# Initial Lidar Observations of the Kasatochi Plume at Multiple MPLNET Sites

A53B-0271

Sebastian A. Stewart[1], Ellsworth J. Welton[2], James R. Campbell[3], Elizabeth Reid[3], John E. Barnes[4], Peter Kelly[5], Robert W. Talbot[5], Neng-Huei Lin[6]

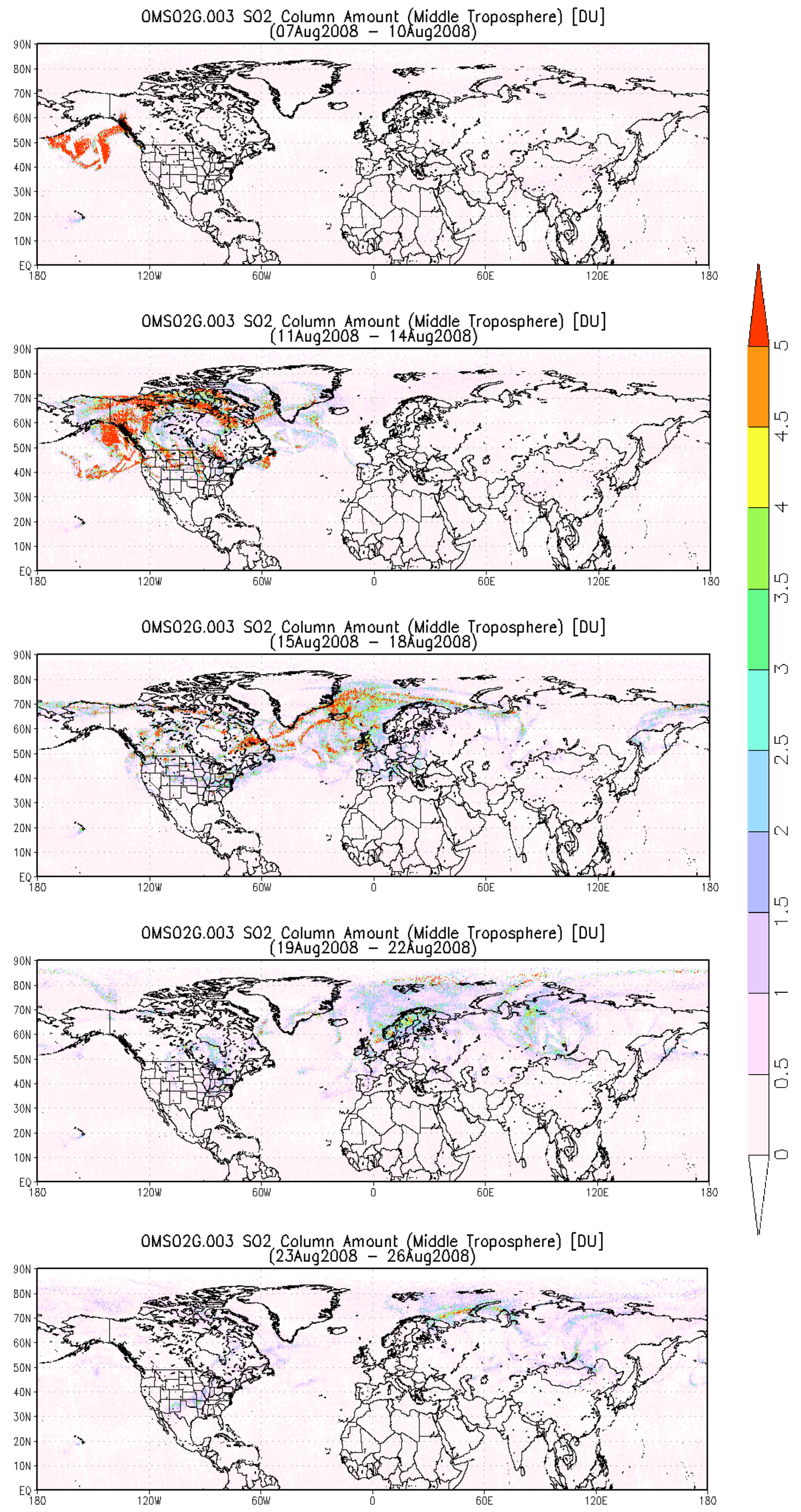
[1]SSAI/NASA GSFC Code 613.1 [2]NASA GSFC Code 613.1 [3]NRL Monterey, CA [4]NOAA ESRL, HI [5]UNH Durham, NH [6]NCU, Taiwan

