

# Instituto Geofísico Escuela Politécnica Nacional (IGEPN)

**Volcano Monitoring in Ecuador**

*IGEPN staff*

**23 February 2021**



**GVMID** Data on Volcano Monitoring Infrastructure



# IGEPN



- Founded in 1983
- Official institution in charge of tectonic and volcanic monitoring in Ecuador since January 2003
- 80 people work at the IGEPN
- Continuous monitoring 24/7/365
- Sasakawa award in 1992
- IAVCEI Volcanic Surveillance and Crisis Management award in 2020



Ground based networks

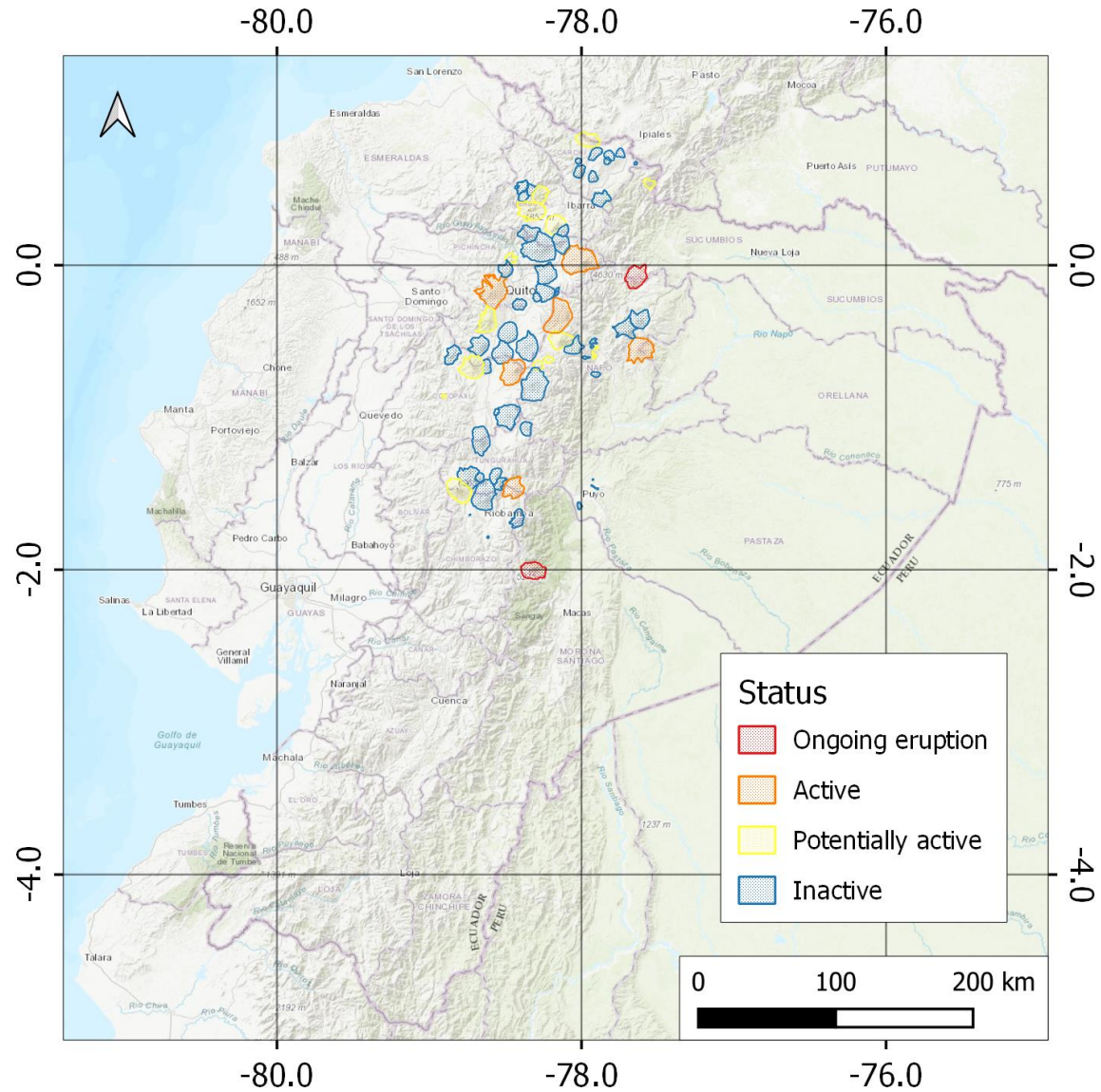
RENSIG

RENAC

RENGEO

ROVIG

REPET



Ground based networks

RENSIG

RENAC

RENGEO

ROVIG

REPET

Level 1

Seismic  
(BB, SP, IS)

Lahars  
(AFM, BB)      Cameras  
(visible + IR)

Rain gauges

Geochemistry SO<sub>2</sub>

Deformation  
(GPS+Tilt+EDM)

Level 2

Seismic  
(BB, SP, IS)

Geochemistry SO<sub>2</sub>

Deformation  
(GPS+Tilt)

Galápagos Network

Seismic  
(BB, IS)

Cameras  
(visible)

Geochemistry  
SO<sub>2</sub>

Deformation  
(GPS)

Level 3

Seismic  
(BB, SP, IS)

