Few examples of EM methods applied to volcanoes and geotermal systems in north Chile

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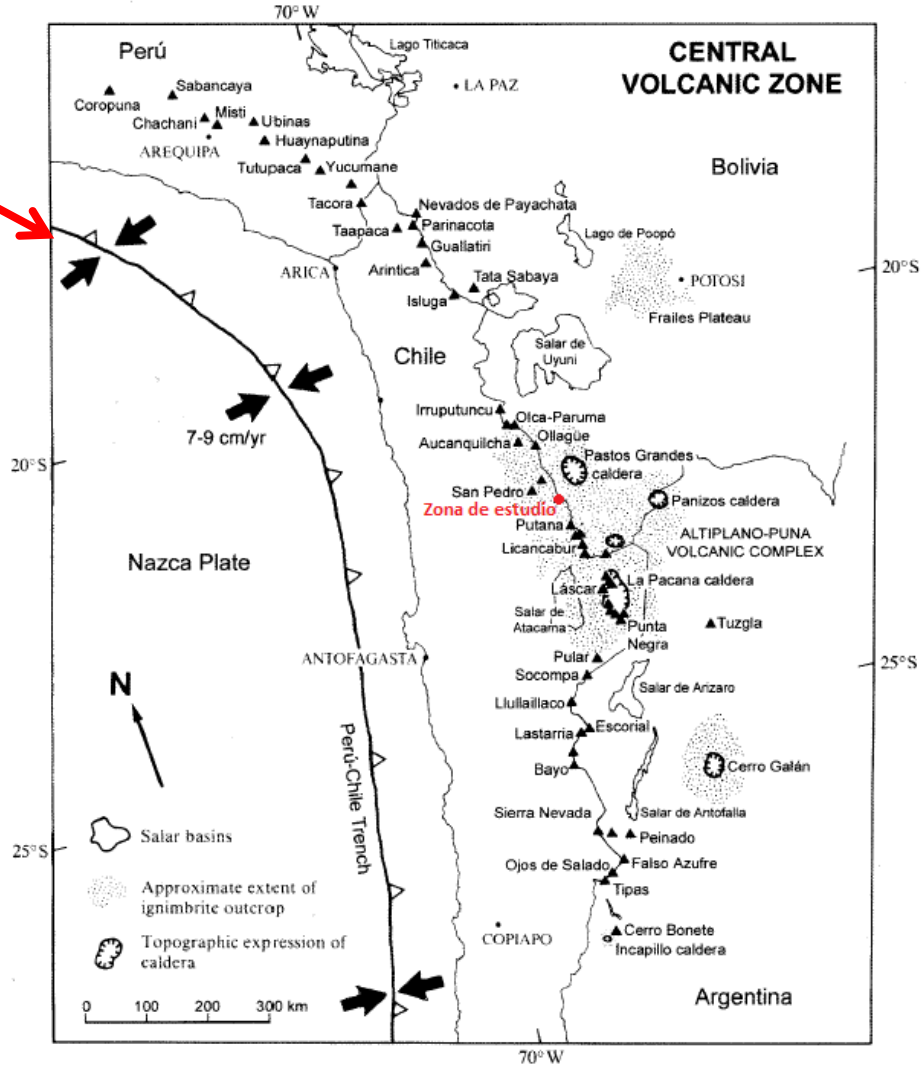
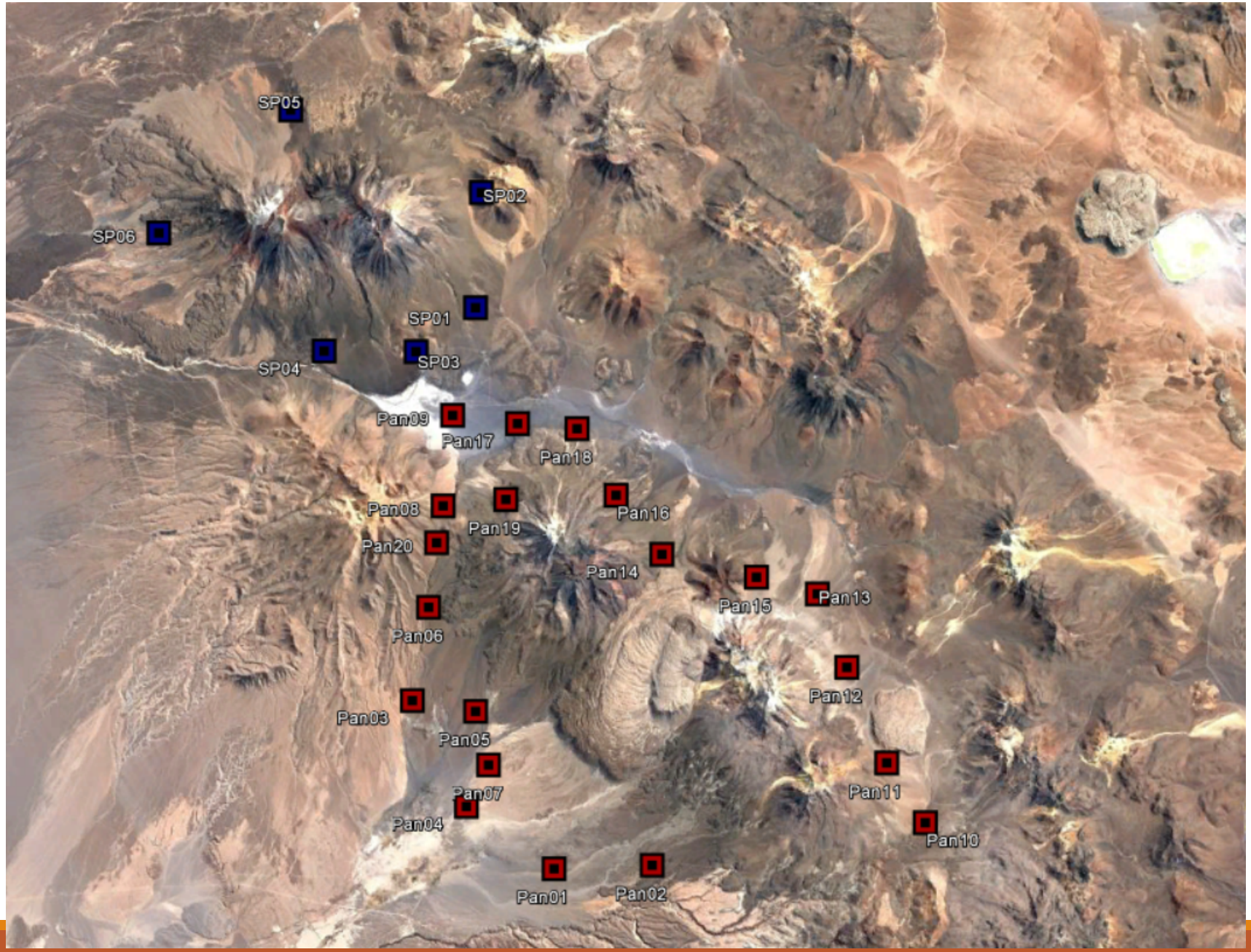
PERU
BOLIVIA
ARGENTINA
Pazific
Ocean
Atlantic
Ocean
Parinacota
Arica
Iquique
Licañabur
Antofagasta
Llullaillaco
Chañaral
Ojos del Salado
Copiapo
San–Félix–Island
San–Ambrosio–Island
Coquimbo
Valparaíso
Tupungato
San Antonio
SANTIAGO
Rancagua
Juan–Fernández–
Islands
Talcahuano
Concepción
Lebu
Temuco
Villarrica
Puerto Montt
Torres del Paine
Punta Arenas
Diego–Ramírez–Islands
7000
5000
3000
2000
1000
500
50
0
m
0
200
400
km
–16°
–24°
–32°
–40°
–48°
–56°
–80°
–72°
–64°