NASA's Micropulse Lidar Network (MPLNET) is an autonomous network of sixteen lidars worldwide (http://mplnet.gsfc.nasa.gov). The plume from the Kasatochi eruption on 7 August 2008 has been observed by several sites; an overview and summary of the initial observations are presented. The data from MPLNET show the profile of the plume, with extended time scale backscatter plots showing the general movement within the mid latitudes.

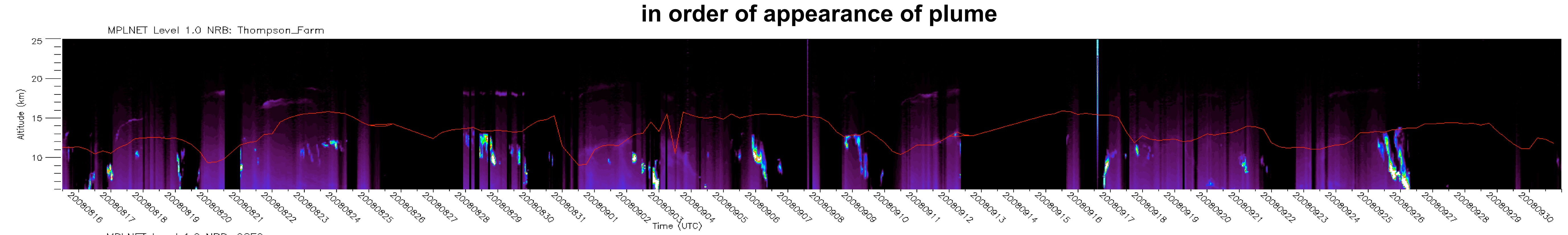
Observations have been made over a 6 week period to map the plume's transit. Injection of volcanic plumes into the upper atmosphere has been shown to have short term effects on the radiative balance and climate of the Earth. The benefits of using ground based lidar in conjunction with space borne lidar to track volcanic plume movements are clear and provide an excellent example of how such observations can be used for future volcanic eruptions.

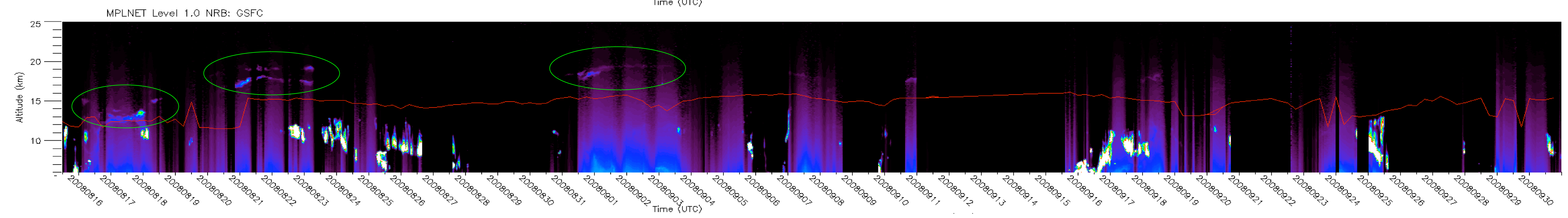
Sulfur dioxide can be used as a tracer for volcanic induced particulates, and is easily observable using NASA's OMI satellite. The transport of the plume from eruption until the first MPLNET observation is shown to the right using OMI data. (http://disc.sci.gsfc.nasa.gov/giovanni )