Deformation  
(GPS+Tilt)

**Ground based networks**

**RENSIG**

**RENAC**

**RENGEO**

**ROVIG**

**REPET**

**Level 1**

Cotopaxi  
Tungurahua  
El Reventador  
Guagua  
Pichincha  
Cayambe

**Level 2**

Chiles Cerro Negro  
Antisana  
Chimborazo  
Cuicocha  
Sangay

**Level 3**

Pululahua  
Ninahuilca  
Quiltoa  
Chachimbiro  
Imbabura

**Galápagos Network**

**Fernandina Island (2):** La Cumbre  
**Isabela Island (4):** Cerro Azul, Alcedo, Sierra Negra, Pto. Villamil

Ground based networks

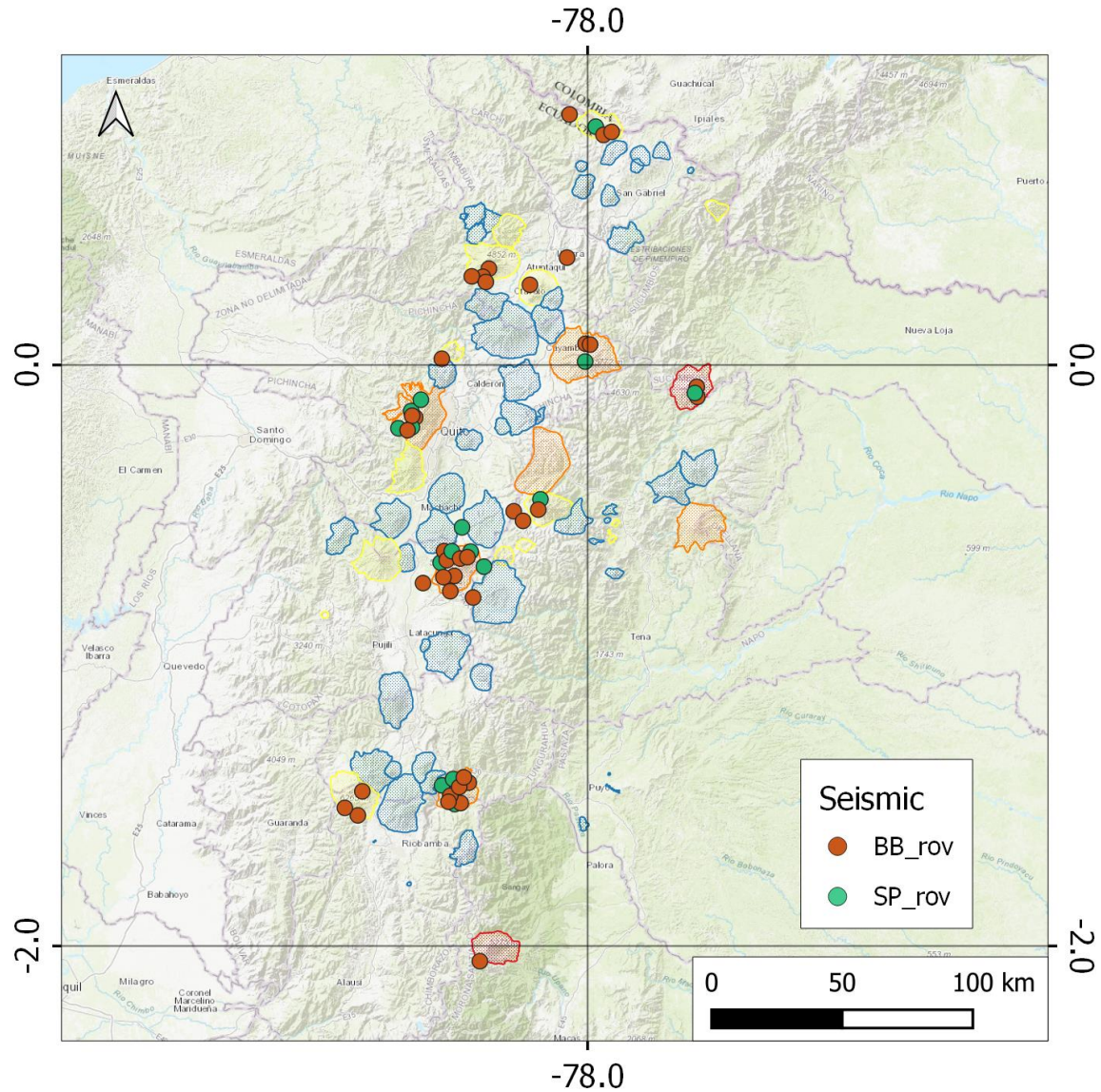
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64 seismometers



