



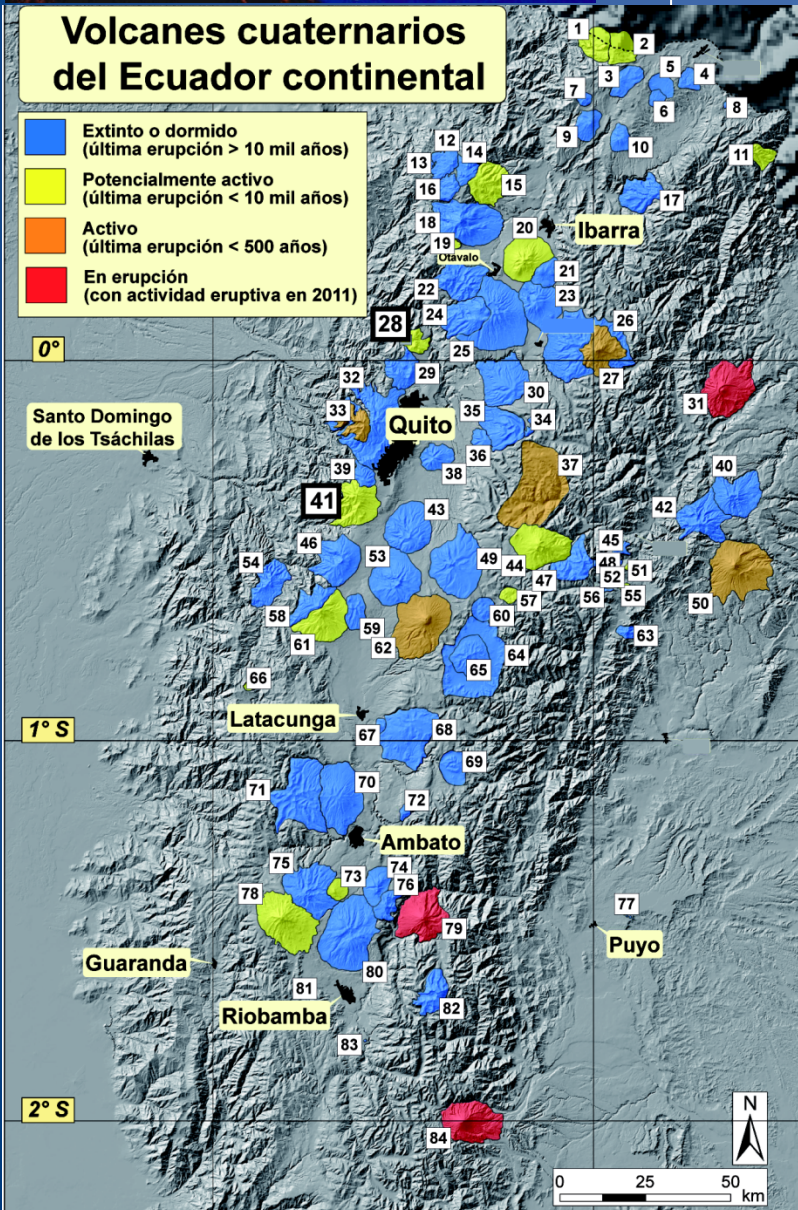
# Analysis of the 2014 - 2015 Seismic Swarms at Chiles Cerro Negro Volcanoes

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**INSTITUTO GEOFISICO**

**ESCUELA POLITECNICA NACIONAL**

**May 2014**

# Geodynamic context: volcanic



## The Continental Arc

- 84 volcanic complexes have been identified.
- 13 potentially active (with at least one eruption during the last 10 Ka).
- 8 active volcanoes (with eruptions since 1532)
- 3 volcanoes are currently in eruption.

# Chiles and Cerro Negro volcanic zone



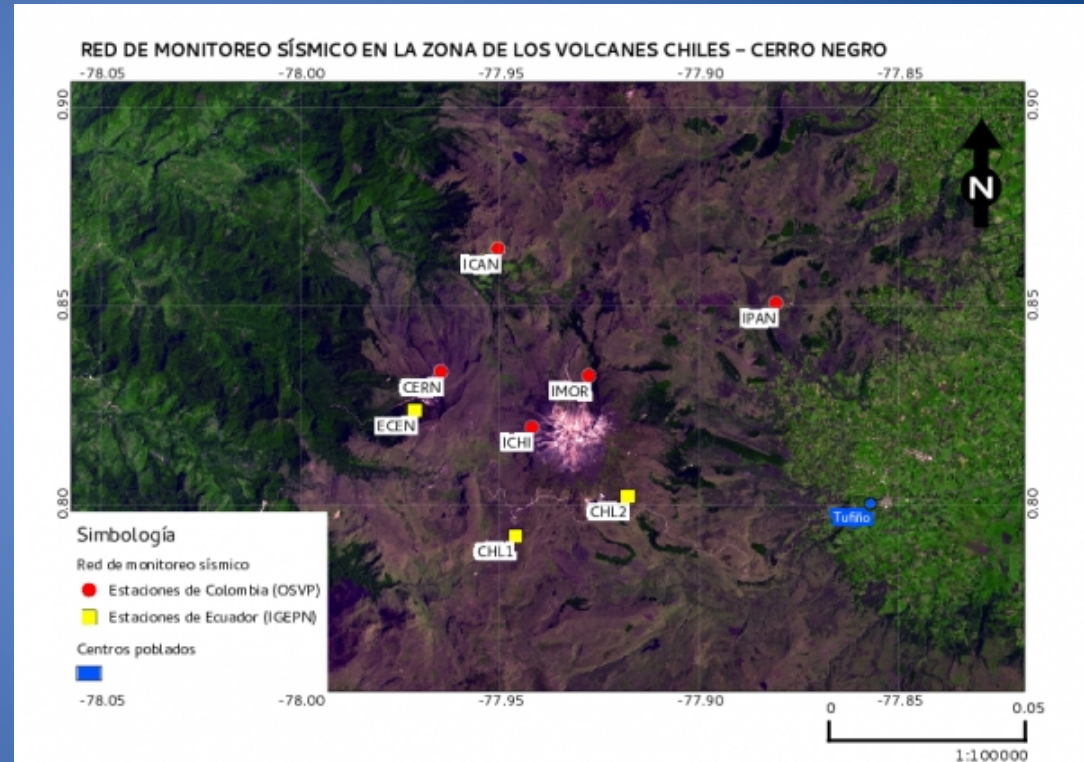
# IG-EPN and OVSP-SGC Joint Monitoring System

