nevertheless, the pressure, wind, and zonal friction drag data on which we based our torque and AAM computation were obtained with the original ERA-Interim model orography. Using another orography for computing the torque/AAM would mean taking the risk that, e.g., the pressure data is not consistent with the orography, and therefore propagating biases and errors into the torque, which would eventually result in a non-closed AAM budget. By choosing to take the orography model distributed by

the ECMWF together with their atmospheric data, we guarantee that the AAM and torques we computed are consistent. Furthermore, as noted in lines 30-32 of p. 5 in the manuscript, torques related to sub-grid scale processes are generally considered to be small at these time scales (e.g., de Viron et al., 1999).

How did we check that our torque and AAM were consistent and somehow 'realistic'?

(1) We checked the closure of the AAM budget: the time derivative of the AAM should be equal to the torque. This item was verified to less half a Hadley for the 1997-98 and 2015-16 winters, and about 1.3 Hadley for the 1982-83 winter, using the ERA ECMWF data. Interestingly, this is far from being the case using NCEP/NCAR Reanalysis data for a reason that one should investigate but remains out of the scope of this paper (see Fig. 1 below).

(2) The angular momentum and the time-integrated torque should be in agreement with the observed LOD. This is the case to a reasonable extent that allows us to reach the conclusions of our article. It means that the combination of the ERA data and the 'ERA orography' creates AAM anomalies of the right magnitude and at the right time that explains the observed LOD, as shown by the near-agreement of the blue and black curves in Fig. 4 (top) of the manuscript.

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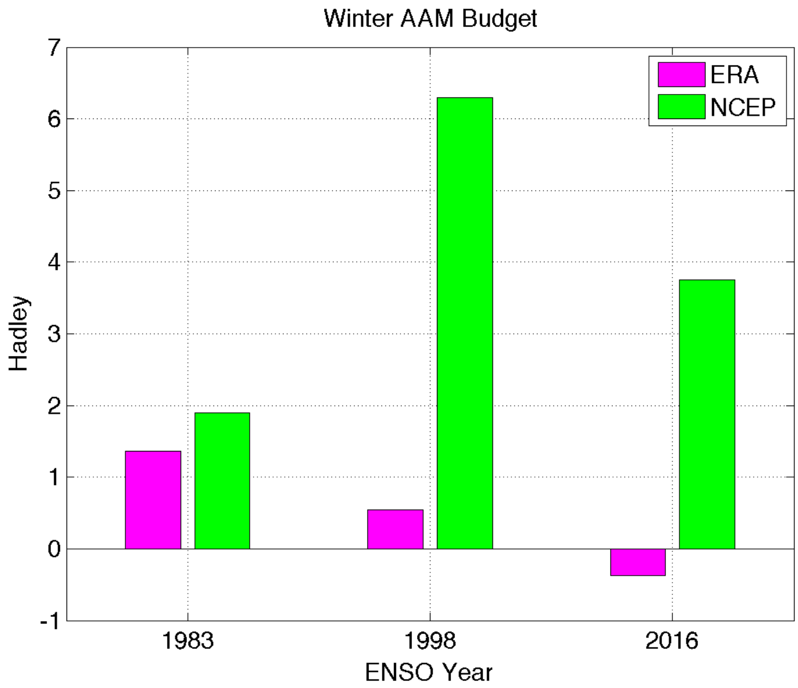

Fig. 1. The difference between dAAM/dt and the mountain+friction torque averaged over the ENSO winter 1982-83, 1997-98, and 2015-16.