Ground based networks

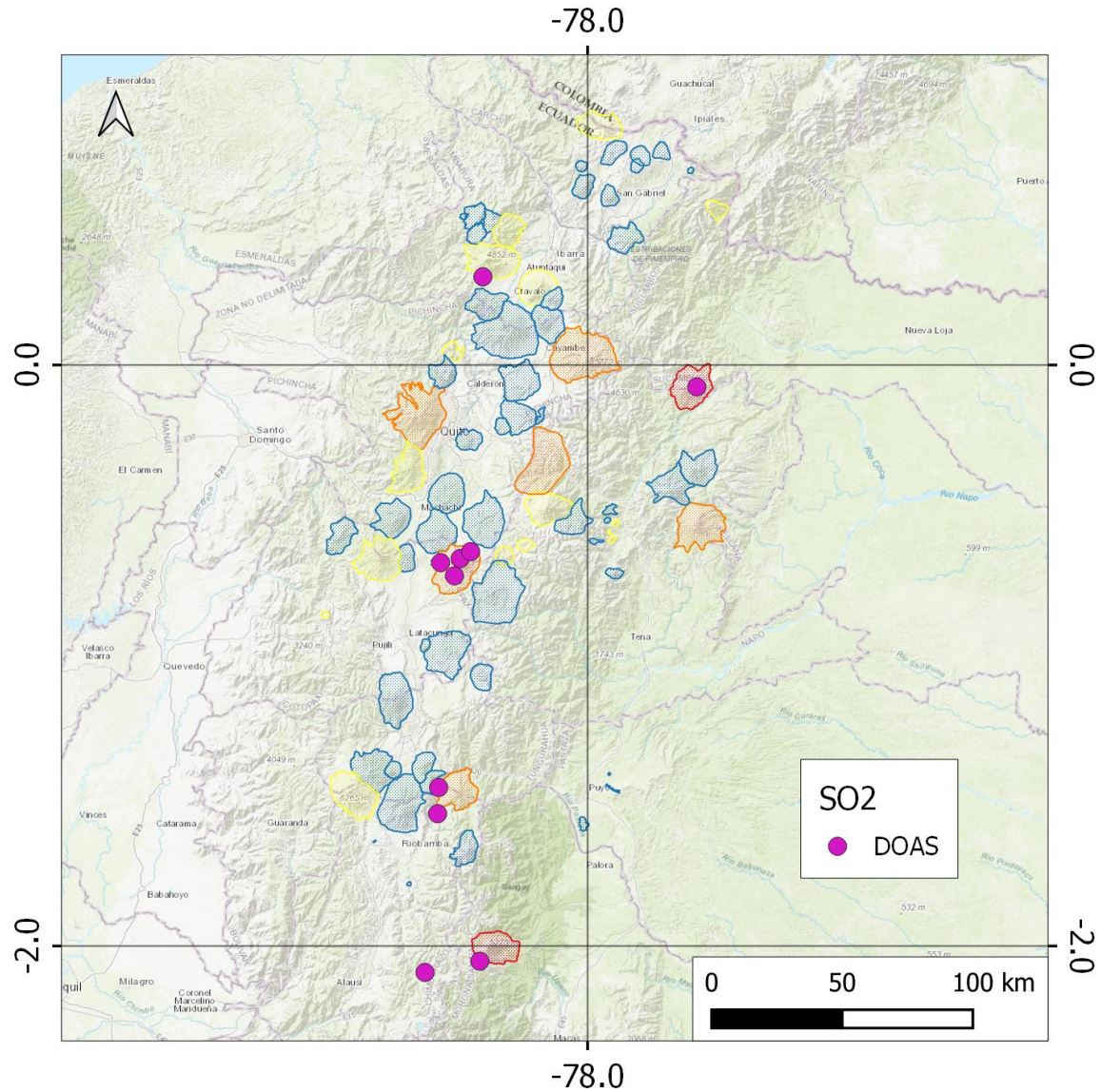
RENSIG

RENAC

RENGEO

ROVIG

REPET



10 DOAS

Ground based networks

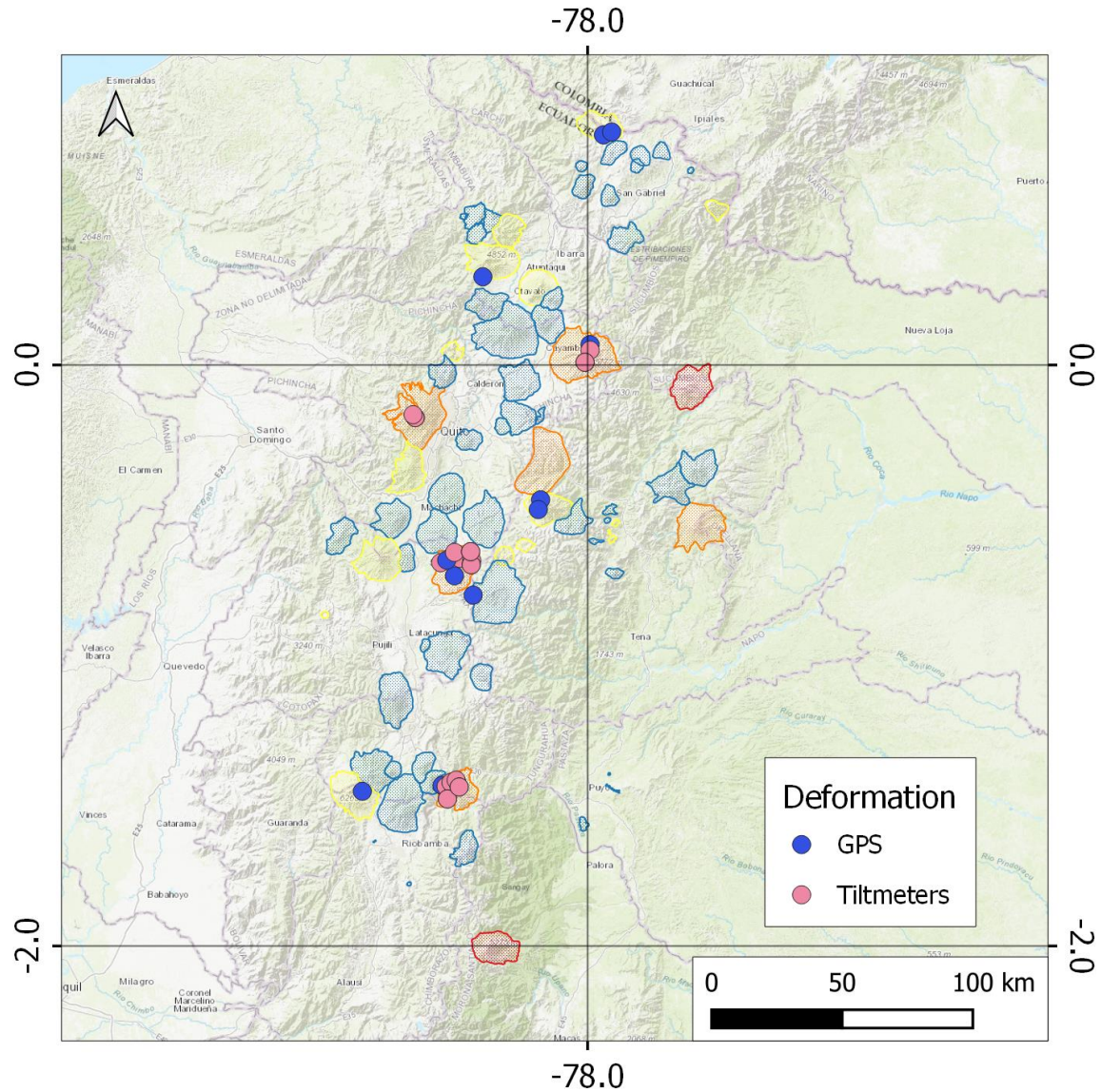
