

# A view from (one) Volcano Observatory

Chris Newhall



# Outline of talk

- How volcano observatories (VO's) are organized and funded
- Observatory mandates, priorities, and capabilities.
- What % of volcanoes are well monitored? Success rates of alerts?
- Some needs to address:
  - Improve availability of remote-sensing data at VO's – incl. InSAR, gas, and weather radar
  - Add at least minimal monitoring to unmonitored volcanoes
  - Add VO staff dedicated to aviation issues, funded by formal contracts, cost-recovery
- Propose **aviation volcanology desk** within WMO, to address these 3 and other needs, to follow-up on IAVW recommendations, and to promote VO-VAAC exchanges.

# How observatories are organized and funded

- Most, part of national geoscience agency, w/ national funding
  - Most have operational, hazard warning mandate
  - A few, with hybrid research-ops mandate, e.g., USGS, INGV
- A few university-run VO's mainly for research
  - E.g., IPG Paris
- Note differences in mandates!

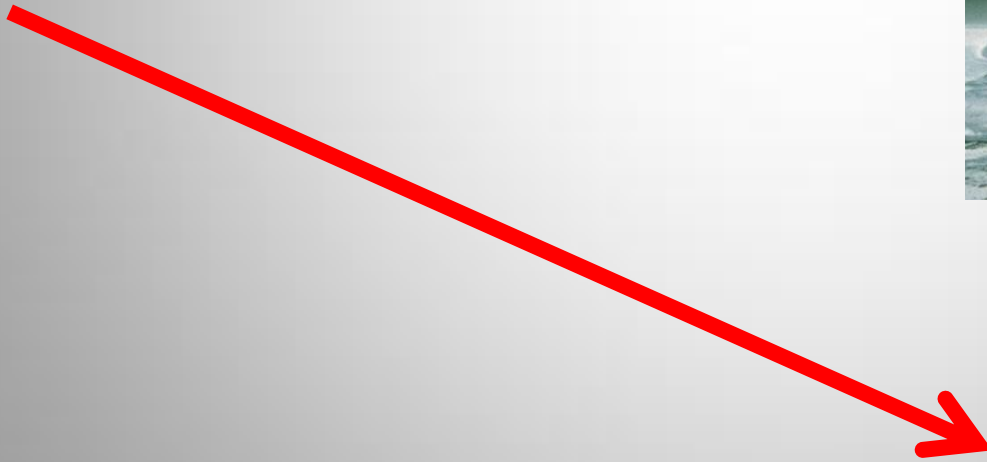
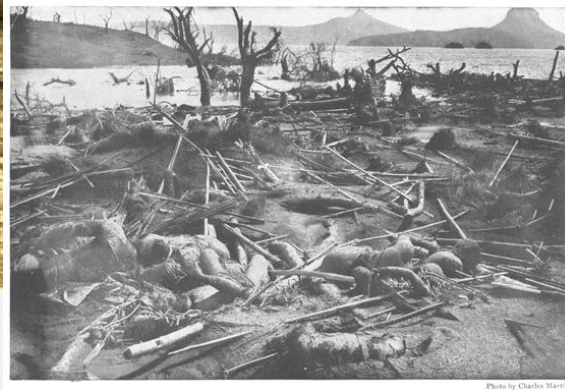
# Any VO's funded and dedicated primarily for ash-aviation issue?

- Yes, AVO, KVERT (joint project of Institute of Volcanology, Petropavlovsk and AVO), and IMO (Icelandic Met Office)
- The VAACs themselves
- Close coordination between JMA Volcanology and JMA VAAC

# Mandates and Priorities for most volcano observatories

- Especially during times of crisis, most VO's are fully occupied keeping people on the ground safe, and responding to queries from local officials and the media
- Those within reach of pyroclastic flows and lahars will be killed within minutes if they aren't notified and evacuated immediately, preferably before eruption starts
- Risk in the air (aviation) is from ash, which is only a "nuisance" hazard on the ground, i.e., not immediately fatal. Yes, of course, ash can be fatal in the air too, but it hasn't been yet.
- Those in the air may also seem remote, abstract compared to those we know are in communities at the foot of a volcano. We don't know them by name
- Most funding comes with local mandate; very few \$\$ have aviation mandate

