

Disclaimer

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Advances on the Volcanic Parameter System with infrasound data

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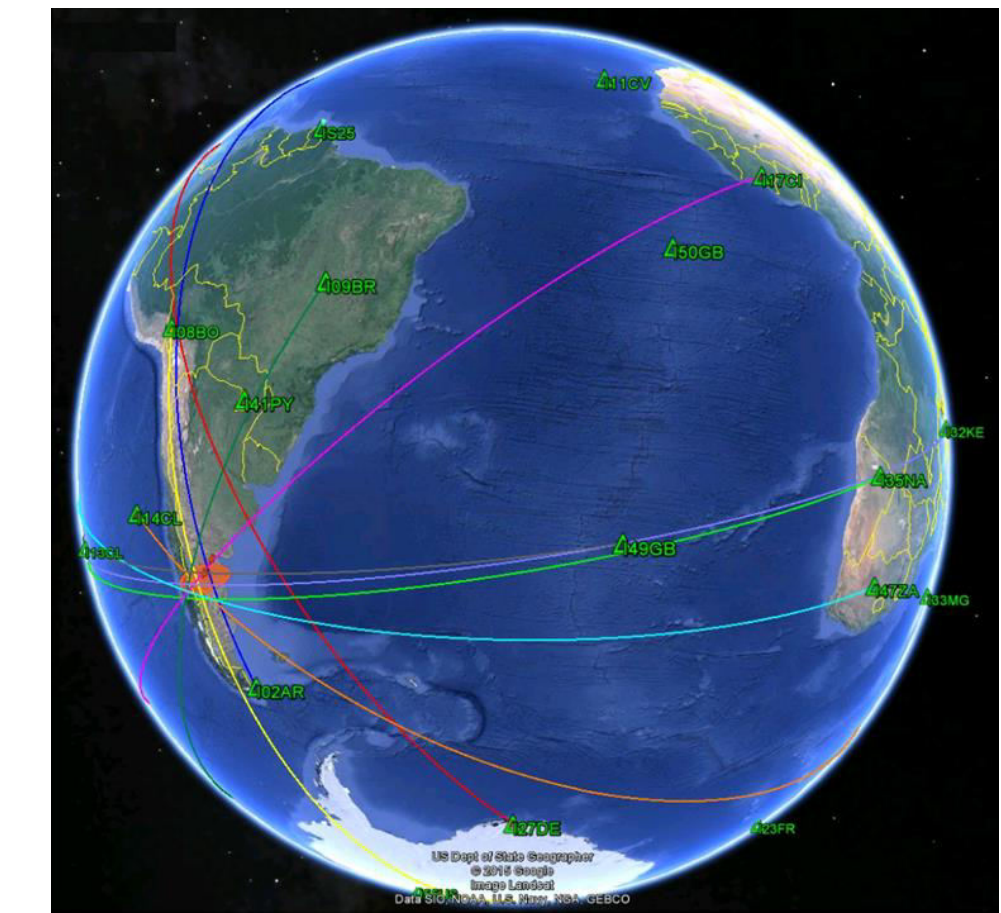
3 VAAC Toulouse -Meteo France ; 4 Atmospheric dynamics Research Infrastructure in Europe (ARISE)



