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The effect of mountain-waves on chlorine activation and solid PSC formation in the Arctic stratosphere

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Abstract

Mountain-induced gravity waves are known to cause local reductions in stratospheric temperature of as much as 10-15 K and are often associated with mesoscale PSCs. However, their effect on chlorine activation and ozone depletion has not previously been considered. I will describe observations of mesoscale PSCs where temperatures were 12 K lower than expected synoptically and show that despite their localised nature they can cause almost complete conversion of chlorine species to ozone destroying forms in air flowing through them. Regions of the Arctic are identified where waves can develop and it will be shown that significant and frequent chemical processing of air is likely to occur by this mechanism.

I will also show that mountain waves can act as a significant source of solid PSCs, for which there is as yet no complete explanation. Vortex-filling Arctic vortex trajectories were combined with a global mountain-wave forecast model to calculate the potential for solid polar stratospheric cloud (PSC) formation during December and January 1994/95. The east coast of Greenland, the Scandinavian mountains and the Urals are found to be solid PSC sources, with the PSCs often predicted to survive on the synoptic scale several thousand kilometres downstream.

Abstract