Recent studies highlighting the influence of the Southern Hemisphere middle atmosphere processes on climate change have given a new urgency to more realistic modeling of the stratospheric circulation. Climate models employ gravity wave drag parameterizations to model the middle atmospheric circulation and temperature with sufficient realism to study ozone changes. Relative to the north, the Southern Hemisphere lacks sufficient drag due to orographic gravity waves to control the winds to realistic values because of limited areal coverage by mountains. Recent analyses of satellite observations have highlighted the potential importance of orographic waves from small islands in the Southern Ocean. These results suggest that islands that are too small to be adequately resolved in climate simulations may be a significant source of gravity waves and middle atmosphere gravity wave drag, which are missing in climate models. In addition, the high-latitude Andes mountains appear to be the source of gravity waves that have been observed over a much larger range of longitudes and latitudes than predicted by orographic gravity wave drag parameterization schemes. We describe the use high-resolution satellite observations to evaluate the importance of these processes to the Southern Hemisphere middle atmosphere circulation, and also to observe waves from non-orographic sources in the Southern Hemisphere.