Case study: Eruption of Calbuco, Chile, 22-23 April 2015



Source: Marcelo Utreras ©DR

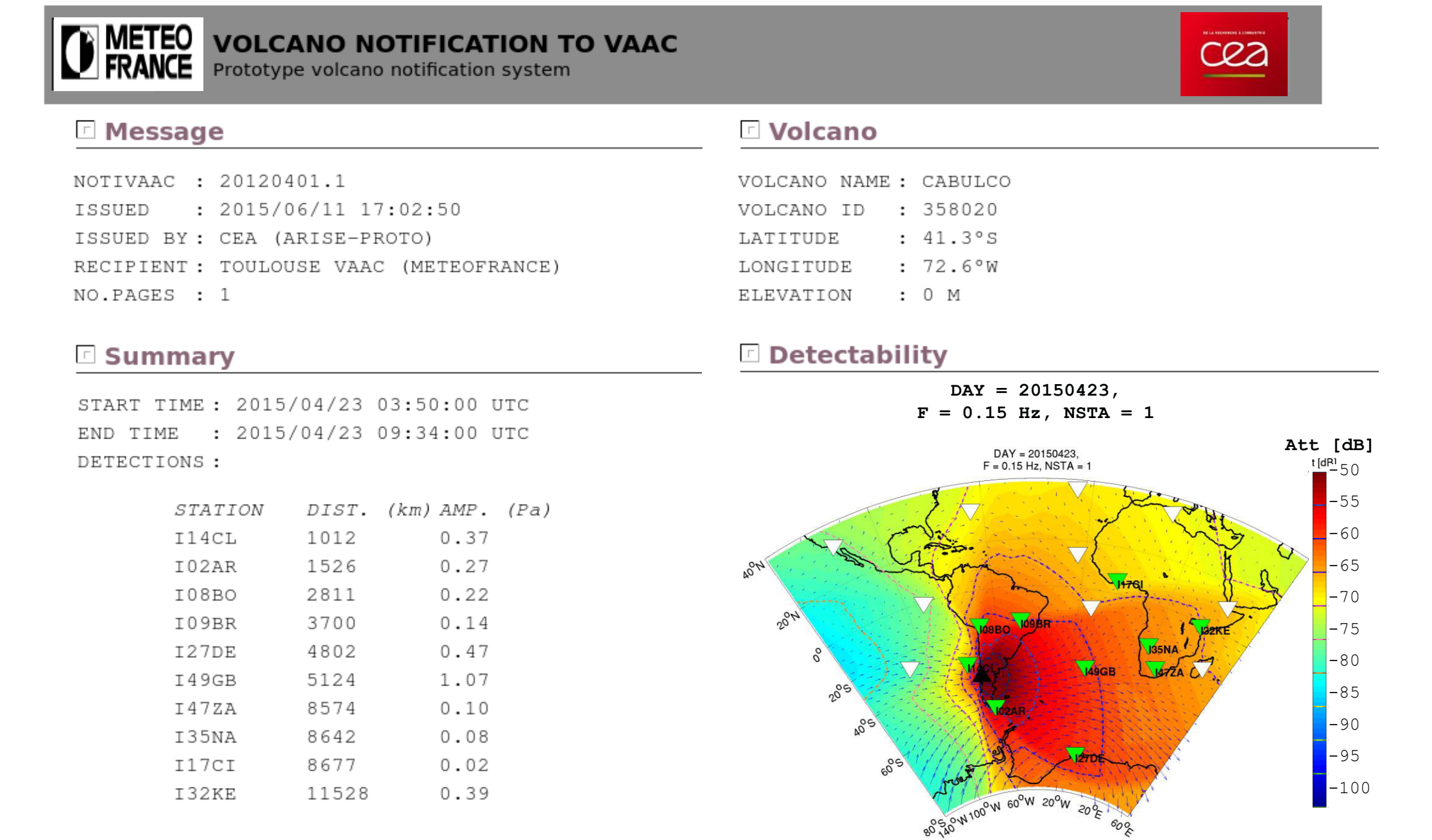
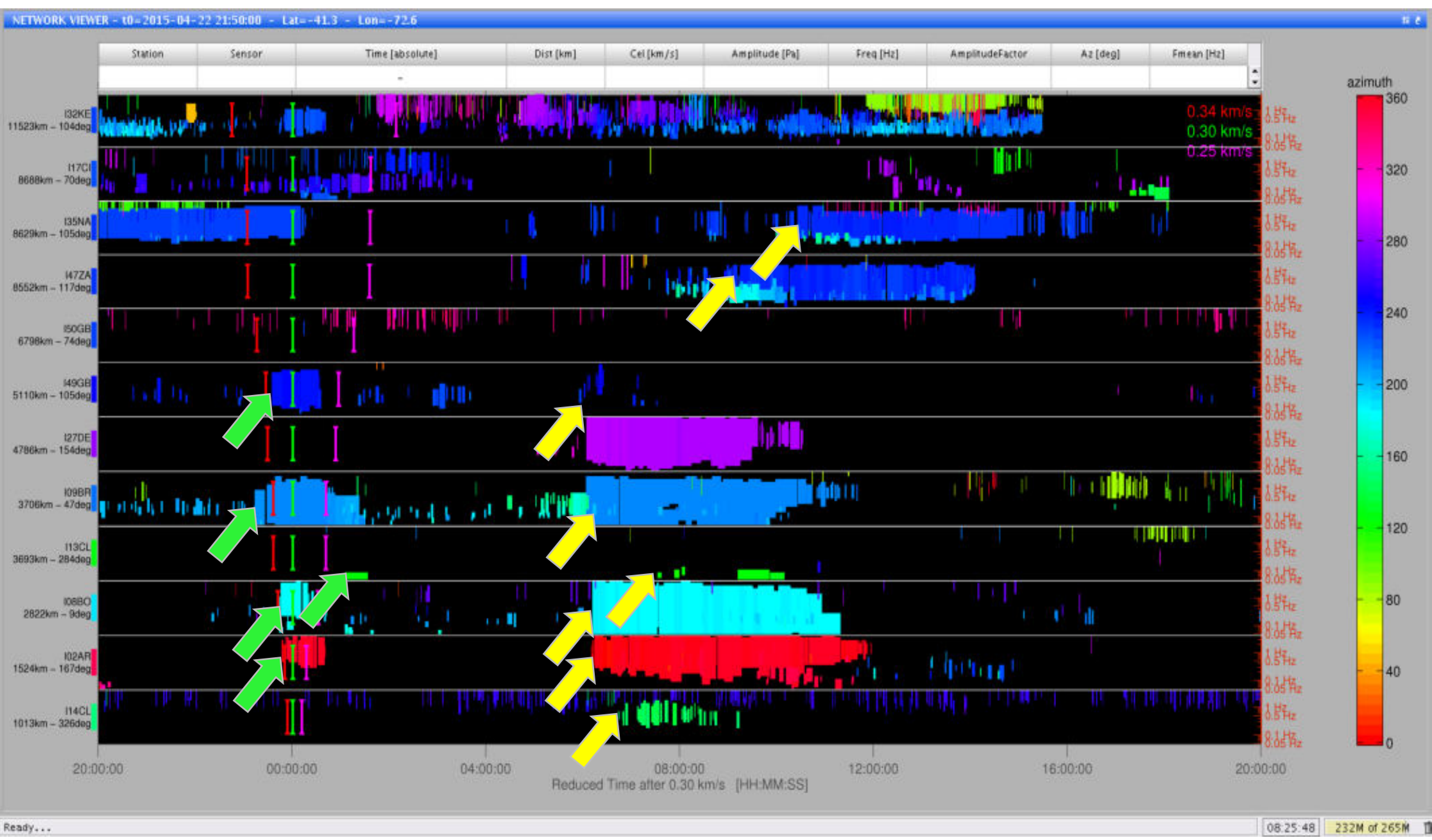