9 broad band stations  
3 electronic tiltmeters  
2 Continuous GPS  
receivers

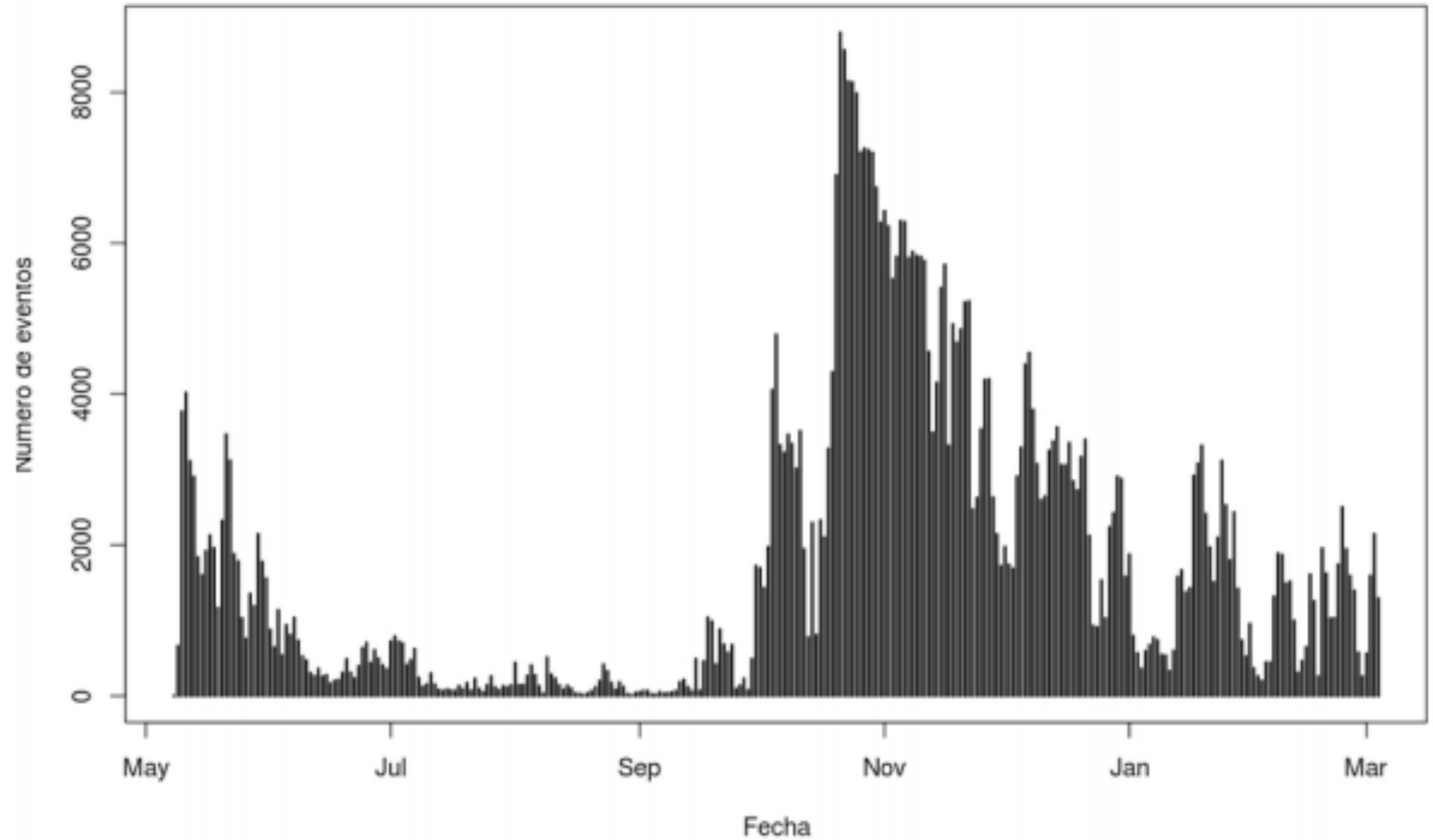
2 Video cameras

Hotspring thermal and  
chemical monitoring

Parallel data transmission  