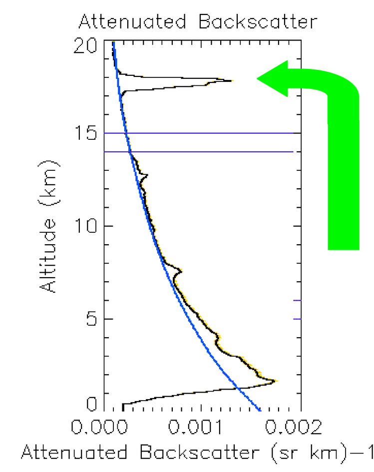
The initial eruption on 07 August 2008 is shown as the higher (red) $SO_2$ concentrations and is carried within the northern latitudes at a slightly lower concentration (violet). Most of the MPLNET sites did not see the plume until two weeks after the eruption. To reduce uncertainties, locations of these northern $SO_2$ concentrations were used as a general source when computing backward trajectories instead of the volcano itself.

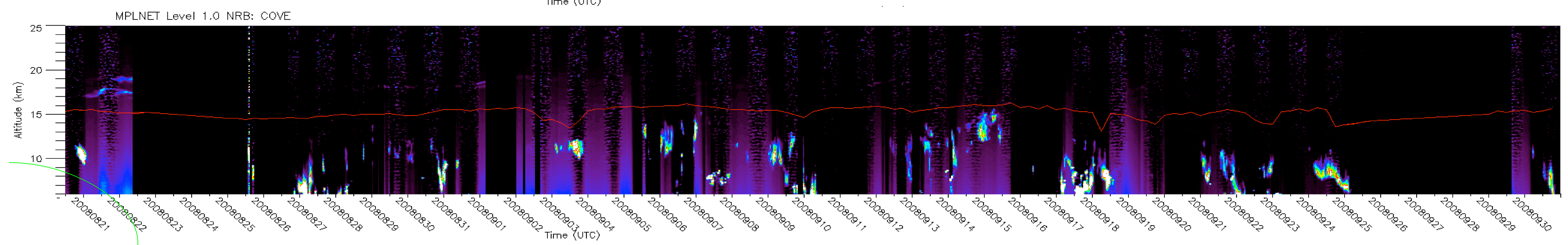


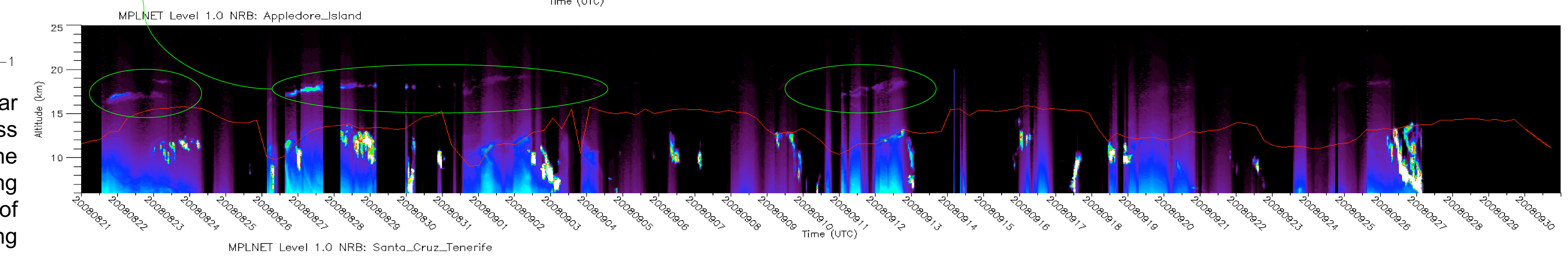

**Individual site normalized relative backscatter plotted versus day of year including tropopause height (red) from NCEP data. Data are in order of appearance of plume**



