

(40-240329-A) Balloon-based Observations of Stratospheric Water Vapor and Aerosol Transport and Removal Pathways

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Following the Hunga eruption in 2022, volcanic water vapor and aerosol plumes were observed moving poleward in the stratosphere, generally in accordance with large scale circulation patterns. Free-flying balloons from a range of latitudinally distributed sites and space-based sensors were used to track the water vapor and aerosol plumes' progress from the tropics to the poles in both hemispheres. Payloads consisting of a NOAA Global Monitoring Laboratory frost point hygrometer (FPH), a NOAA Chemical Sciences Laboratory portable optical particle spectrometer (POPS), an ECC ozonesonde, and a radiosonde are routinely flown from Boulder, CO; Hilo, Hawaii; Reunion Island, France; and Lauder, New Zealand. Payloads consisting of a cryogenic frost point hygrometer (CFH), an ECC ozonesonde and a radiosonde are routinely flown from San Jose, Costa Rica, and Lijiang, China. Additionally, ECC/FPH/POPS launches also took place from Scott Base, Antarctica in austral spring 2022 and 2023 and from Utqiagvik, AK and in boreal spring 2023. The balloon-based vertical profiles, spanning from the surface to ~ 28 km can also resolve the vertical separation of water vapor and aerosol plumes. The buoyancy of air masses, radiative heating, gravitational settling of particles, and large scale circulation patterns, determine the altitude of volcanic water vapor and aerosol plumes. In addition, in situ measurements also provide information on the removal of stratospheric water vapor through dehydration in the polar vortex and stratospheric aerosol through gravitational settling, following the Hunga eruption. The observed meridional transport and removal pathways may be directly compared to those in global climate models.

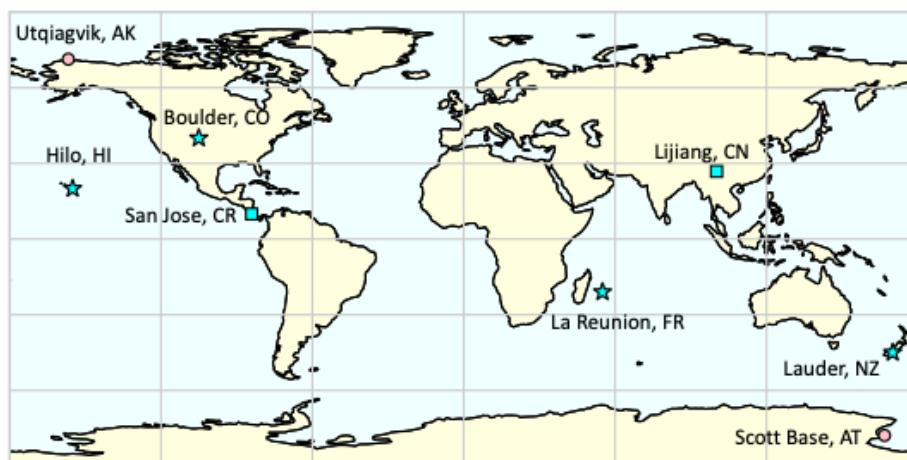


Figure 1. Map of launch sites for water vapor and aerosol sondes. Blue stars show routine ECC/FPH/POPS launch sites, circles denote additional ECC/FPH/POPS launch sites, and blue squares show routine ECC/CFH launch sites.