# Local vs. aviation impacts, from the VO perspective

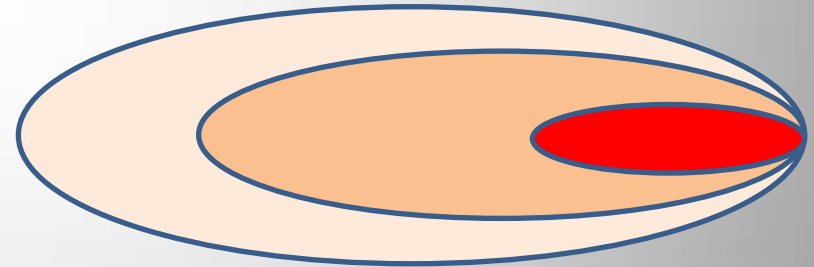
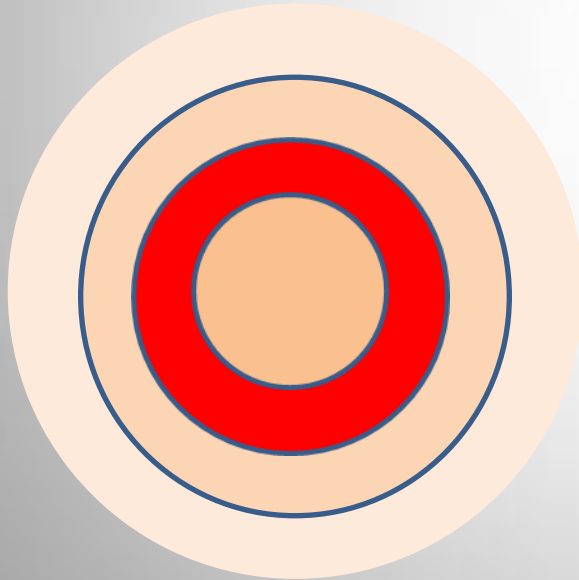


# Schematic comparison of risk concerns, local vs. aviation-oriented VO

Local view

Aviation view

Cross-sectional view



Map view

# Capabilities of VO's

- Range: Zero to Excellent
- End members:
  - An observatory with full time, highly trained staff of 100, ~100 sensors, perfect internet and other telecom access, and at least one person dedicated to ash-aviation issue. Vs.
  - An observatory with one high-school graduate, operating one seismograph and having intermittent cell phone or SSB communications.

# How successful are VO's in their alerts?

- Winson et al. (2012, 2013) reported that ~20% of eruptions at frequently-active, open-vent volcanoes were successfully forecast, and ~30% of eruptions at infrequently-active, plugged volcanoes.
- Preceding data are from all observatories that use alert levels
- Success rates from the best observatories are much higher but even there, not perfect.

# Many volcanoes are still unmonitored

- ~ 25 monitored at high research level
  - ~ 100 with multiparameter monitoring, modest research too
  - ~ 350 monitored with at least 1 seismograph
  - ~ 550 with historical eruptions (past 100-2000 y)
  - ~ 1500 with inferred Holocene activity
  - ~ 2000+ that MIGHT still erupt
- 
- Few observatories have more than 20 y of monitoring history; some observatories opened only when unrest began (e.g., Agung, Pinatubo, Sinabung).

## Need to monitor the unmonitored volcanoes

- The biggest risks may be from the least monitored volcanoes.
- Cost of putting in basic multiparameter monitoring ~USD 100,000
- Cost of putting in one seismic event counter, with telemetry by SMS or Iridium <USD 1000?
- Maintenance costs? -- Mainly for access to remote areas, plus data transmission costs

# Need ground- and space-based remote sensing data to VO's?

- Key info from met services (e.g., radar) is sometimes in another office, ministry, and thus not integrated with volcano information that goes to the VAAC's
- Key info from other remote sensing is rarely pushed to VO's. Some can be pulled, but some is still restricted in research programs or available but not processed in real-time.
- How best to integrate ground- and space-based remote-sensing data into VO operations and advisories?

# Need aviation volcanologists

- General shortfall in funding and staffing at VO's.
- Rare to have staff members dedicated exclusively to aviation concerns. We have aviation meteorologists. Why not add aviation volcanologists?
- How to fund them? Very few VO's (NZ, Iceland, Japan?, Russia?) invoke cost-recovery. Only a few more are explicitly tasked to take care of aviation.

# Need FUNDED aviation mandates!

- VO's are generally willing to provide info ... but are generally underfunded and understaffed, and won't be give full attention to aviation unless formally funded to do so.
- ICAO mandate without funding is virtually useless; few observatories have even heard of it through their own ministerial levels!
- Need contractual or other FUNDED mandates to take care of aviation concerns

# World Organization of Volcano Observatories (WOVO)

- WOVO → IAVCEI → IUGG → ICSU
- Dedicated volunteers, but... limited in what it can do without paid, full-time staff.
- Potential role: VO advocacy in WMO or direct to cabinet/ministry levels, incl. for aviation.
- Would a WOVO “aviation volcanology” desk in WMO be helpful? I think so!

# It's not all about money!

- Importance of knowing each other – personally, and knowing the needs and constraints of each office.
- Best way to achieve this is through extended exchange visits. VO staff to relevant VAAC and vice versa. Directors first, maybe, but then follow it up with the staff who will actually do the work.
- Friendship, respect, and trust are important!

# Take-home points

- Most volcano observatories understand the concern about ash in the air and would be willing to provide better info. But their formal mandates are mostly focused on the ground, and data about what's in the air is rarely available at the VO's and integrated with data from normal VO monitoring instruments.
- One way aviation can get better information from volcano observatories is to offer contracts or otherwise help observatories to hire staff dedicated to aviation issues
- Another way is for those VO staff to spend extended time in VAACs, and similarly, for selected VAAC staff to visit VO's for weeks at a time, so that calls to the VAAC are between colleagues who know each other, and are even friends!
- Another measure – the time is right? Establish an Aviation Volcanology desk within WMO, to advocate for additional VO resources dedicated to aviation issues, to help VO's get cost-recovery, and to organize VO-VAAC exchanges.