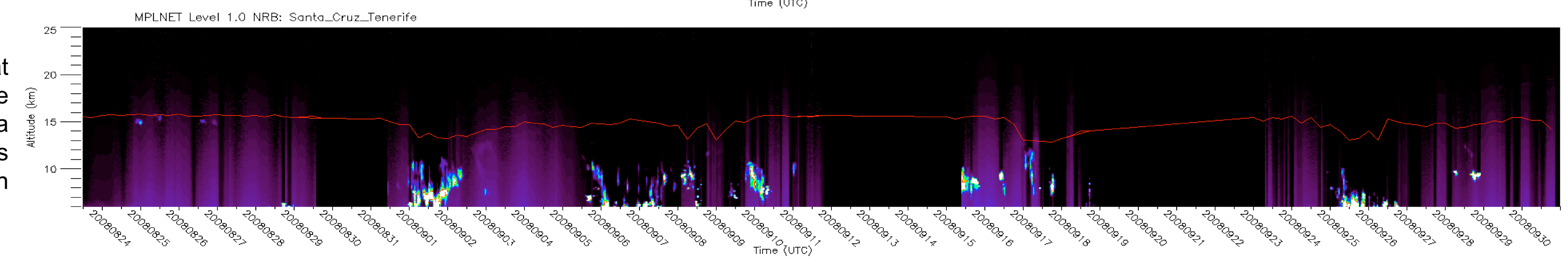



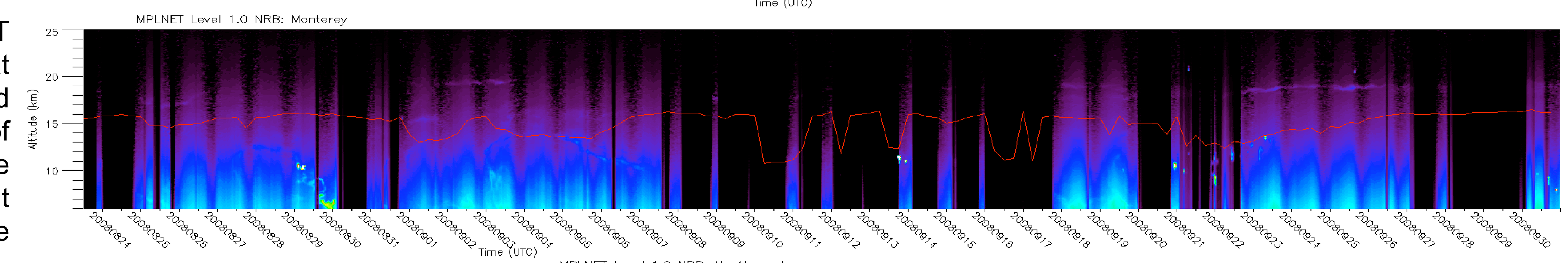



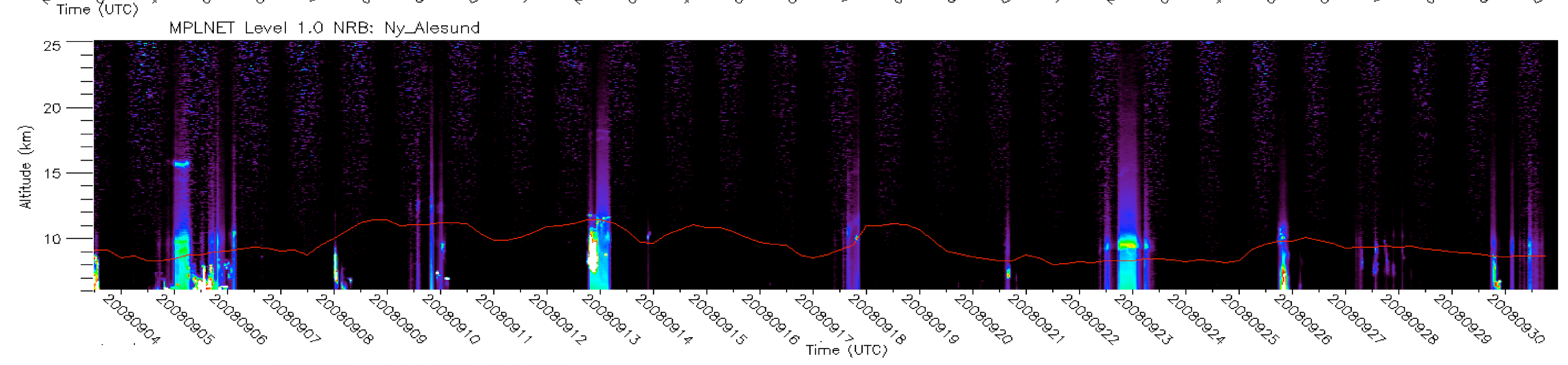



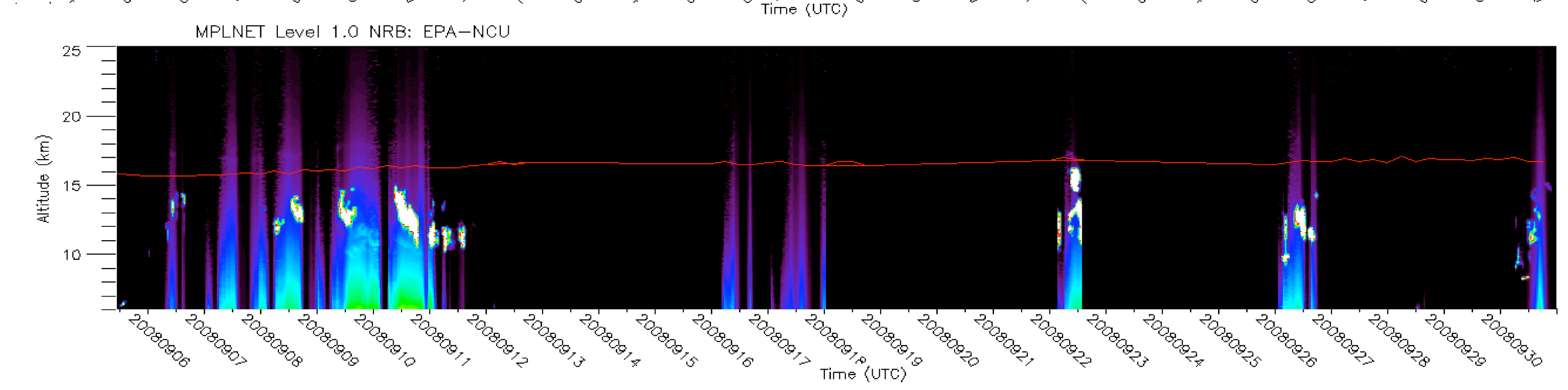

The data from lidar produce vertical cross sections of the atmosphere showing the concentrations of particulates at varying altitudes.