Stations	Distance (km)	Theor. Az (°)	Arriving Time (TU)
IS02 Argentina	1525	343	22:50:59
IS08 Bolivia	2810	187	00:09:19
IS13 Eastern Island Chili	3695	125	02:19:00
IS09 Brazil	3700	215	00:36:09
IS49 Tristan de Cunha United Kingdom	5120	245	02:10:30
IS50 Ascension United Kingdom	6795	230	04:18:00
IS35 Namibia	8640	230	04:51:30
IS17 Ivory Coast	8675	225	06:13:00
IS32 Kenya	11525	227	08:20:10

Table 1: Event associated with the first eruption on 22 April 2015 at 21:50 UT

Stations	Distance (km)	Theor. Az (°)	Arriving Time (TU)
IS14 Robinson Crusoe Chili	1010	149	06:39:14
IS02 Argentina	1525	343	06:32:19
IS08 Bolivia	2810	187	06:43:55
IS09 Brazil	3700	215	07:23:05
IS27 Neumayer Antarctic	4800	277	08:22:55
IS13 Eastern Island Chili	3695	125	10:28:24
IS49 Tristan de Cunha United Kingdom	5120	245	08:39:19
IS47 South Africa	8570	230	11:52:04
IS35 Namibia	8640	230	12:01:04
IS17 Ivory Coast	8675	225	12:26:00
IS32 Kenya	11525	227	15:10:00

Table 2: Event associated with the second eruption 23 April 2015 at 04:22 UT



Evaluation with VAAC Toulouse

The evaluation datasets are:

- Volcano – Etna ; Period – 1-15 December 2015
- Volcano – Meru ; Period – 20-21 September 2015

VPS format defined with VAAC Toulouse and ARISE partner

- ✓ Comparison with real-time regional bulletins
- ✓ Evaluation on historical dataset (VAAC vs. IMS)
- ✓ Report to the relevant working group of ICAO/WMO MET panel
- ✓ Once VPS functional with Toulouse VAAC, pilot project will be extended to other VAACs

Powerful volcanic eruptions, such as those of Calbuco in 2015, or Eyjafjallajökull in 2010, may cause disturbances in the different atmospheric layers. These eruptions are measured by infrasound stations and analyzed in order to extract parametric data best characterize the volcanic source.

The remote monitoring of volcanic activity with infrasound is of interest to Volcanic Ash Advisory Centres (VAACs) that are responsible for monitoring, modelling and disseminating information on volcanic ash clouds that may endanger aviation. The synergy between the CTBTO and ARISE (Atmospheric dynamics Research Infrastructure in Europe) partners offers a unique opportunity for the establishment of a Volcanic Parameter System (VPS) using infrasound data from a global station network.

The VPS makes best use of the infrasound component of the IMS together with the operational capabilities of the IDC. ARISE advanced products provides valuable parametric inputs on the atmosphere dynamics driving infrasound wave propagation. These results may serve as quality indicators increasing VAACs confidence when receiving notification messages. The proposed approach is tested on CTBTO vDEC (virtual Data Exploitation Centre) with VAAC Toulouse, designated by the International Civil Aviation Organization (ICAO), and demonstrates on a specific dataset the usefulness of infrasonic data to International Airways Volcano Watch.