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REPET



30 GPS 16 tiltmeters



Ground based networks

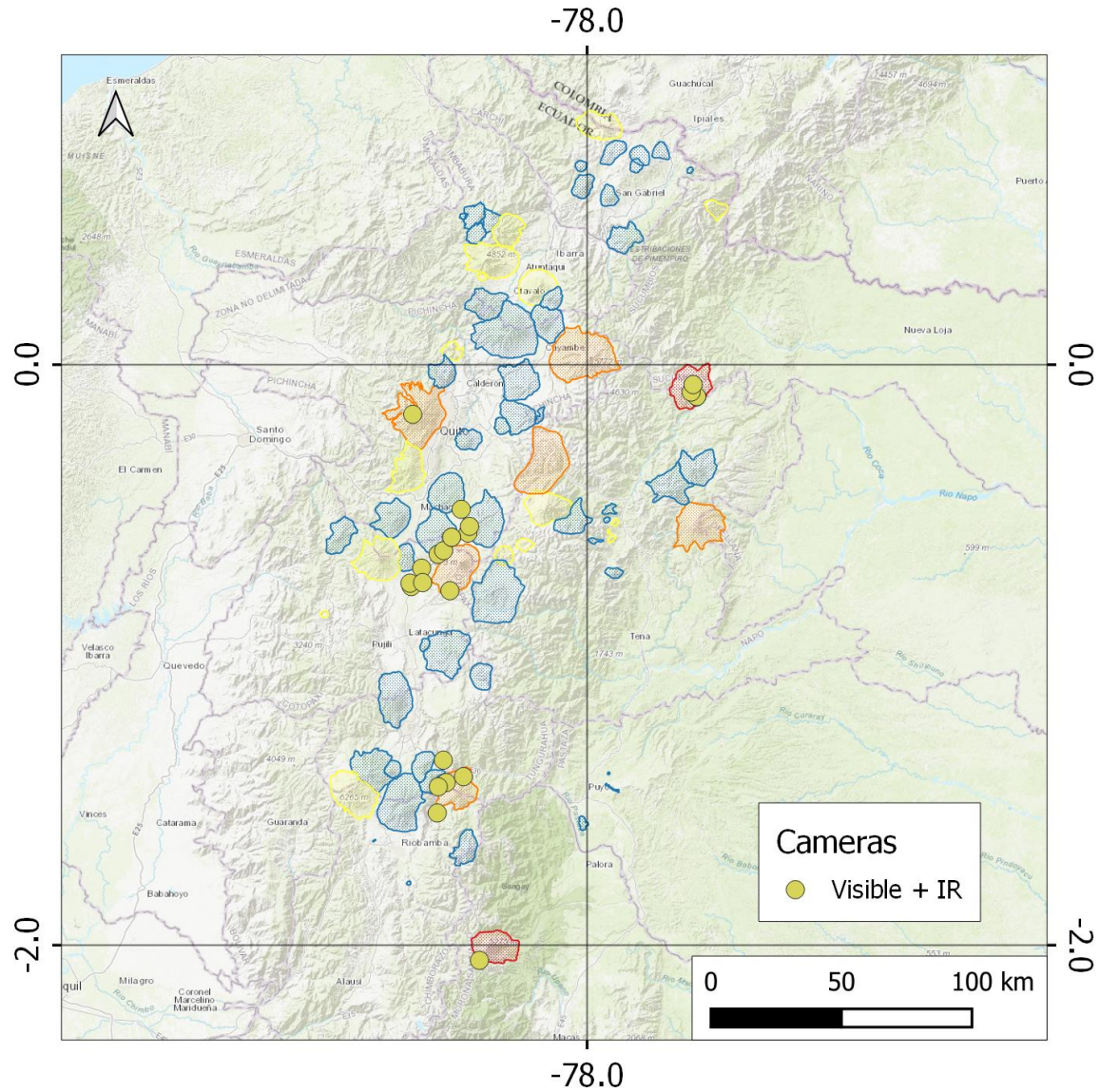
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RENGEO