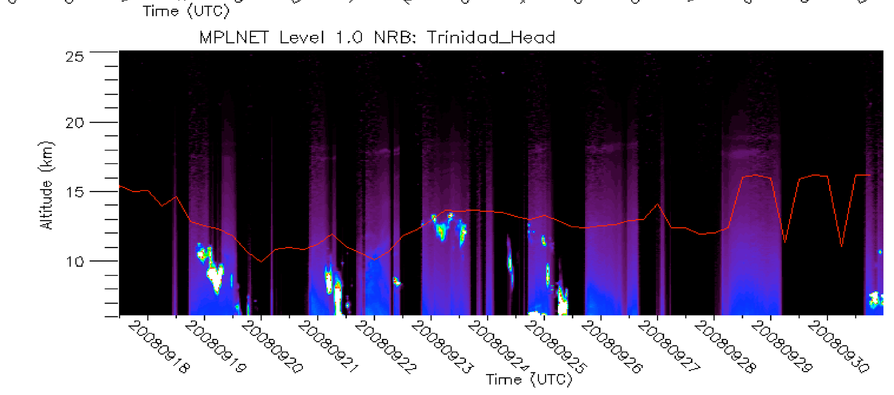
The volcanic plume is identified at high altitudes above the tropopause and generally gives a weak return signal. The two sites identified here are also shown in the backwards trajectory plots.

