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# *Interactive comment on* "High resolution numerical modeling of mesoscale island wakes and sensitivity to static topographic relief data" *by* C. G. Nunalee et al.

**Anonymous Referee #2**

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This manuscript is well-written and the reviewer is delighted to see studies of the sensitivity to orographic height (which is usually not published by modeling groups or left as a detail not considered worthy of publication). That said, the reviewer is concerned about the way in which the orographic datasets are interpolated to the target resolution. As explained below, it seems likely that the differences in GTOPO30 and STRM are due to resolution differences and not the datasets per se.

The orographic height generated from GTOPO30 and SRTM as shown in Figure 3 look like two completely different mountains. In particular, the "GTOPO30 mountain" does not even look like a smoothed version of the "SRTM mountain. While this could be due to plotting cross sections that are not averaged along the other dimension, it could also



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be due to the interpolation method. If that is the case it is not surprising that the two simulations are drastically different.

The authors state that they use the default interpolation method to map elevation data from GTOPO30(approx. 1km)/STRM(approx. 300m) to the model grid (1km). If interpolation and not remapping is used to map from a higher resolution grid to a lower resolution grid, one ends up effectively sampling the value closest to the target grid point in question instead of averaging source grid values over a control volume (as is done in remapping). If indeed linear interpolation is used to map STRM data to the model grid, such sampling is occurring which will inevitably lead to higher elevations than if remapping is used. This does not happen with GTOPO30 since it has approximately the same resolution as the model grid. The reviewer therefore speculates that the GTOPO and STRM differences are due to not using remapping. The authors are kindly asked to use remapping for the STRM mapping. If the authors show cross sections of the raw topographic data they will likely show that STRM has much higher elevations than GTOPO simply because it is higher resolution and therefore resolving the peaks better. In that case the authors should not attribute the differences to the orograhic source dataset per se but the resolution of the topographic data.

In any case, the manuscript demonstrates that orography rougher than GTOPO is needed to accurately simulate flow downstream of the obstacle. This leads to questions about the smoothing procedure. There are several techniques (e.g. envelope orography) that attempt to raise peak heights without introducing spurious noise in the solutions. Maybe such techniques would render the GTOPO-based elevations rough enough for producing more accurate results. How and how much the orography is smoothed might be as important as the raw datasets. As mentioned above, the differences may be more due to differences in the resolution of the raw elevation dataset rather than which dataset is used (for this particular case). The above needs to be discussed in the manuscript. It would be very interesting if the authors would investigate different smoothing algorithms (such as envelope orography) if they are easily



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accessible/doable (from a software perspective).

Many models also include effects of under-resolved orography in the parameterizations. These usually use the standard deviation of the under-resolved orography. Are such parameterizations used here? This should also be mentioned in the manuscript since such parameterizations could also lead to significantly different simulation results.

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Interactive comment on Geosci. Model Dev. Discuss., 8, 2973, 2015.