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21 visible

3 IR

Ground based networks

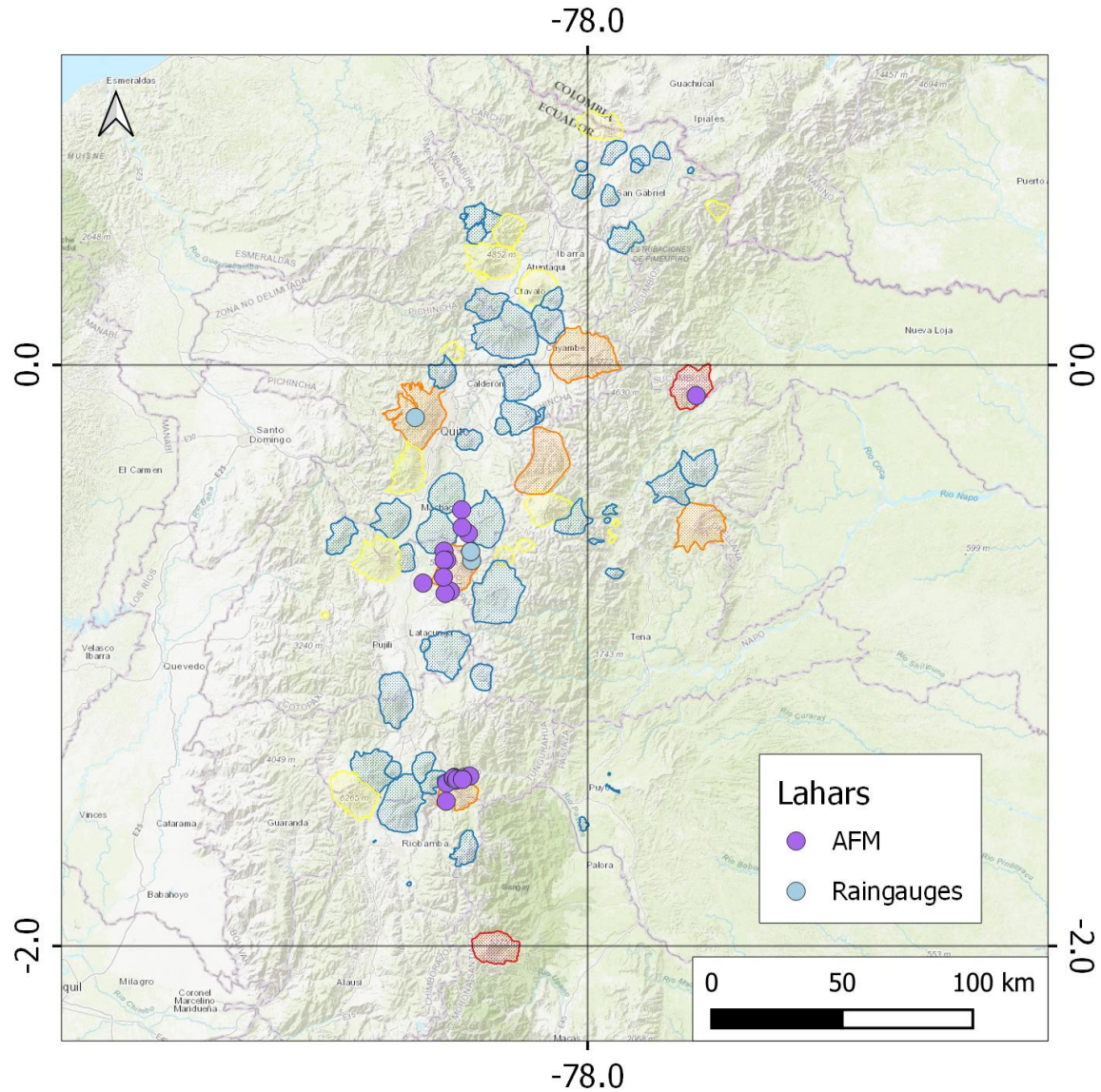
RENSIG

RENAC

RENGEO

ROVIG

REPET



18 AFM

5 rain gauges



Ground based networks

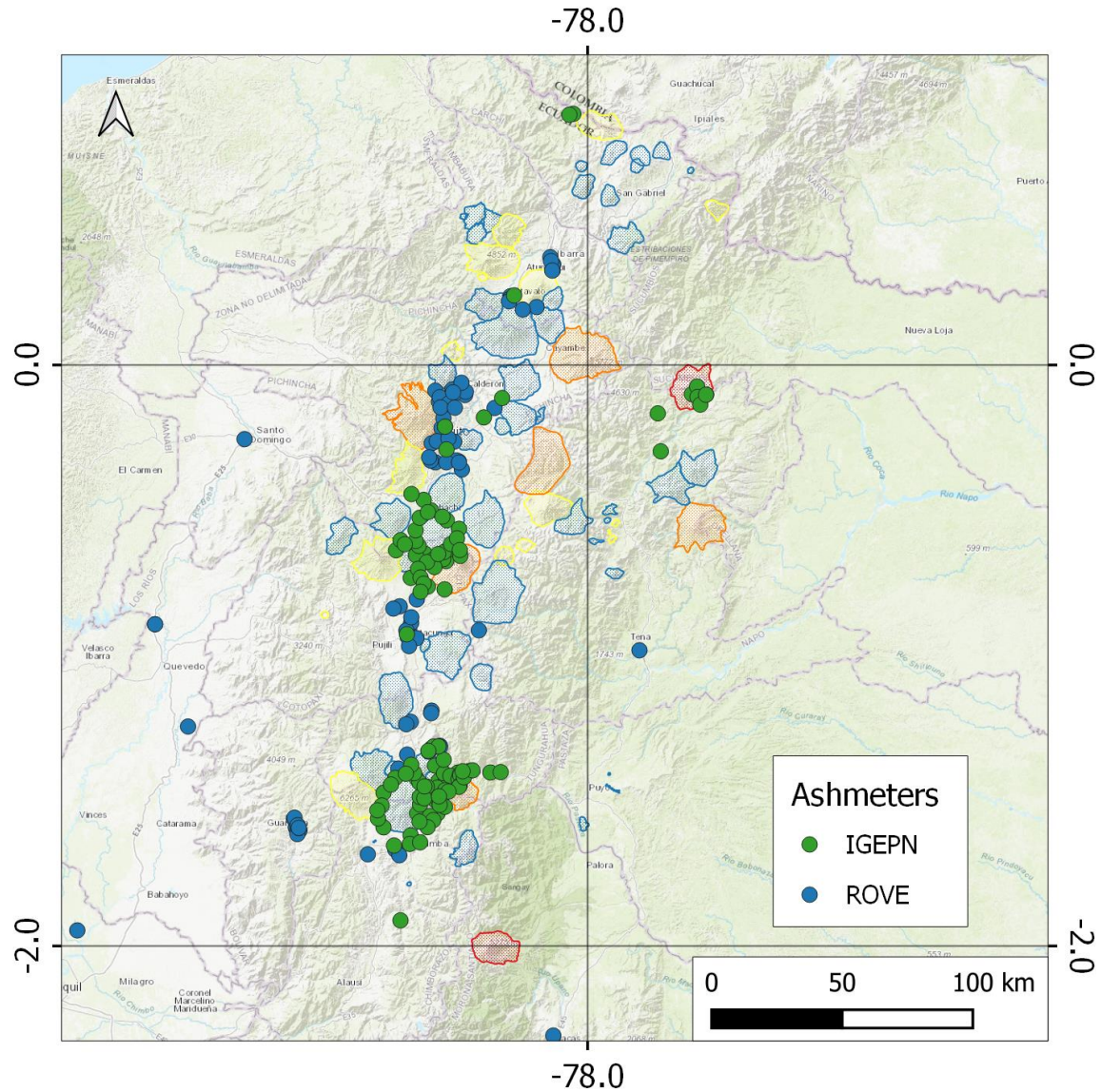
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REPET



