

WOVOdat classic episode of unrest: The Pinatubo 1991 Plinian eruption

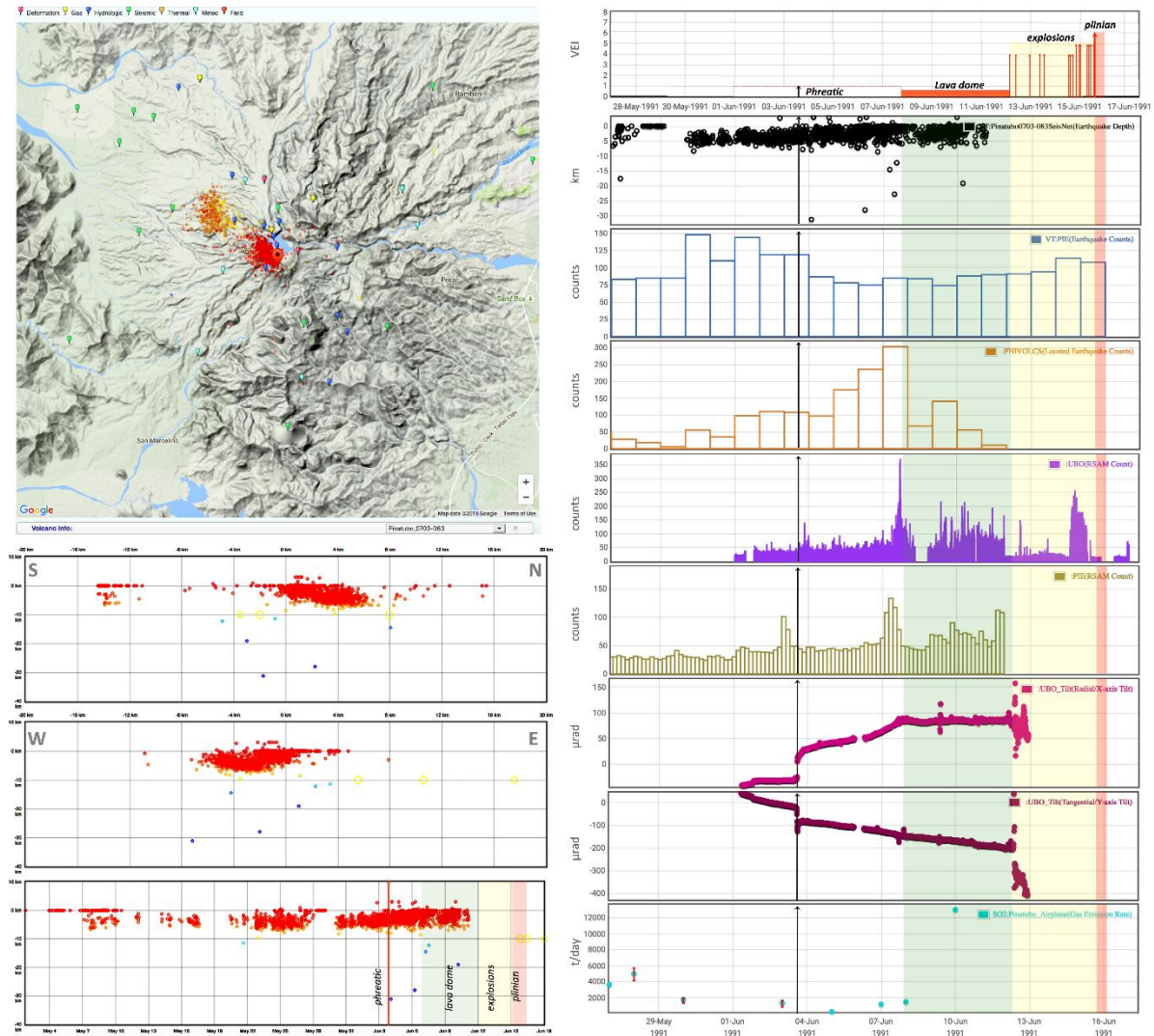
On 15 June huge amounts of gas-charged magma accumulated under the surface of Mt. Pinatubo in the Philippines and finally exploded creating the largest volcanic eruption ever monitored on Earth, the explosion sent an ash column of 35km height directly into the stratosphere covering an area of 125 000km². On land, hot flows of gas, ash and lahar descended violently into the valleys surrounding the volcano.