to OVSP (SGC) and IGEPN

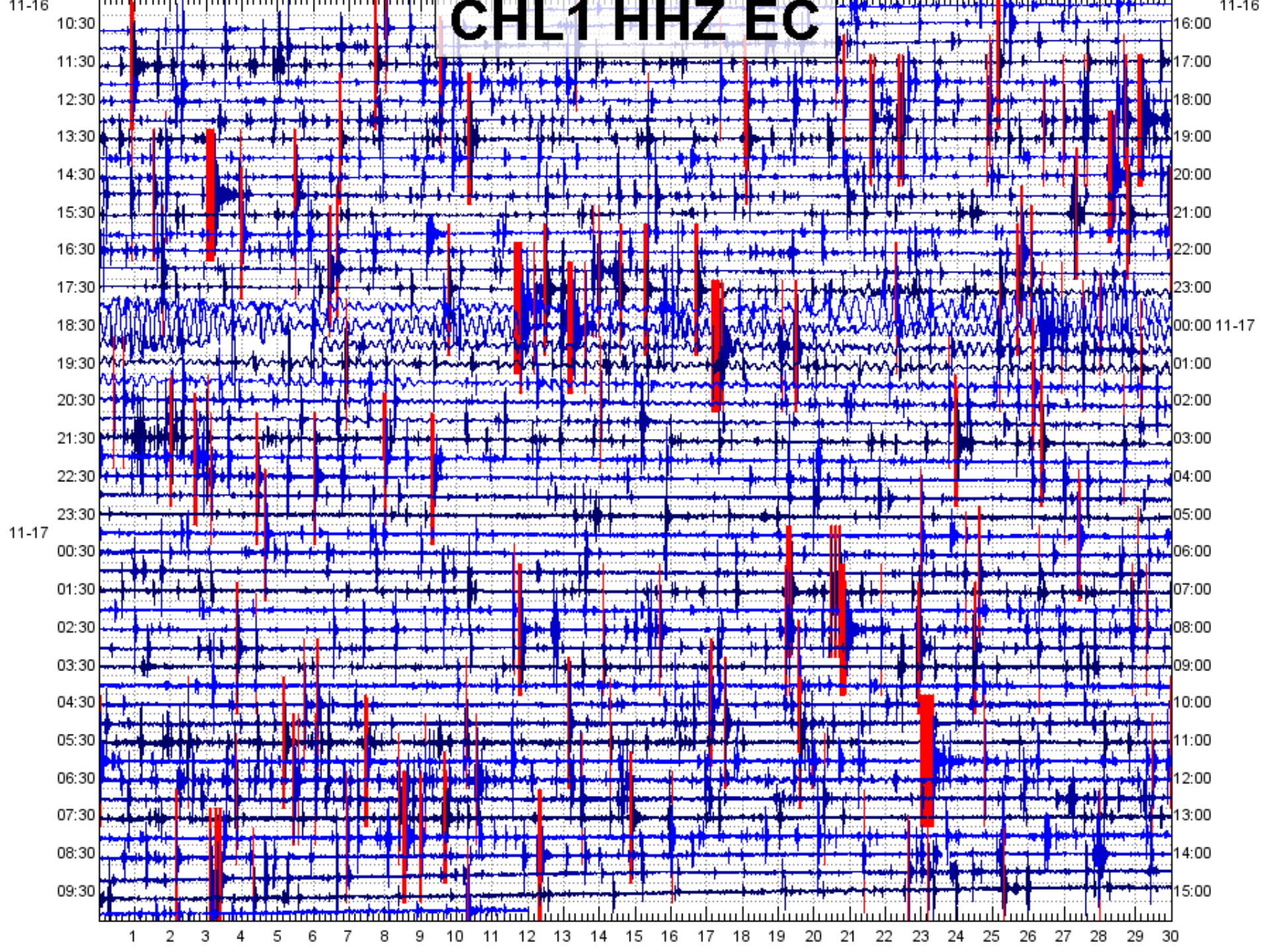


## Complejo volcánico: Chiles - Cerro Negro

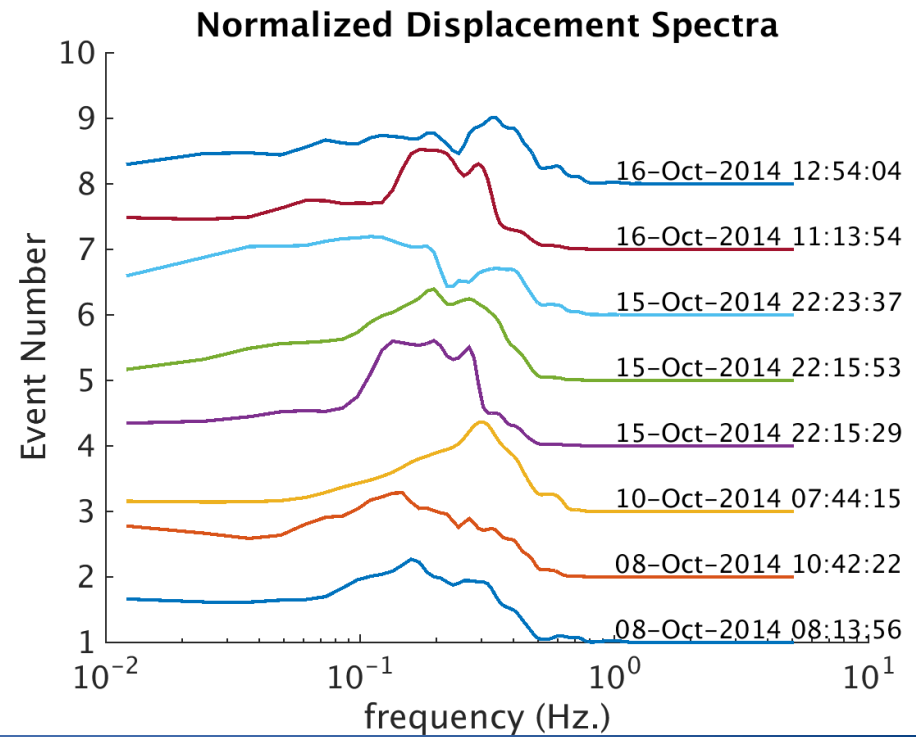
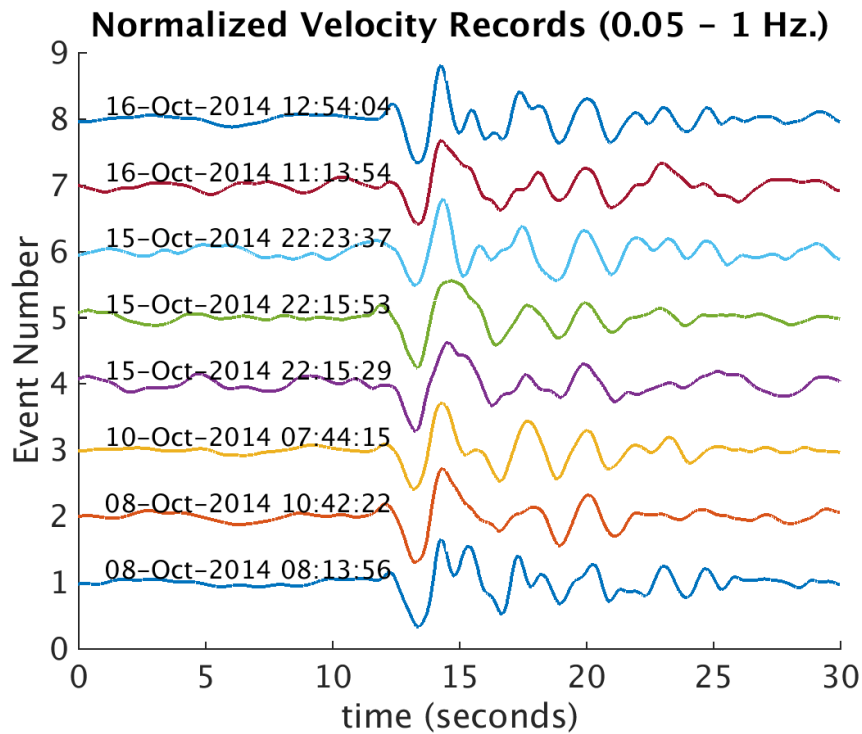