250 ashmeters



Ground based networks

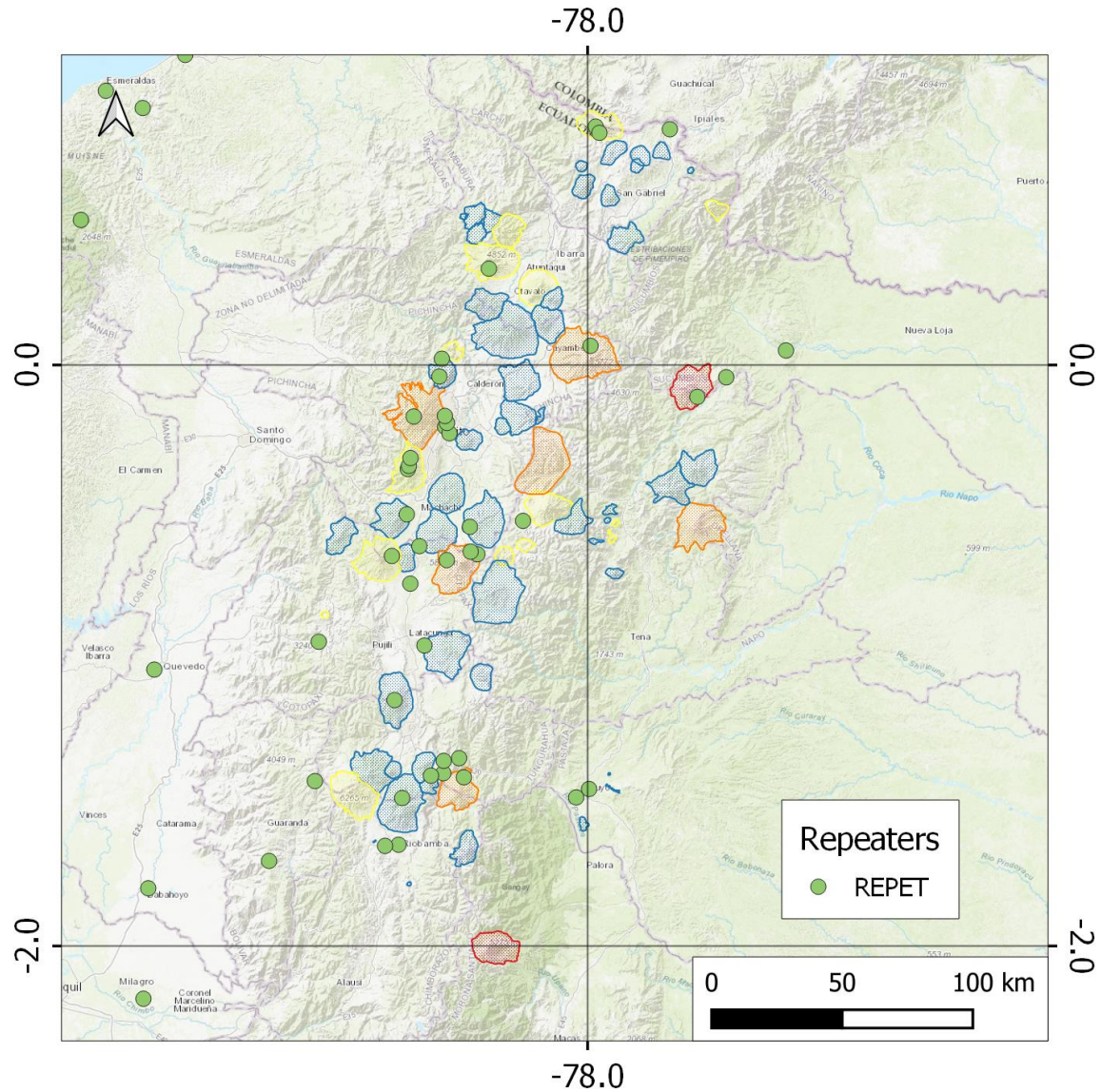
RENSIG

RENAC

RENGEO

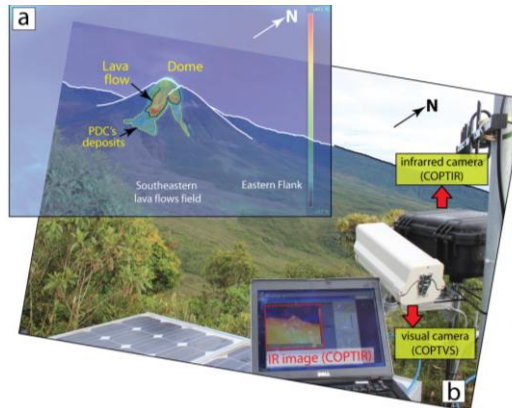
ROVIG

REPET



## Periodic measurements

- Diffuse CO<sub>2</sub>
- Volcanic fluids sampling
- OP-FTIR
- Multi GAS
- Mobile DOAS
- Ash sampling
  
- EDM
- Temporary dense seismic networks