The unrest started, on early April, the director of the Philippine Institute of Volcanology and Seismology ([PHIVOLCS](#)), Dr. Raymundo Punongbayan set up a team that installed portable seismographs on the area. As the seismic activity increased, Prof. Chris Newhall from the US Geological Survey ([USGS](#)) and a small team, installed seven telemetered seismic sites, two telemetered tiltmeters to measure ground deformation, and used a COSPEC (correlation spectrometry) instrument to measure sulfur dioxide gases. By early June, they realized that the levels of seismicity and SO₂ gas emissions indicated large amounts of magma were moving through the volcano conduits towards the surface and alerted the local authorities about an imminent eruption.

Pinatubo's seismic data (depth, magnitude) from different stations, the gas emission, and the deformation during the unrest and after the eruption is [available here](#) [Fig 1] at the World Organization of Volcano Observatories ([WOVOdat](#)) co-funded by Prof. Chris Newhall, and currently led by Prof. Fidel Costa. The database gathers unrest of volcanoes all over the world and makes the carefully organized data public so it can be used to construct models that help forecast eruptions.

The chronology of the unrest can be summarized as follow:

16 July 1990 : Mw 7.8 earthquake struck ~100km northeast of Pinatubo on the island of Luzon.
2 April 1991 : 1st phreatic explosion
1 – 7 June : series of gas and ash explosions
3 – 4 June : significant gas explosion, followed by harmonic tremor.
7-12 June : lava dome forming
12 June : 1st magmatic explosion (VEI=3), followed by series of explosions.
15 June 1991 : climactic event, Plinian eruption (VEI=6). Ash plume reached 35km; Erupted volume ~ 5 km³
Summit collapsed to form a caldera with ~2.5km diameter.
Early September : ash eruption
July – October : resurgent lava dome extruded in the new caldera



Snapshot images of WOVodat online visualization tools, showing the chronological development of Pinatubo 1991 unrest. Earthquake hypocenters and monitoring station locations are overlaid on Google map terrain (upper left). Earthquake depth can be visualized in a north-south and east-west cross section profile as well as in time series way (lower left). Multi-parameter monitoring data displayed together in interactive time series plots with eruption phases (right). Data compiled by WOVodat (Ng, et al., 2016; Newhall et al., 2017) from PHIVOLCS, USGS, and Newhall and Punongbayan, 1996.

Pinatubo data can be visualized and downloaded using WOVODat interactive online tools:

- Single volcano view: https://wovodat.org/precursor/index_unrest_devel_v6.php?vnum=273083
- Temporal evolution of unrest: [https://wovodat.org/eruption/index.php#1?vnum=273083&dataType=NetworkEvents\(VT\)&dataMinTime=1991-01-02 00:00:00&dataMaxTime=1991-09-02 00:00:00&ed_stime=1991-05-01 19:29:07&ed_etime=1991-08-19 02:53:12&vei=6](https://wovodat.org/eruption/index.php#1?vnum=273083&dataType=NetworkEvents(VT)&dataMinTime=1991-01-02 00:00:00&dataMaxTime=1991-09-02 00:00:00&ed_stime=1991-05-01 19:29:07&ed_etime=1991-08-19 02:53:12&vei=6)
- Earthquake hypocentre query and timeline display: https://wovodat.org/populate/convertie/Volcano_zone/main.php?data_type=hypocenter_search&volcanoes=Pinatubo&radius=0,30&depth=-5,30&time=0000-00-00%2000:00:00,2021-06-15%2011:05:57&magnitude=-1,9&type=R,PF,G,Q,V,VT,VT_D,VT_S,H,H_HLF,H_LHF,LF,LF_LP,LF_T,LF_ILF,VLP,E,U,O,X,RF&name=visitor&email=visitor@gmail.com&observatory=EOS
- Classic episode of unrest: <https://www.wovodat.org/epiunrest/classicepisodes.php>

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