*Conteo automático de eventos entre Mayo 2014 y Marzo 2015.*

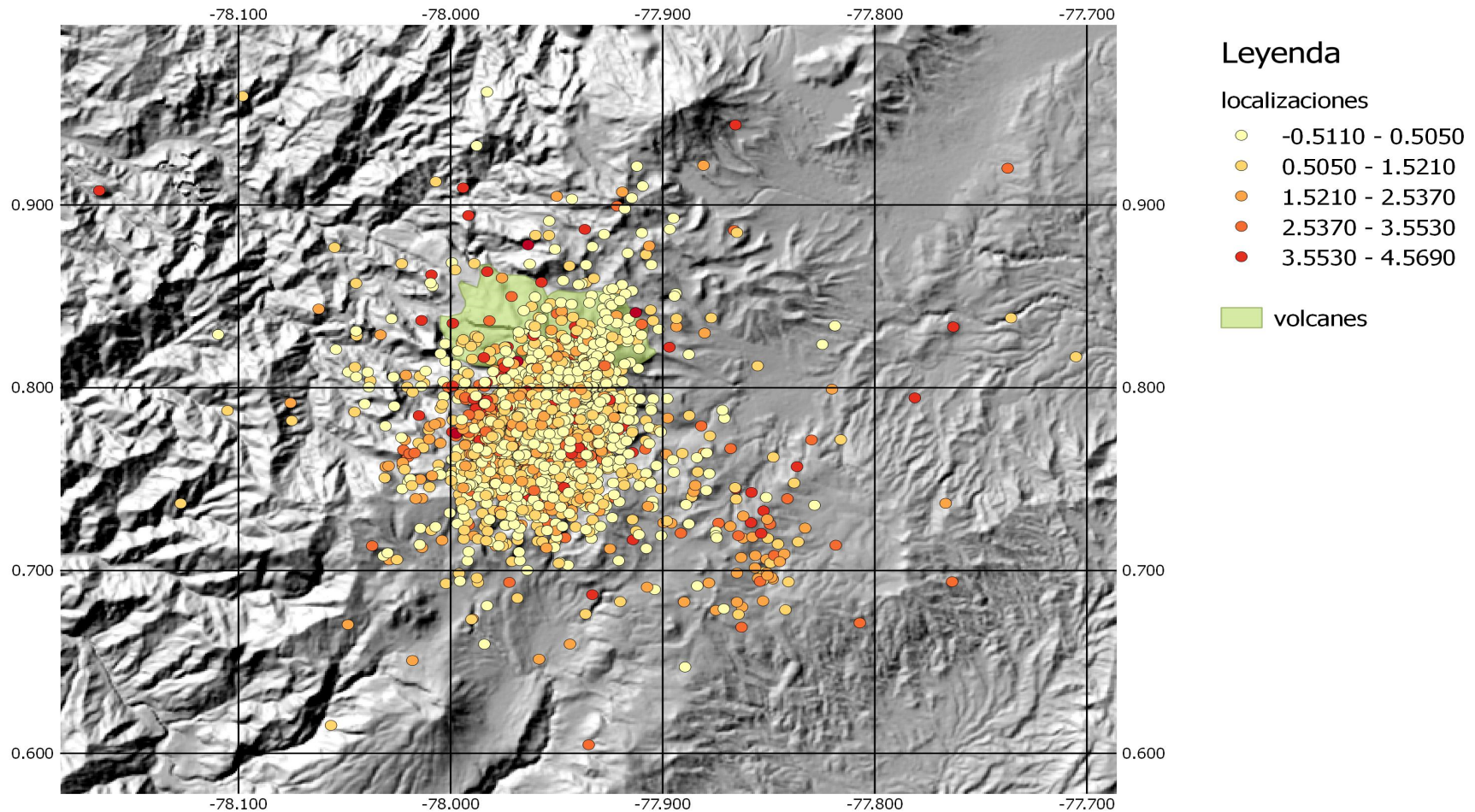
# CHL1 HHZ EC



# Sismos con componentes de largo periodo asociados