70° W
Perú
Bolivia
Chile
Argentina
CENTRAL
VOLCANIC ZONE
Lago Titicaca
• LA PAZ
Sabancaya
Coropuna
Chachani
Misti
Ubinas
Huaynaputina
AREQUIPA
Tutupaca
Yucumane
Tacora
Nevados de Payachata
Taapaca
Parinacota
Guallatiri
Lago de Poopó
ARICA
Arintica
Tata Sabaya
• POTOSI
Isluga
Frailes Plateau
Salar de
Uyuni
Irruputuncu
Olca-Paruma
Ollagüe
Aucanquilcha
Pastos Grandes
caldera
San Pedro
Zona de estudio
Panizos caldera
Putana
ALTIPLANO-PUNA
VOLCANIC COMPLEX
Licancabur
La Pacana caldera
Láscar
Salar de
Atacama
Punta
Negra
Tuzgla
Pular
ANTOFAGASTA
Socompa
Salar de Arizaro
Llullaillaco
Escorial
Lastarria
Cerro Galán
Bayo
Sierra Nevada
Salar de Antofalla
Peinado
Ojos de Salado
Falso Azufre
Tipas
Cerro Bonete
Incapillo caldera
COPIAPO
7-9 cm/yr
Nazca Plate
Perú-Chile Trench
N
Salar basins
Approximate extent of
ignimbrite outcrop
Topographic expression of
caldera
0
100
200
300 km
20°S
25°S
70° W

