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### **Injection of water into the stratosphere by moderate volcanic eruptions**

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Three soundings of water vapor using cryogenic frostpoint hygrometers launched in June 2011 at Beltsville, MD, USA; Lindenberg, Germany; and Sodankylä, Finland, show layers of strongly enhanced water vapor in the stratosphere. This enhancement was up to 30% above the mean value or 1 ppmv above the largest value previously observed at these stations. Trajectory analysis traces these events back to a volcanic eruption which took place at Grímsvötn volcano Iceland on 21 - 28 May 2011. Observations of the initial eruption plume indicated plume top altitudes exceeding 20 km. The eruption of Grímsvötn may have had ample supply of water especially in the early phase of the eruption, due to caldera geothermal water or meltwater from its ice cap. Thus, this moderate Plinian eruption may have injected significant amounts of water vapor well into the stratosphere and may thus be contributing to the source term of stratospheric water vapor. Simultaneous observations of aerosol backscatter at Lindenberg indicate the absence of particles, implying that volcanic particles were injected to this altitude were too large and fell out over the time of transport, or that their concentration was too low. Volcanic injections of water vapor into the lower and middle stratosphere may go unnoticed by observing systems other than in situ observations and may therefore be underestimated due to lack of available data.