con movimiento de fluidos en el interior



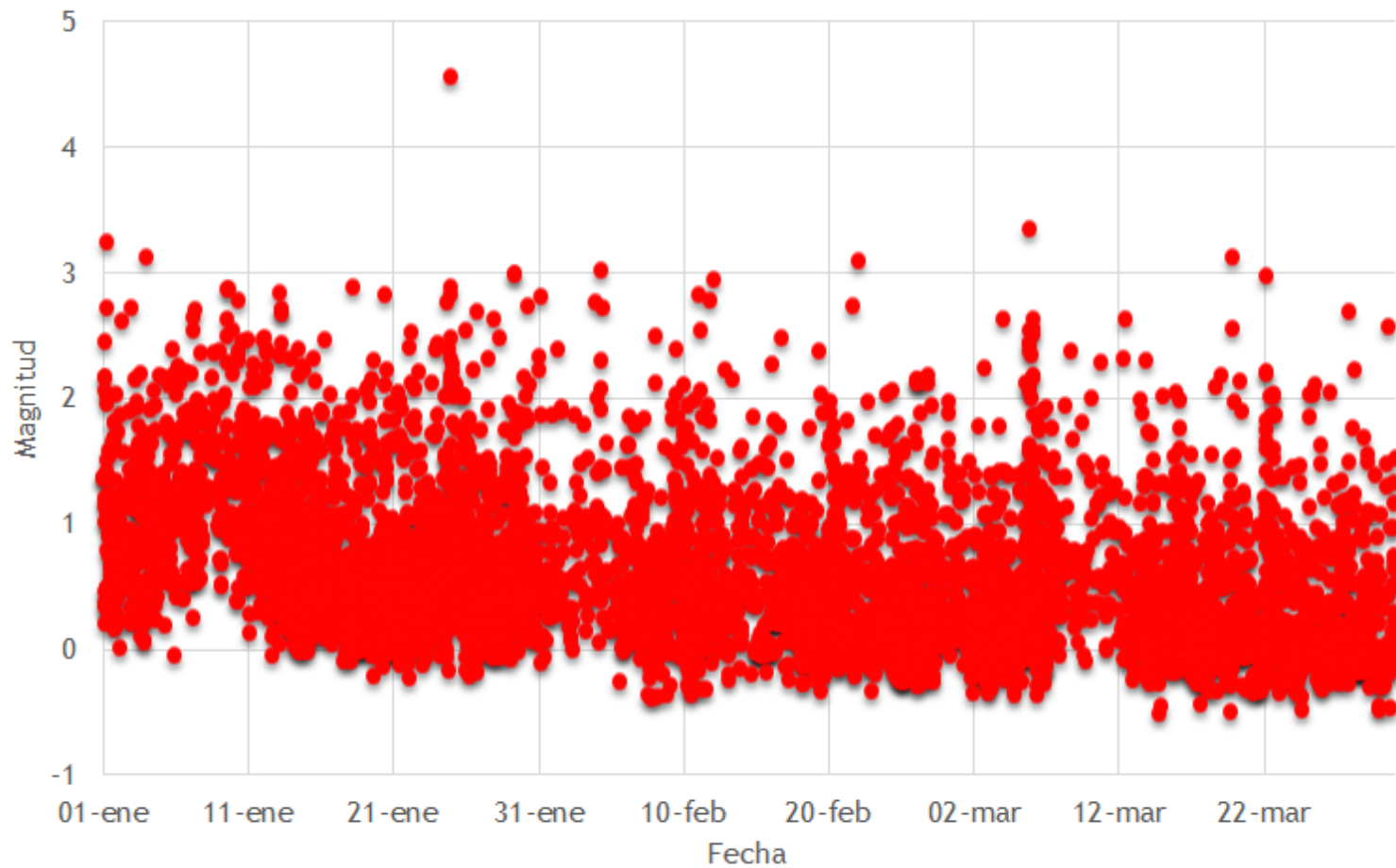
# EPICENTRAL DISTRIBUTION



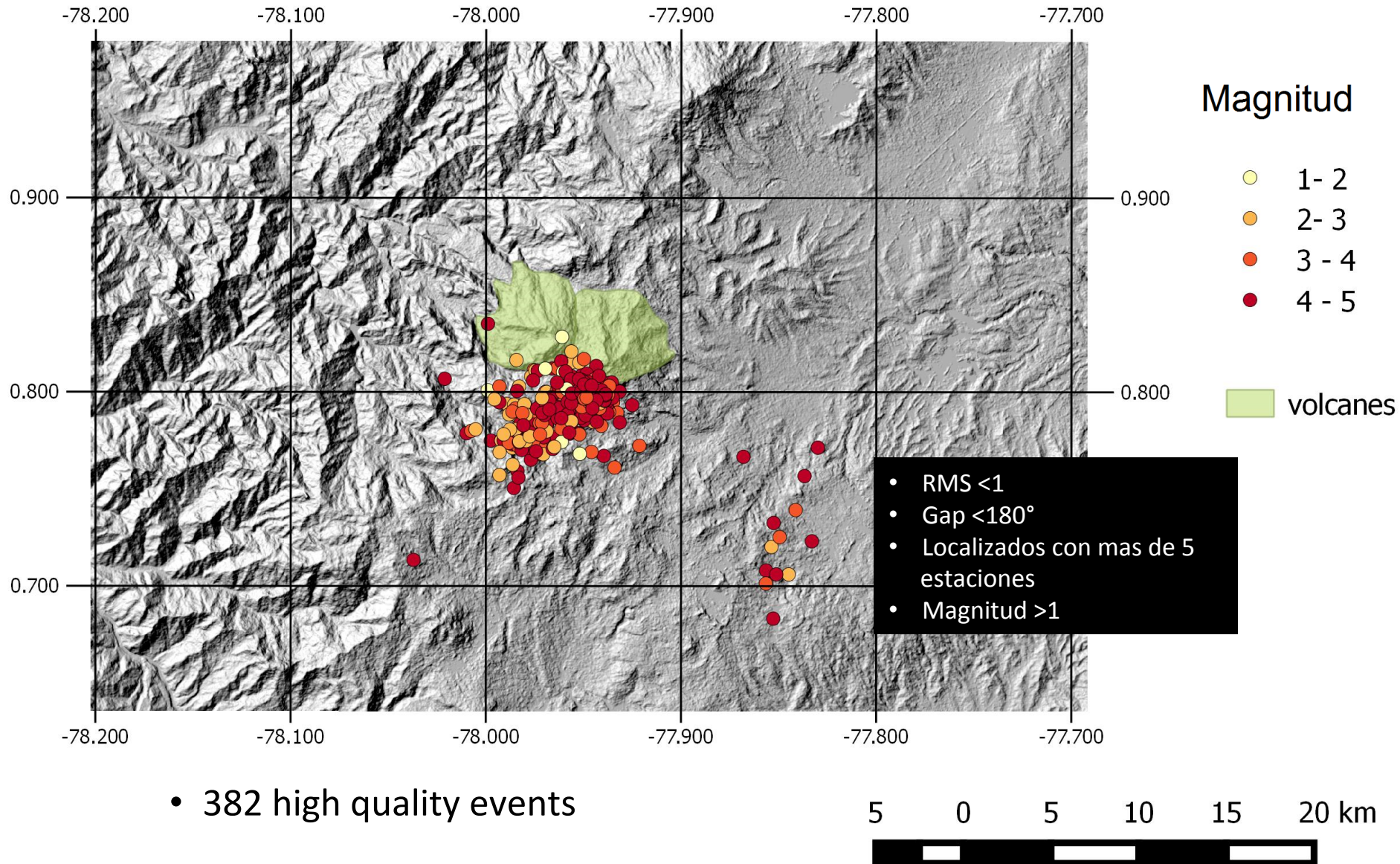