San Pedro – Linzor volcanic chain (Renzo Mancini)


SP05
SP02
SP06
SP01
SP04
SP03
Pan09
Pan17
Pan18
Pan08
Pan19
Pan16
Pan20
Pan14
Pan15
Pan13
Pan06
Pan12
Pan03
Pan05
Pan07
Pan11
Pan04
Pan10
Pan01
Pan02

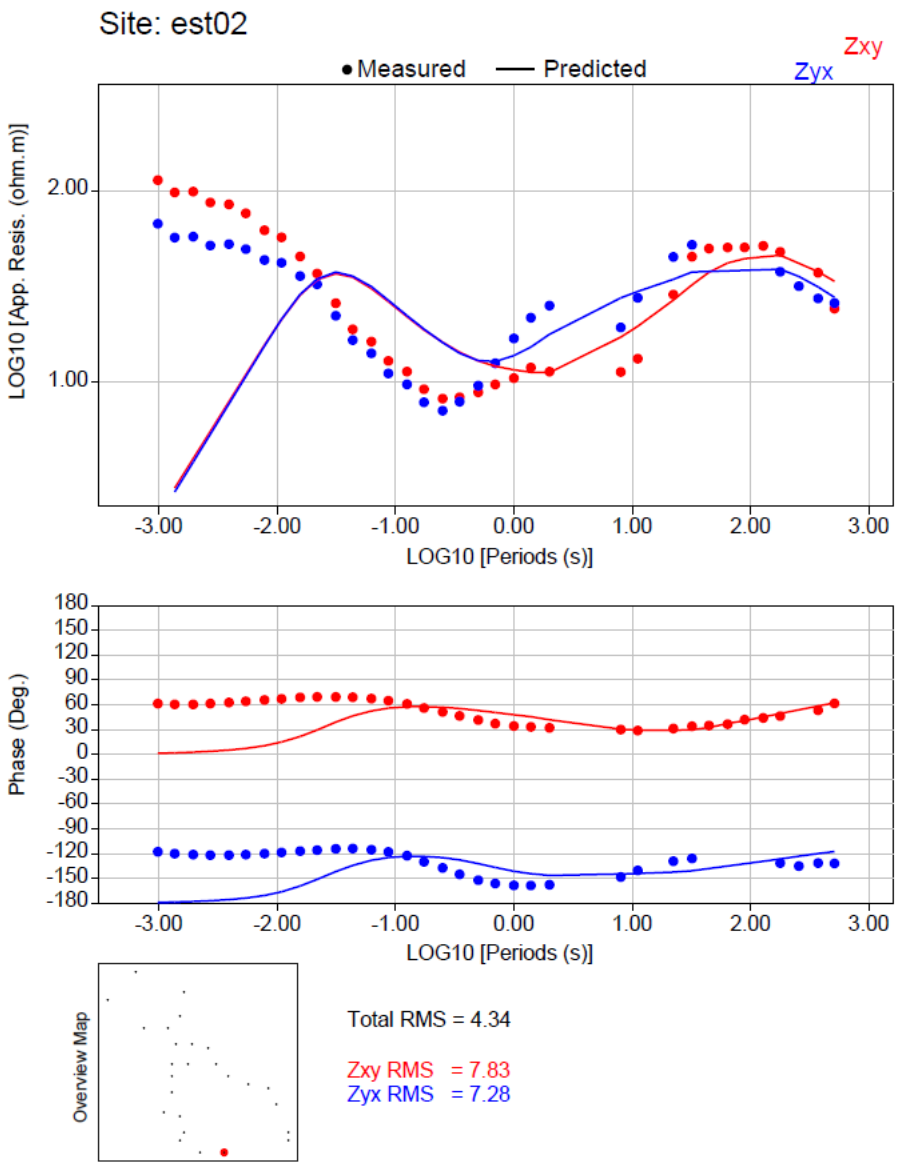
Daniel acá pongo el criterio final que se tomo para definir el ancho de la grilla (es el del paper)