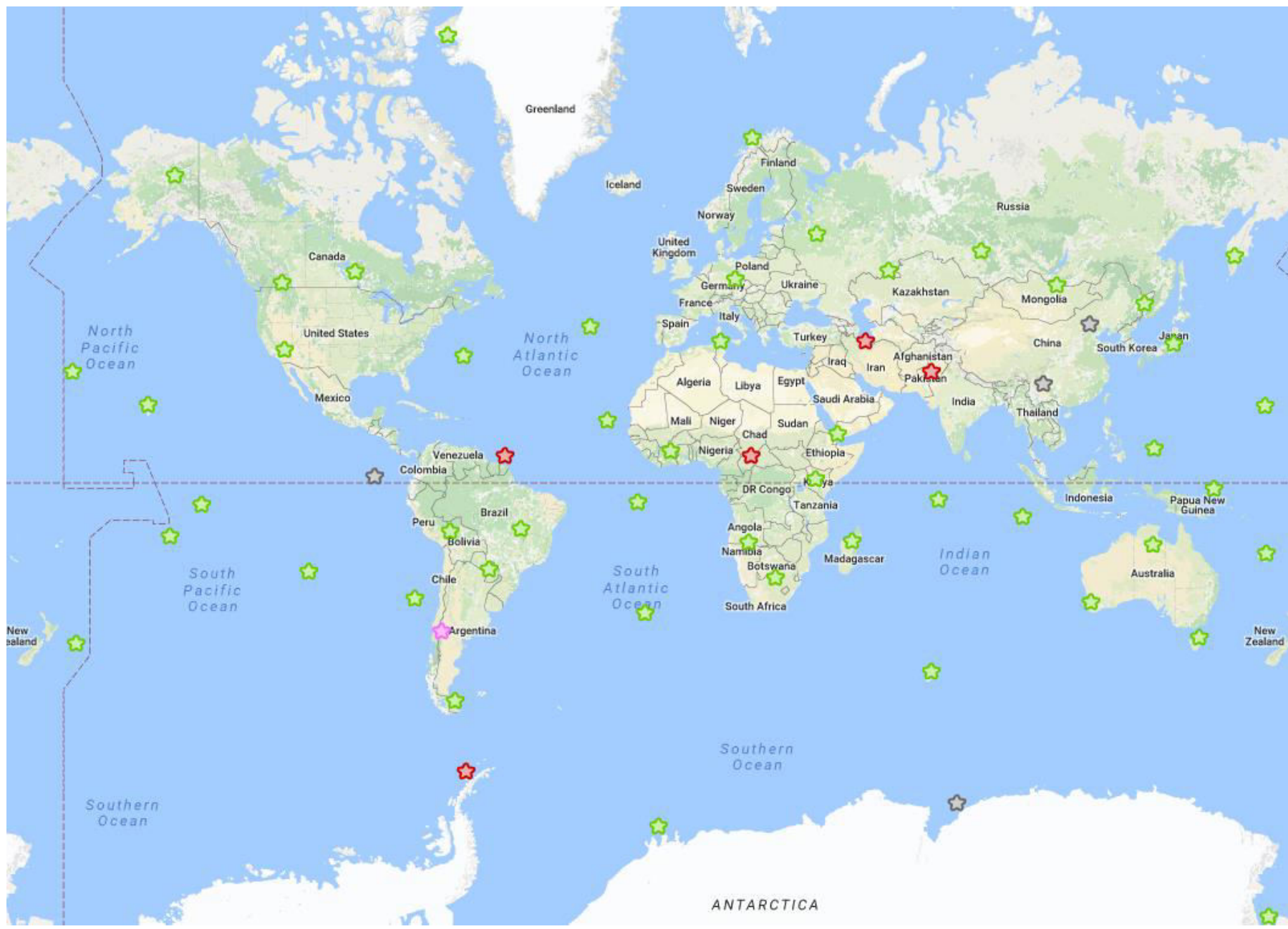