- 5528 events located between January and March 2015

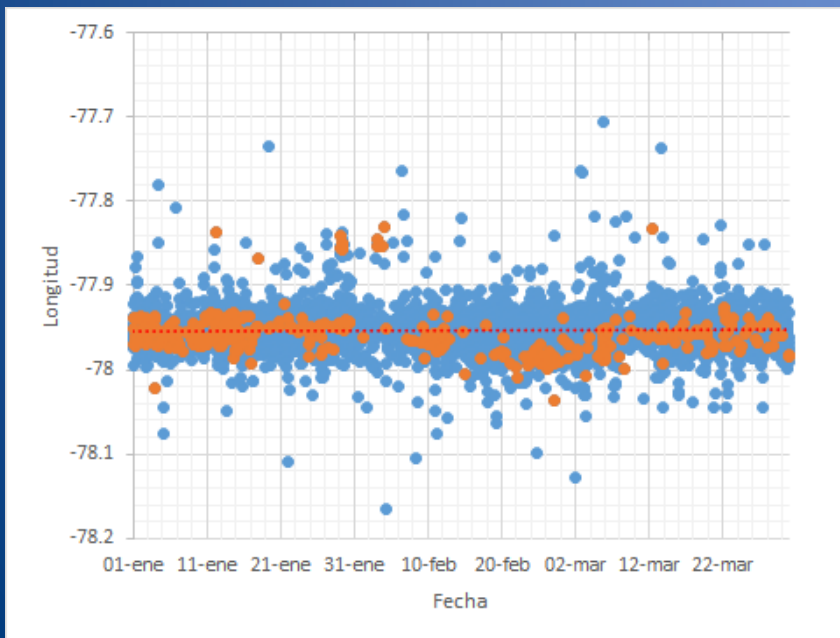
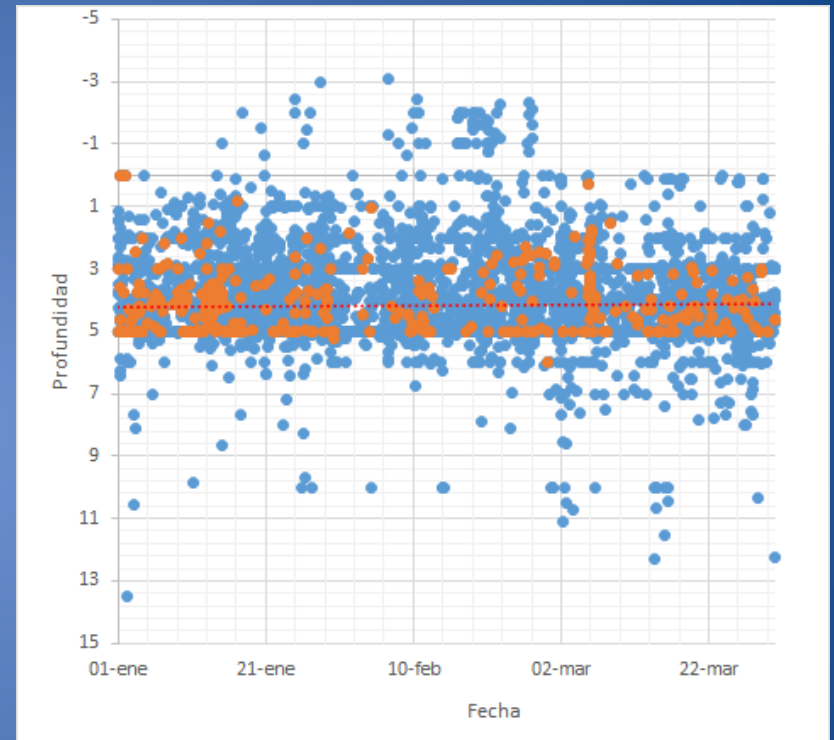
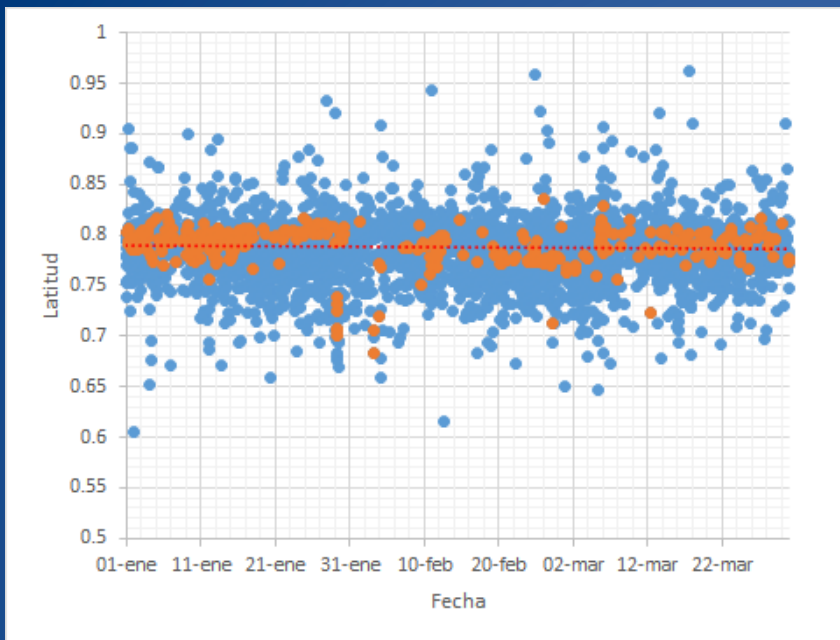