In this area it was possible to see high variations in the topography, where for 15 km in the horizontal direction we have 2 km variation in the vertical direction, showing a high contrast in the west and east sides of the volcanic chain, finally this important topography influence showing a mismatch in the data, creating the need to consider the topography in the inversion to correct that, considering this anormal conditions in the field, we performed a criteria to determinate the discretization the horizontal direction for cases with a high topography contrast. We note 2 important features,

first: it was necessary to perform the most ne grid under the stations, in this case we use a logarithmic increase, which start under the stations and increase upwards and downward, creating a more ne grid under it. For this we use the 3DGrid program performed by Naser Meqbel.

Second: in this research we have difference of 2 km in the horizontal direction between stations, therefore it was no possible make the first consideration under all stations, then for decide where create the most ne grid, it was necessary consider the conductivity under it, prioritizing a finer grid under the most conductivity stations to avoid overlap in the same discretization block, because less resistivity generate lower penetrations (skin depth analysis).

Primeros ajustes antes de la topo



Ajuste final después de la topo

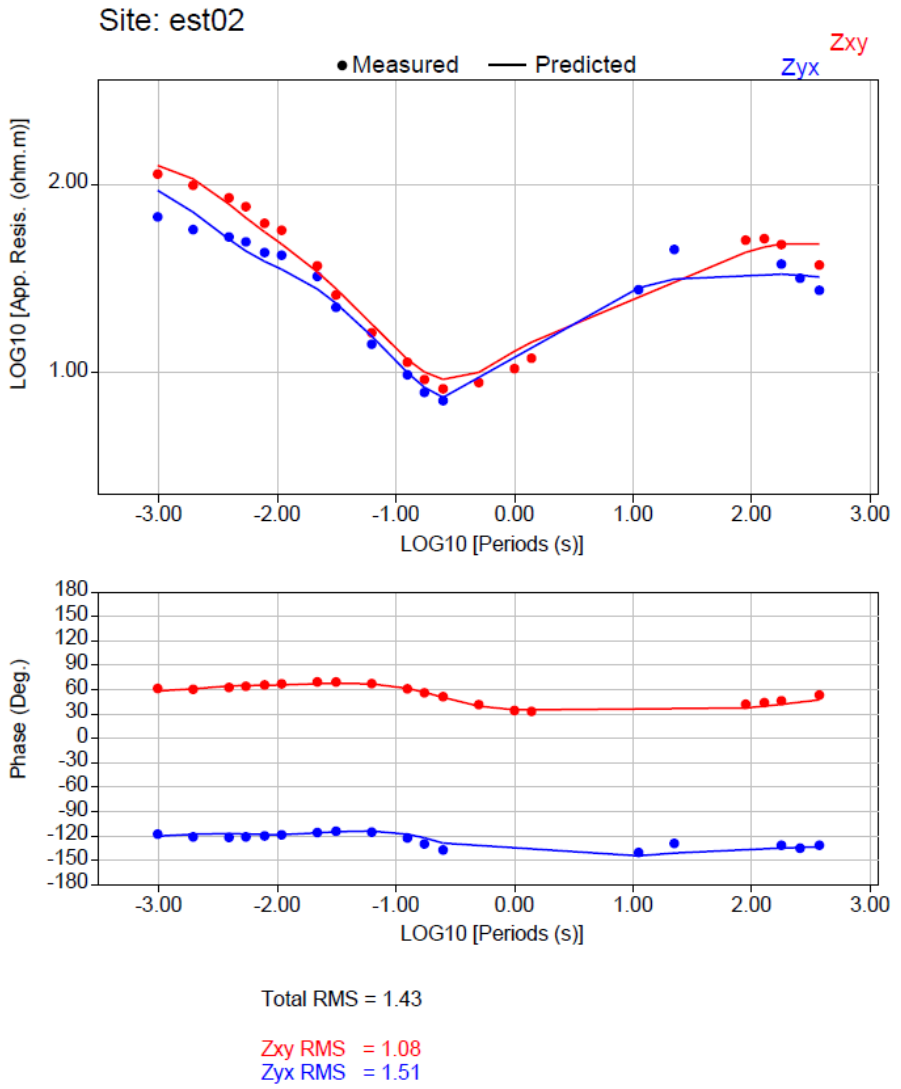
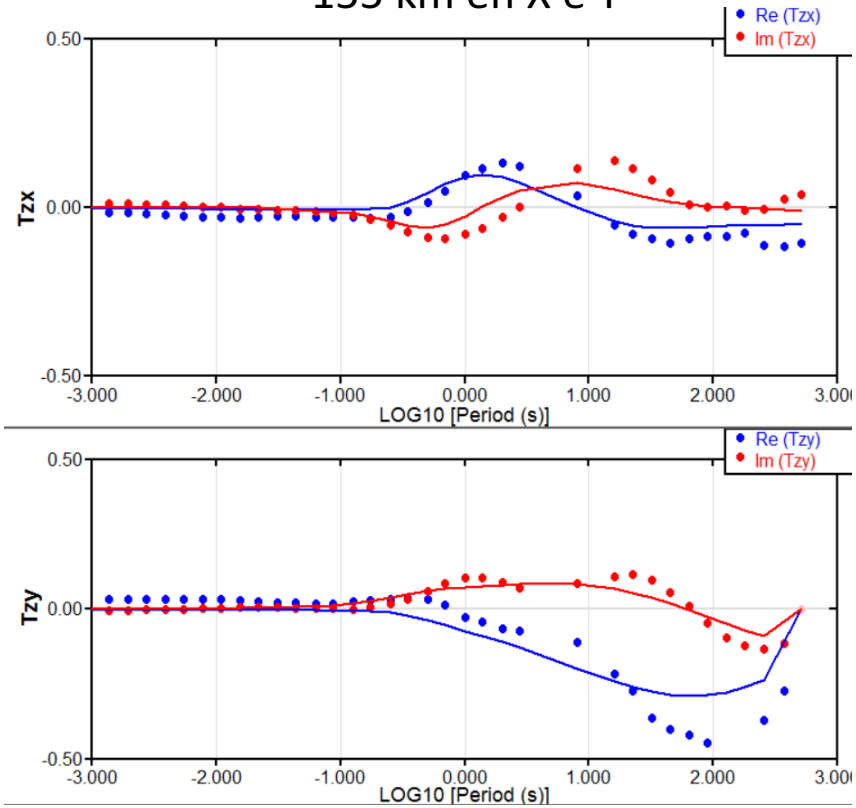
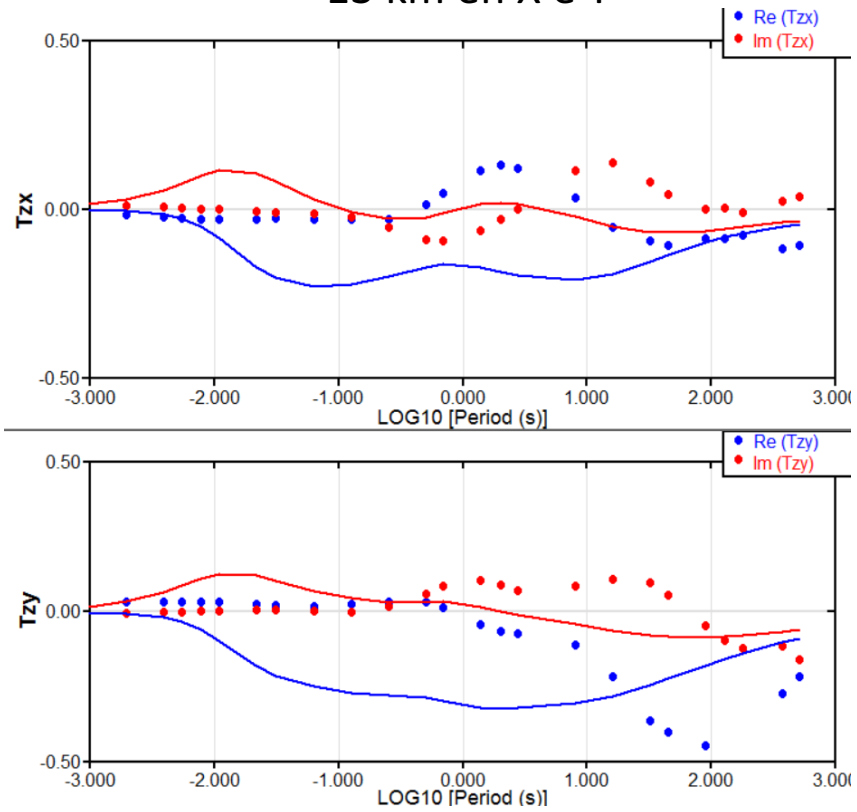


