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The sensitivity of mesospheric analyses to a parameterization of gravity wave drag due to nonorographic sources

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The drag due to subgrid-scale gravity waves from nonorographic sources such as deep convection is frequently parameterized in climate models with domains that include the stratosphere or mesosphere. The tuning of such schemes can impact the strength and temperature of the polar vortex and thus the amount of wintertime ozone depletion. In this work, we show that mesospheric analyses from the Canadian Middle Atmosphere Model agree better with independent measurements of temperature when a nonorographic gravity wave drag (GWD) scheme is used. While this lends confidence to the GWD scheme used, it also implies that mesospheric observations contain information that can be useful for constraining GWD parameterizations. Assimilating mesospheric temperatures reduces the sensitivity of model states (temperatures and winds) to the presence of the GWD scheme. However, mesospheric constituents remain sensitive to the presence of the GWD scheme, even when mesospheric measurements are assimilated. This then suggests that observations of various mesospheric constituents may contain information about gravity wave sources.