## Magnitud sismos localizados (Enero -Marzo 2015)



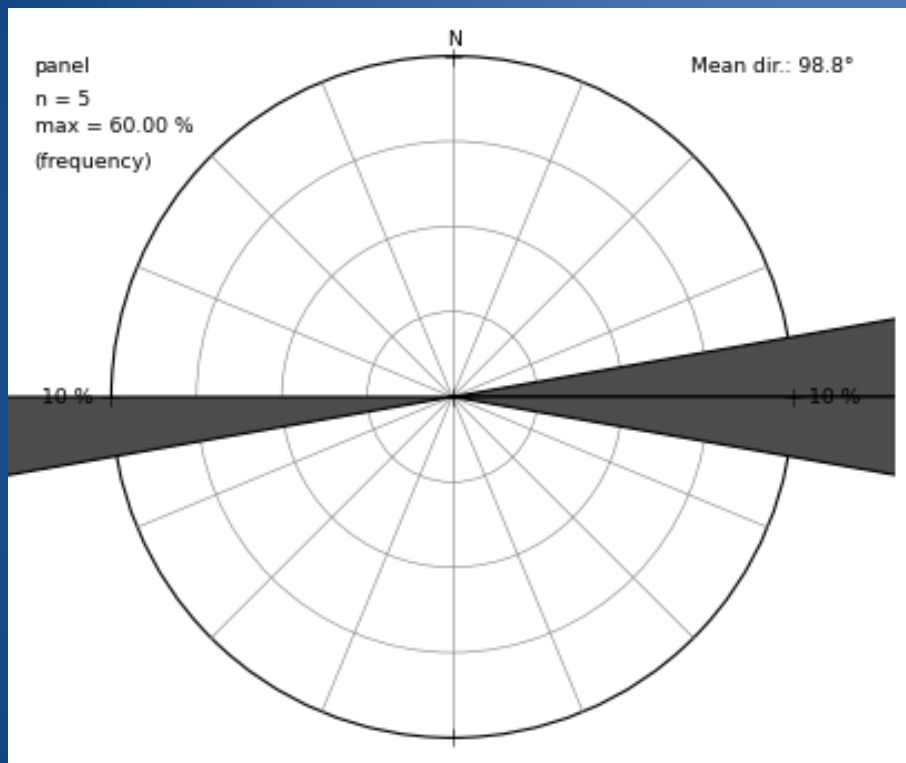
# HIGH QUALITY EPICENTRES



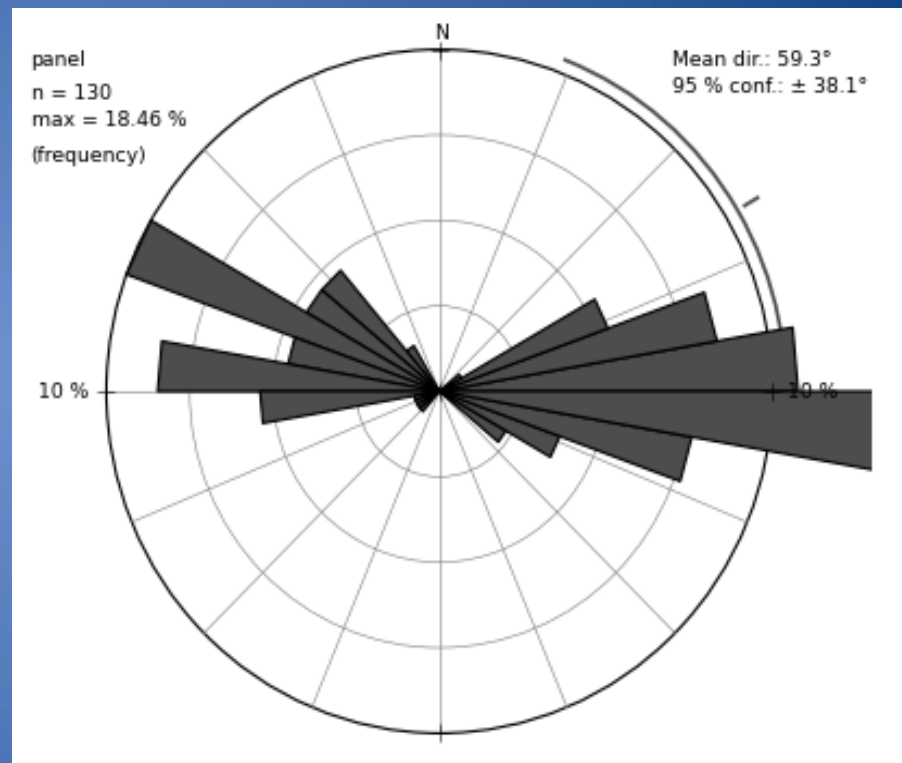


Blue- All hypocenters data  
 Orange- High quality events

# PRESSURE AXIS BY FOCAL MECHANISMS

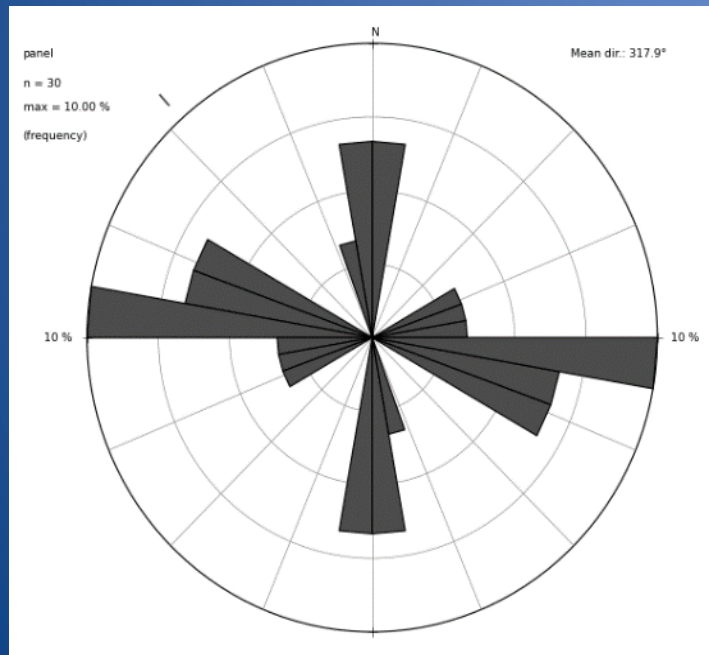
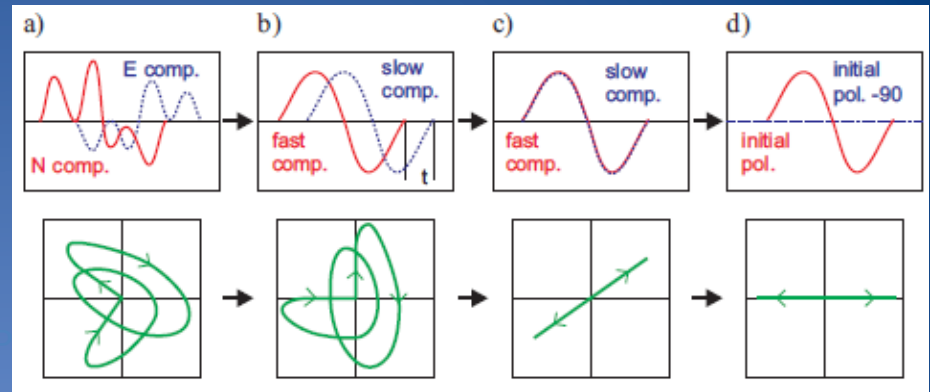