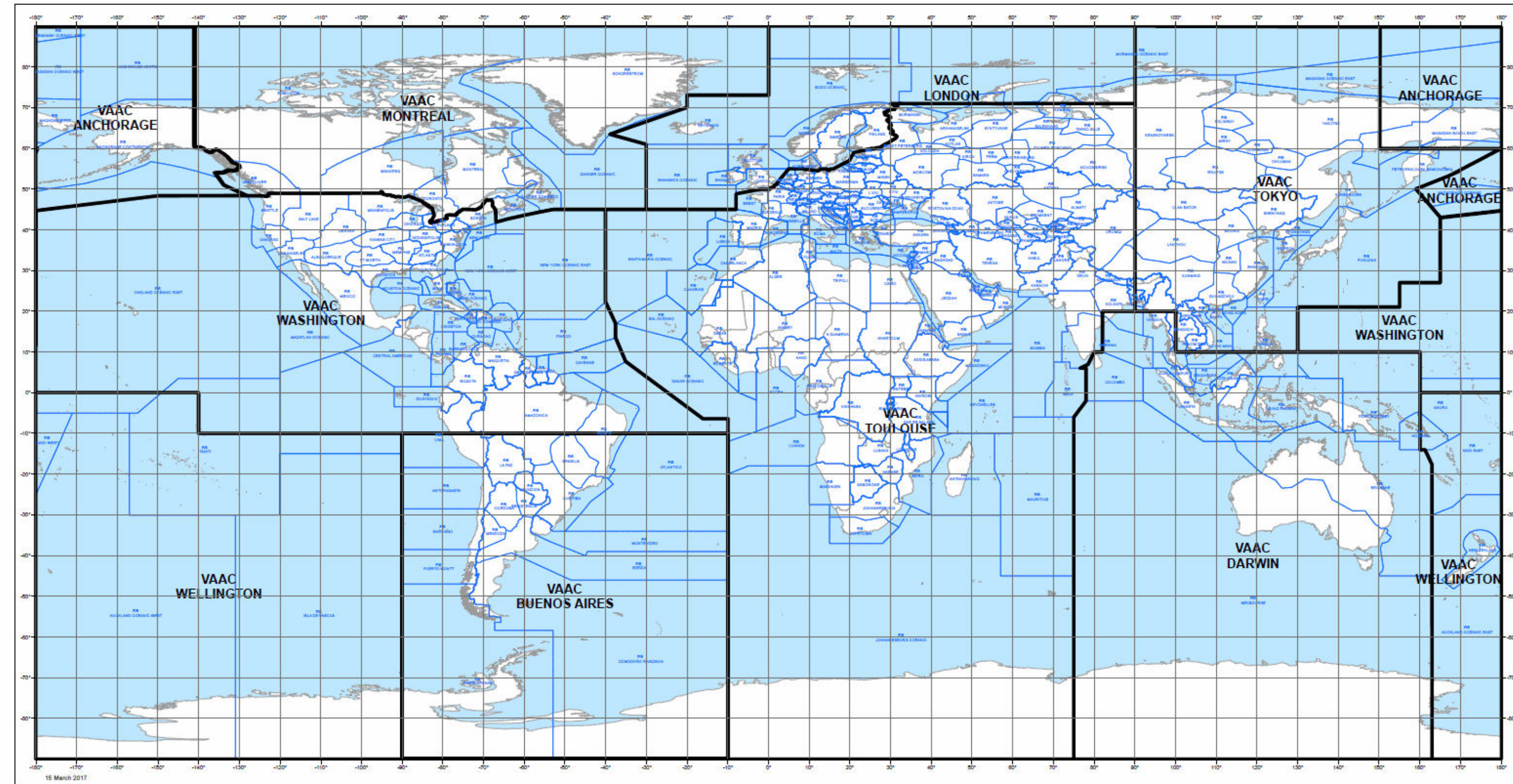