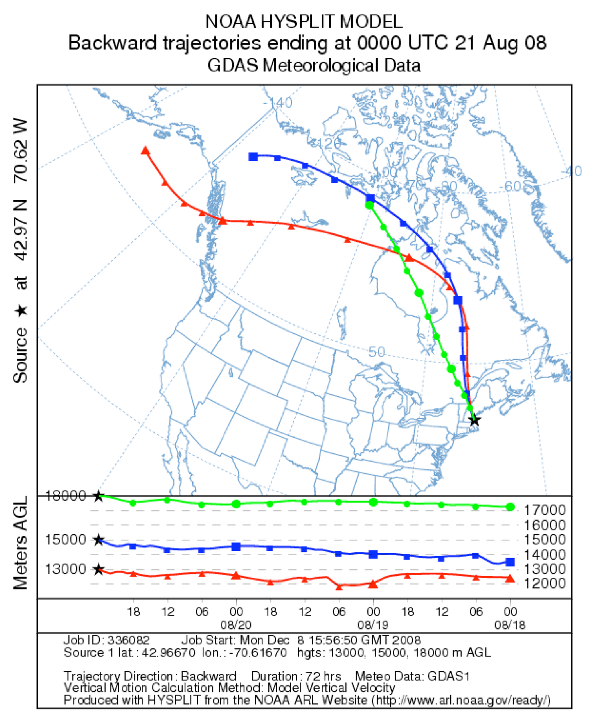


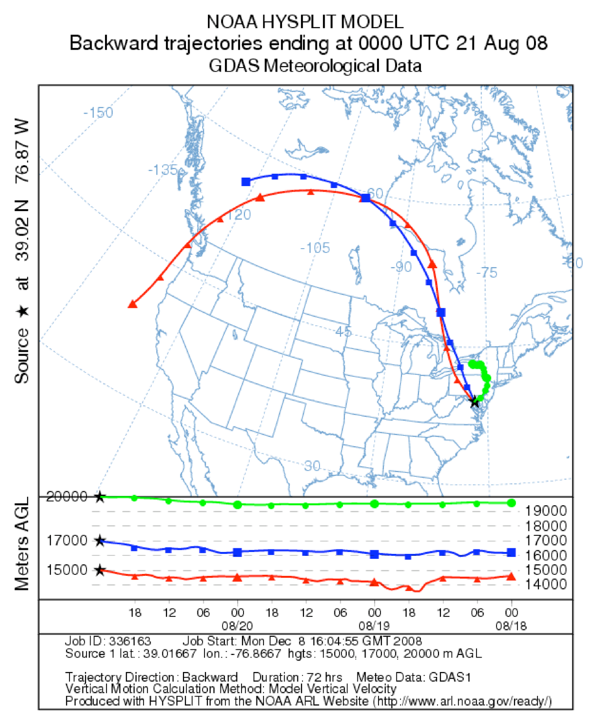



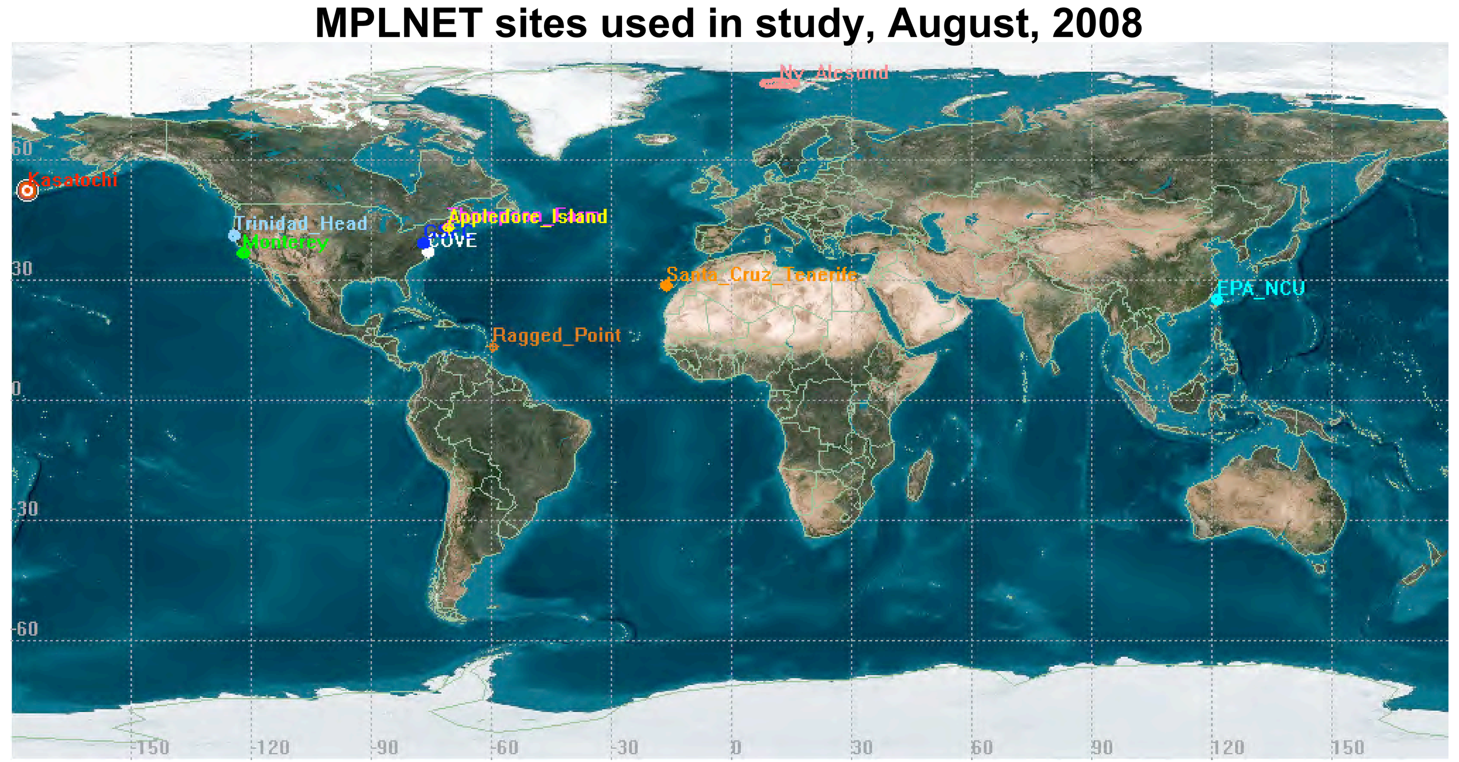




Backward trajectories were computed using the NOAA HYSPLIT tool (http://www.ready.noaa.gov/) for two MPLNET sites that exhibited a strong signal from the plume. UNH Appledore Island (left) detects the plume above the tropopause at an altitude of ~16,000 meters on 08.21.08, and again one week later. At the instance of the first observation, a back trajectory shows movement in the northern latitudes and hints at a possible source in the Aleutian Islands near Kasatochi.

At NASA GSFC (right) the plume was observed slightly earlier; between 08.17.08 and 08.21.08. Similarly, a back trajectory plot at this site enforces the transport above the tropopause within the same area.

**MPLNET sites used in study, August, 2008**




The Kasatochi volcano in the Aleutian islands erupted on August 7, 2008, producing a significant plume of ash and $SO_2$ that has since spread over the Northern Hemisphere. The plume's transport has been observed with numerous satellite, aircraft, and ground based sensors and has been detected in the stratosphere and troposphere, providing an excellent opportunity to examine exchange across the tropopause. Multiple sites in NASA's Micro Pulse Lidar Network (MPLNET) have detected the plume from the Arctic to the tropics. The evolution of the plume is easily observed using the unique observational capability of MPLNET: continuous lidar profiles from the surface to the lower stratosphere.

**Author Contact**

Sebastian.A.Stewart@nasa.gov

**The authors gratefully acknowledge all contributors of the NASA-GSFC MPLNET,which is funded by the NASA Earth Observing System (EOS) and the NASA Radiation Sciences Program**