Enero-Septiembre

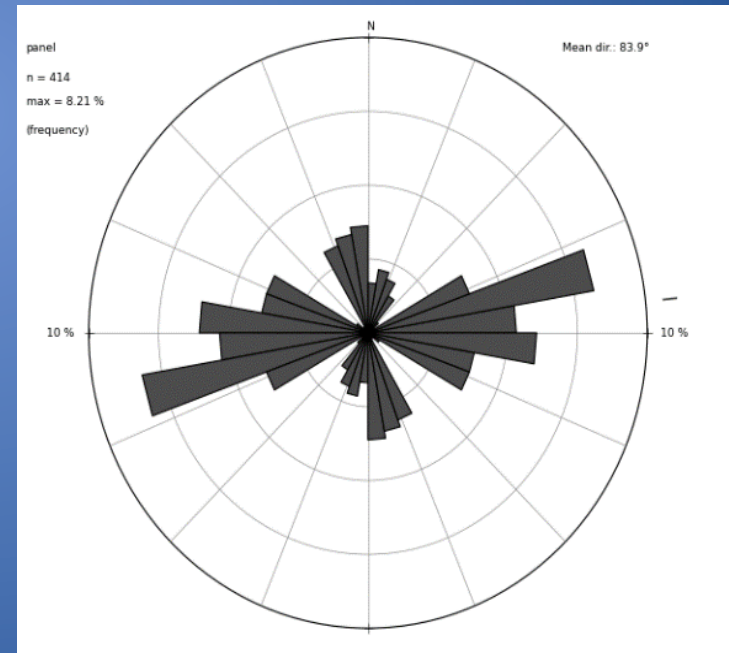


Octubre

# Shear wave splitting



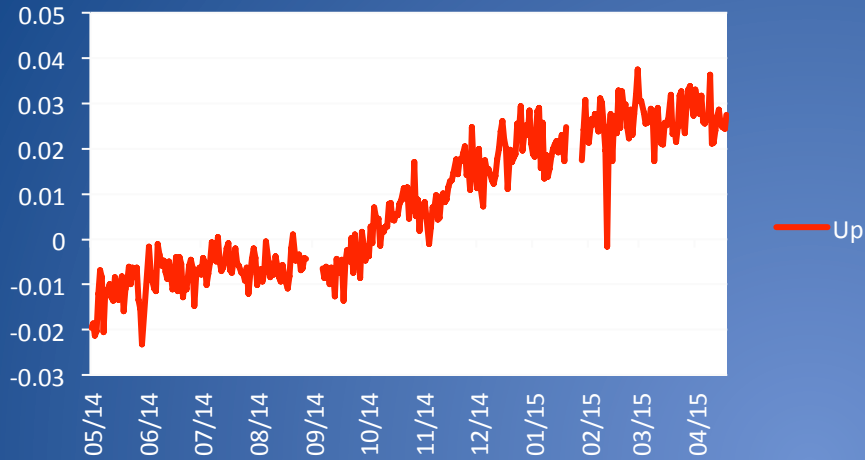
Enero-Septiembre



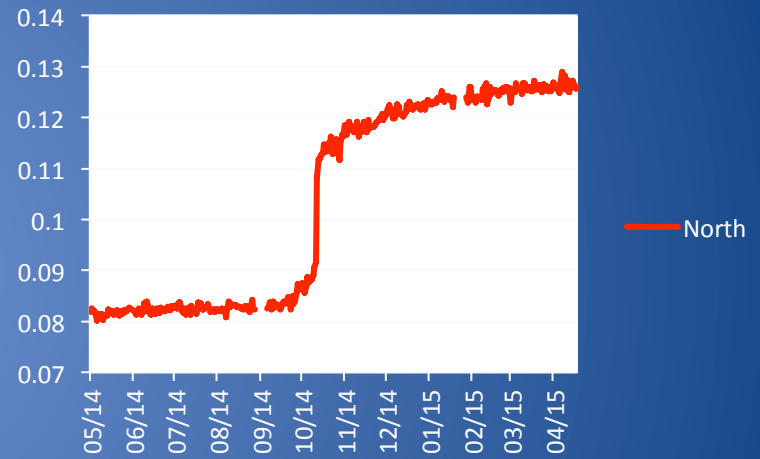
Octubre

# Chiles

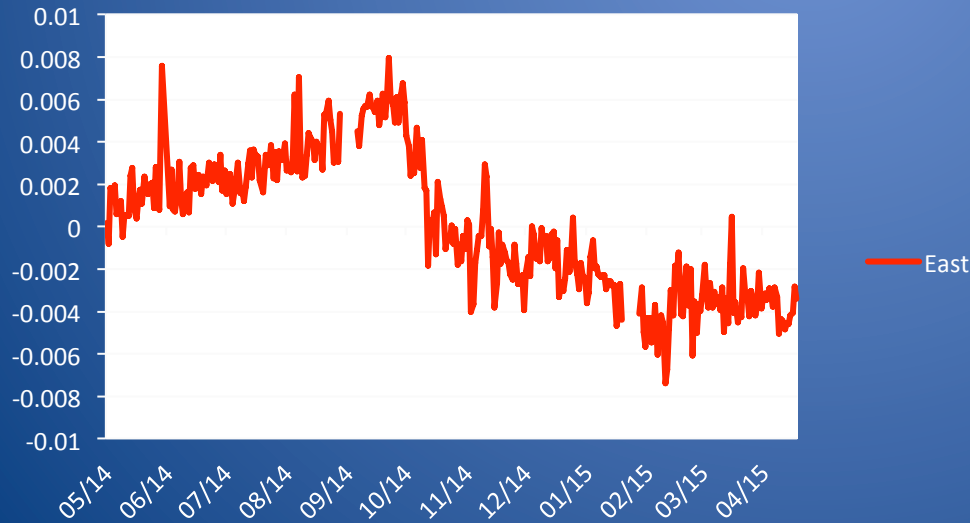
## Up



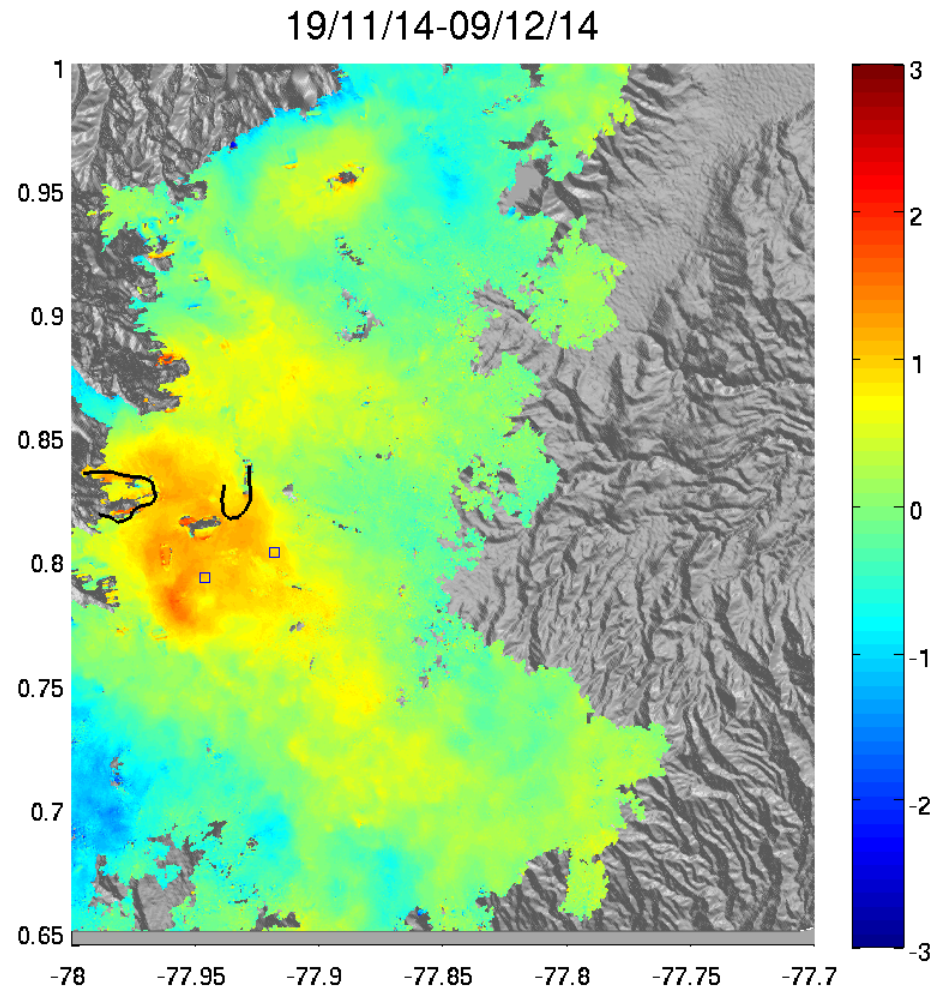
## North



## East



# Ground deformation



MANANTIAL	AGUAS HEDIONDAS			
Municipio	Tufino			
Datos fisicoquímicos	<b>1996</b>	<b>1997</b>	<b>2013</b>	<b>2014</b>
pH	5.7	4.9	4.5	3.85
Temperatura (°C)	54.5	46	67	55
Conductividad eléctrica (μS/cm)	N.A	1800	1190	2630



Cortesía de V. Burbano, OVSP – Servicio Geológico Colombiano





# Summary

- ❖ Swarm type seismicity since August 2013.
- ❖ VLP component in several events
- ❖ Pressure axis from focal mechanisms almost parallel to regional compression stress
- ❖ Shear wave splitting shows a bimodal stress orientation
- ❖ Cm-scale inflation of area around volcanic centers
- ❖ Changes on hot spring properties
- ❖ Data suggests a volcanic intrusion that affects hydrothermal system.