Figure 1. Status of the IMS infrasound network in April 2017

- Network construction 2001 – 2017
- Sustainment of assets
- Infrasound component 80% complete (50 of 60 station installed)



VAACs areas or responsibility (as of April 2017, source icao.int)

References

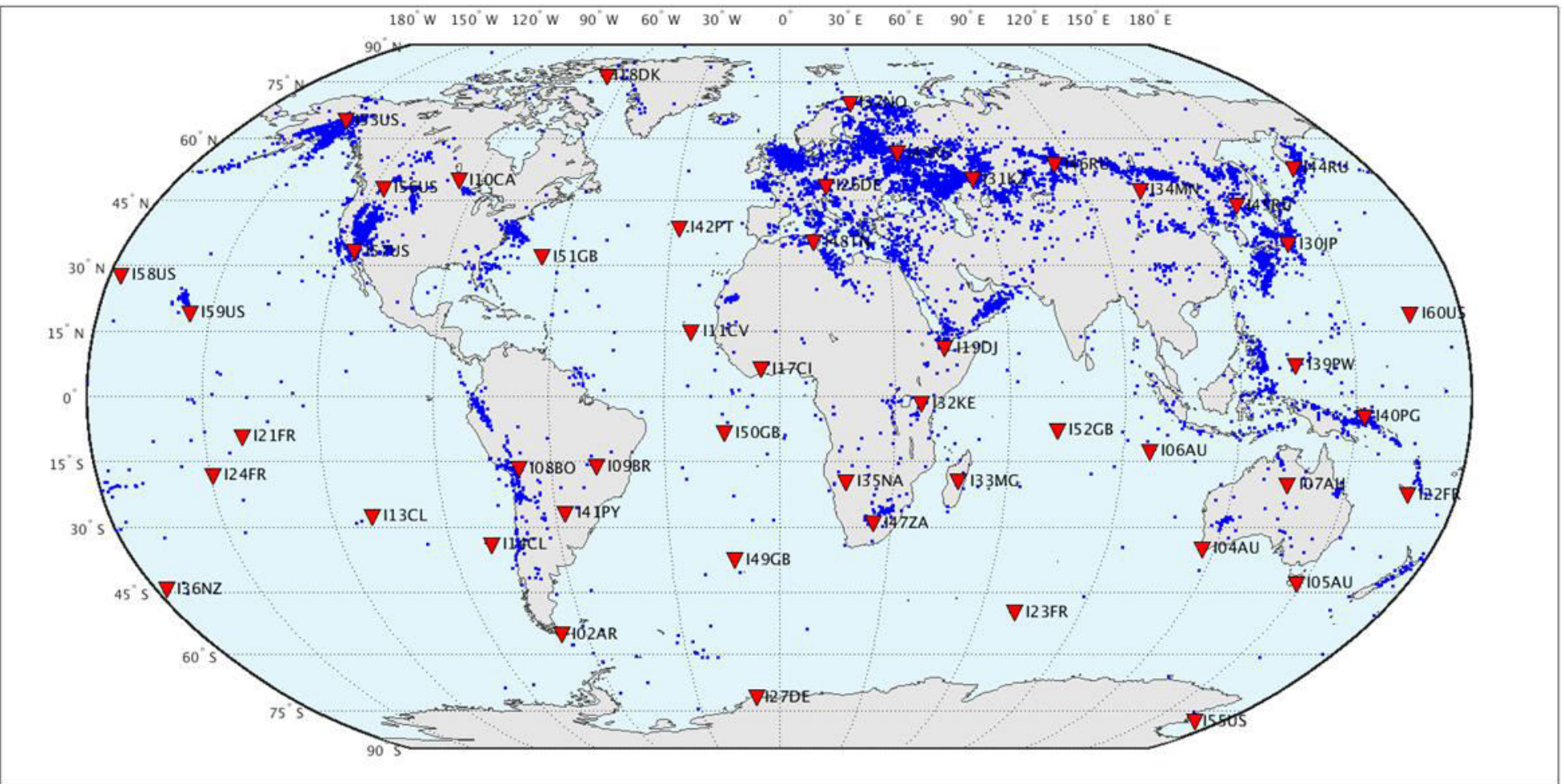
ARISE Atmospheric dynamics Research Infrastructure in Europe <http://arise-project.eu/>
Towards a volcanic notification system with infrasound data, Pierrick Mialle, WMO, Seventh International Volcanic Ash Workshop, Anchorage, Alaska, October 2015

Project Motivation

- Large scale volcanic eruptions may eject ash and hazardous gas high into the atmosphere
- Ash encounters represents a serious threat to the safety of aircraft
- VAACs are mandated by the ICAO to coordinate and disseminate information on volcanic ash clouds
- Timely availability of reliable information is crucial to mitigate the risk of aircraft encountering volcanic ash
 - Volcanic and seismological observatories
 - Remote sensing
 - Pilot report

