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Effect of gravity waves from small islands in the Southern Ocean on the Southern Hemisphere atmospheric circulation

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Climate models suffer from large biases in the simulated zonal momentum budget in the Southern Hemisphere. It has been suggested that the gravity wave flux from several small islands in the Southern Ocean is important for the zonal momentum budget in the Southern Hemisphere, and these islands are generally under-represented in climate models.

The effect of these small islands on the atmospheric circulation in the Southern Hemisphere is considered with a series of simulations using the NASA Goddard Earth Observing System Chemistry- Climate Model in which the gravity wave stress generated by these islands is increased to resemble observed values. The enhanced gravity wave drag leads to a 2K warming of the springtime polar stratosphere, partially ameliorating biases in this region. Resolved wave drag declines in the stratospheric region in which the added orographic gravity waves deposit their momentum, such that changes in gravity waves are partially compensated by changes in resolved waves, though resolved wave drag increases further poleward. The orographic drag from these islands has impacts for surface climate, as biases in tropospheric jet position are also partially ameliorated. These results suggest that these small islands are likely contributing to the missing drag near 60S in the upper stratosphere evident in many data assimilation products.

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