- Temporary dense infrasound networks
- Thermal imaging surveys





## Lacking data

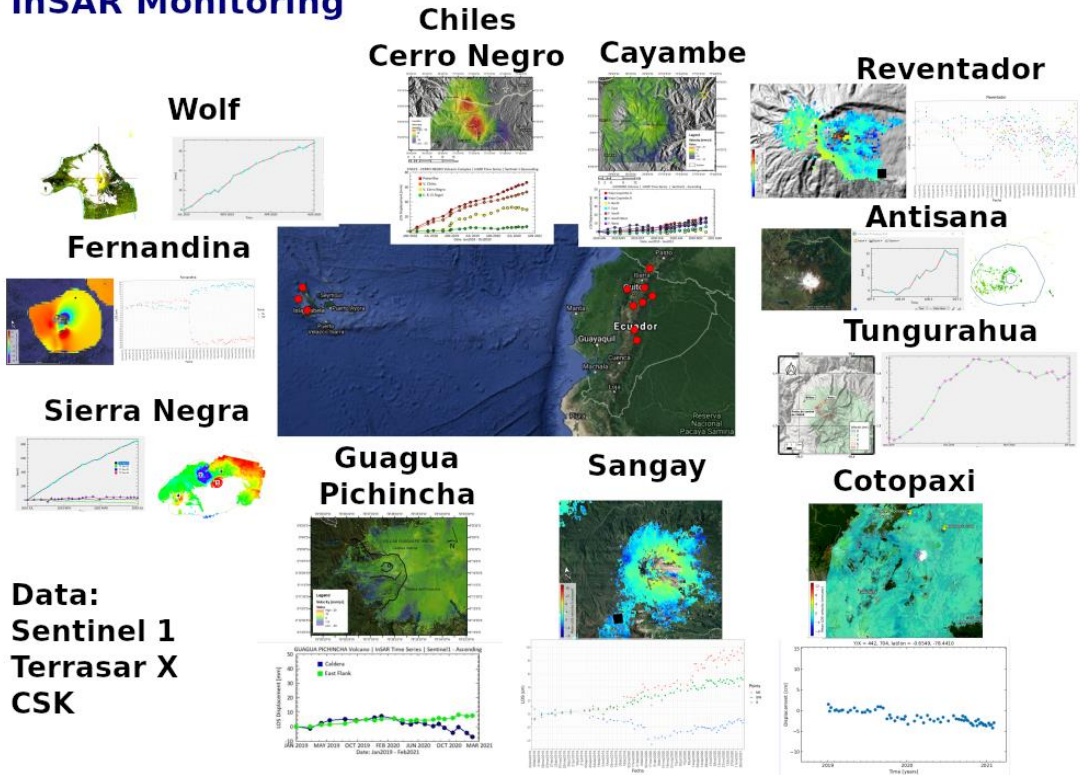
- Continuous Multi GAS
- UV cameras
- Certified laboratory
- Rain gauges
- Continuous diffuse CO<sub>2</sub> monitoring at volcanic lakes
- Infrasound arrays
- Ground-based radar and disdrometers for monitoring ash