7 years of Infrasound in IDC Operations

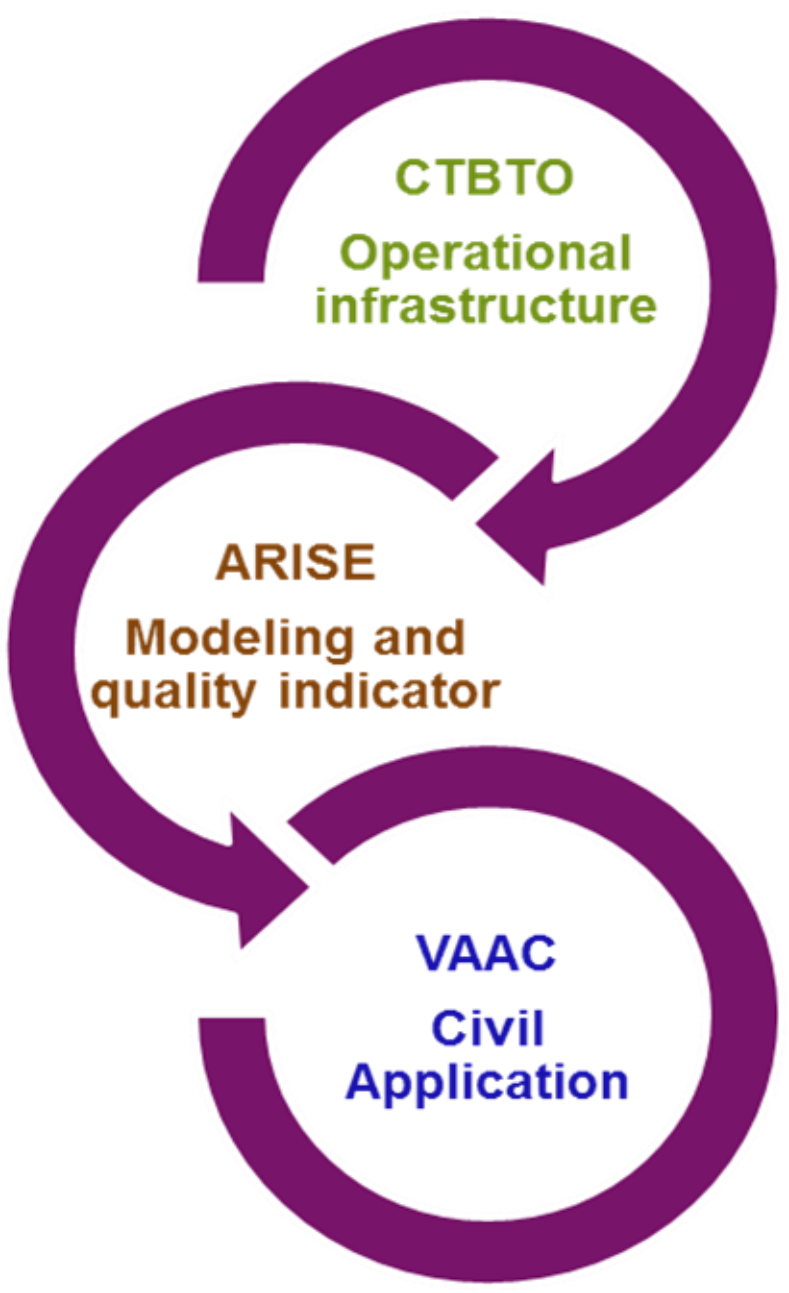
Figure 3. IDC products, comprising volcanic eruptions



- CTBTO system is operational and offer adequate environment for volcanic parameter system on vDEC

From Science To Operations

- Efforts towards the establishment of a VPS
- The synergy CTBTO / ARISE offers a unique opportunity for the establishment of a VPS using infrasound data from a global station network



- The VNS makes best use of the infrasound component of the IMS together with the operational capabilities of the IDC
- ARISE advanced products provide valuable parametric inputs on atmosphere dynamics that drives infrasound wave propagation.
- These results may serve as quality indicators increasing VAACs confidence when receiving notification messages.
- The proposed approached is tested with VAAC Toulouse, mandated by the ICAO, to demonstrate the usefulness of infrasonic data to International Airways Volcano Watch.
- Formalization through a future CTBTO-ICAO/WMO agreement

Implementation on vDEC – the ARISE link

- VPS 1.0 delivered by ARISE (Spring 2017)
- VPS 1.0 implemented in IDC-like environment
- Adaptation for vDEC environment and preparation of automatic messages regarding potential volcanic activity
- Ongoing testing and evaluation towards automatic messaging system with VAAC Toulouse

Concluding remarks

- ✓ ARISE – CTBTO – VAAC develop a VPS for Civil Aviation
- ✓ Seeking support from volcano-infrasound research community to enhance the VPS
- ✓ Ongoing work: Improve VPS reliability to reduce false alarms rate
- ✓ Enhancement s: Include atmospheric specifications to improve accuracy of infra wave parameters; and calculate source amplitude with confidence interval