# Satellite based monitoring

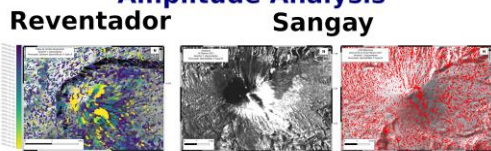
- Deformation

## InSAR Monitoring



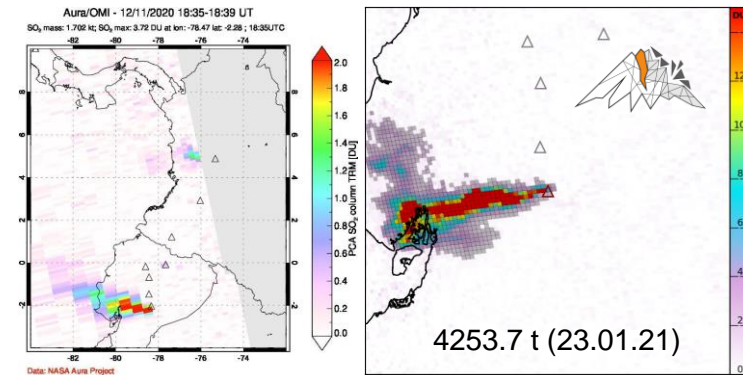
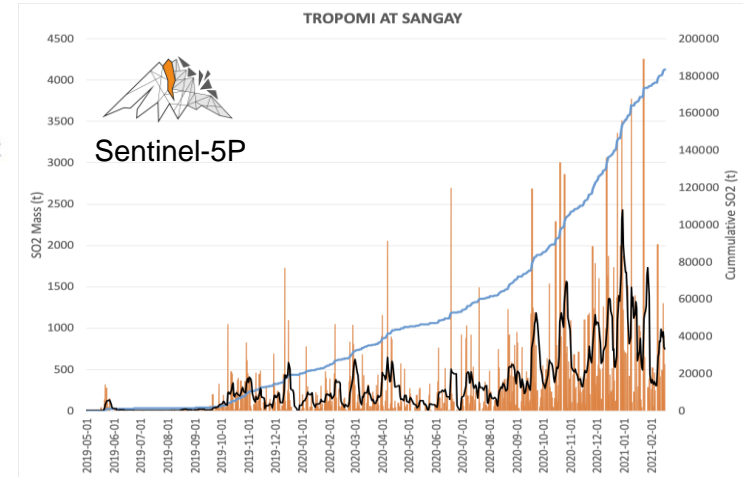
Data:  
Sentinel 1  
Terrasar X  
CSK

## Amplitude Analysis



**Volcano Supersite, Geohazard Supersites and Natural Laboratories (GSNL) of the Group on Earth Observation (GEO), Committee of Earth Observation Satellites (CEOS), Demonstrator Project, COMET, Leeds University, INGV Italy, OpenSARLab**

## Degassing



OMI+OMPS  
so2.gsfc.nasa.gov

## Satellite based monitoring

- **Thermal**
  - IR sensors/sat
  - Sentinel
  - MODIS/Acqua TIR/RGB
  - MODIS/Terra TIR/RGB
  - VIIRS/Suomi
  - LANDSAT 8
  - ASTER/Terra
- **Ash**
  - Washington VAAC
  - GOES-16
  - Ash3D for ash dispersion and sedimentation simulations: 2 daily simulations for Sangay and Reventador

### Sites/Tools

- NASA Worldview
- MOUNTS
- MIROVA
- MODVOLC
- FIRMS



- **Future plan:**
  - Automatic alerts based on thresholds
  - Automatic classification of seismic signals (currently tested at Cotopaxi)
  - Integrate ground and satellite data in a robust and well-organized database in order to have real-time multiparametric monitoring.
  - Seismo-acoustic alert system
  - Apply for grants
- **Interest in Global Volcano Monitoring Infrastructure**
  - We will fill the excel templates form GVMID in the incoming weeks
  - We will check which data are included in the WOVO database and share the data from the IGEPN.
  - Part of the real time data is available at [www.igepn.edu.ec](http://www.igepn.edu.ec)





Thanks!