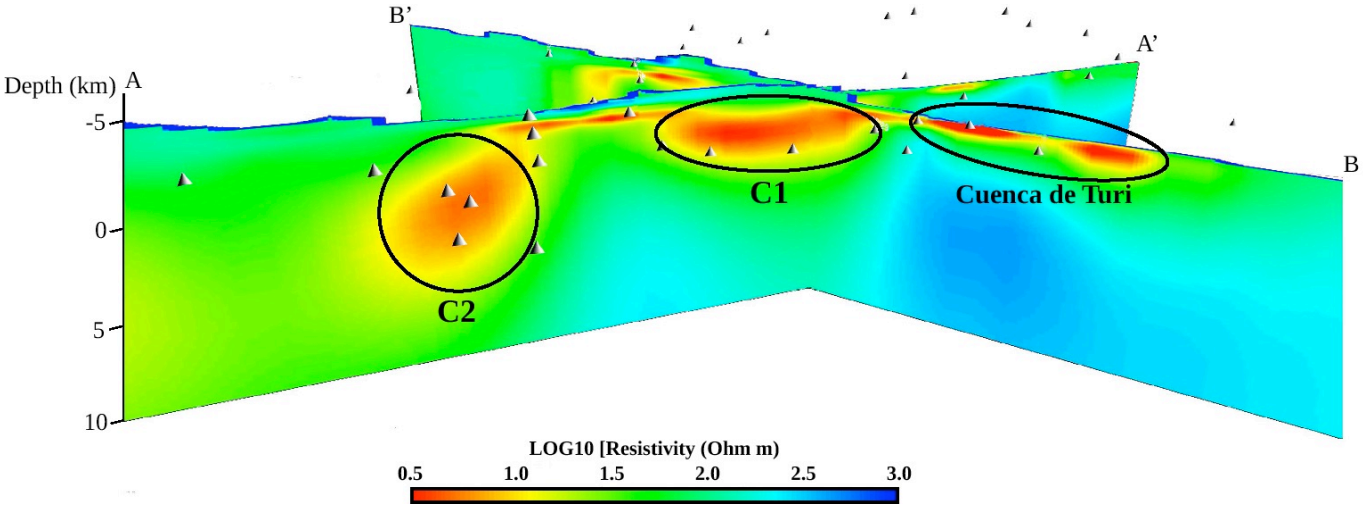
Grafico que muestra como mejora el tipper, aumentando el tamaño de la grilla, de 13 km Hasta 155 km

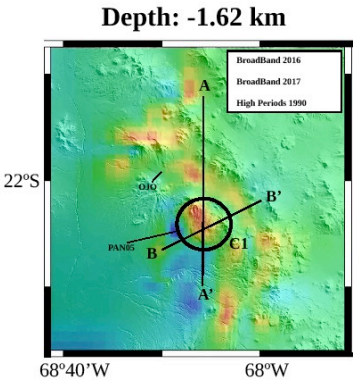
155 km en X e Y



13 km en X e Y




B'
A'
Depth (km)
A
-5
0
5
10
B
C1
Cuenca de Turi
C2
LOG10 [Resistivity (Ohm m)
0.5
1.0
1.5
2.0
2.5
3.0


Depth: -1.62 km
BroadBand 2016
BroadBand 2017
High Periods 1990
A
B'
C1
B
A'
22°S
68°40'W
68°W

El Tatio – La Torta Geothermal Field (Ariel Figueroa)

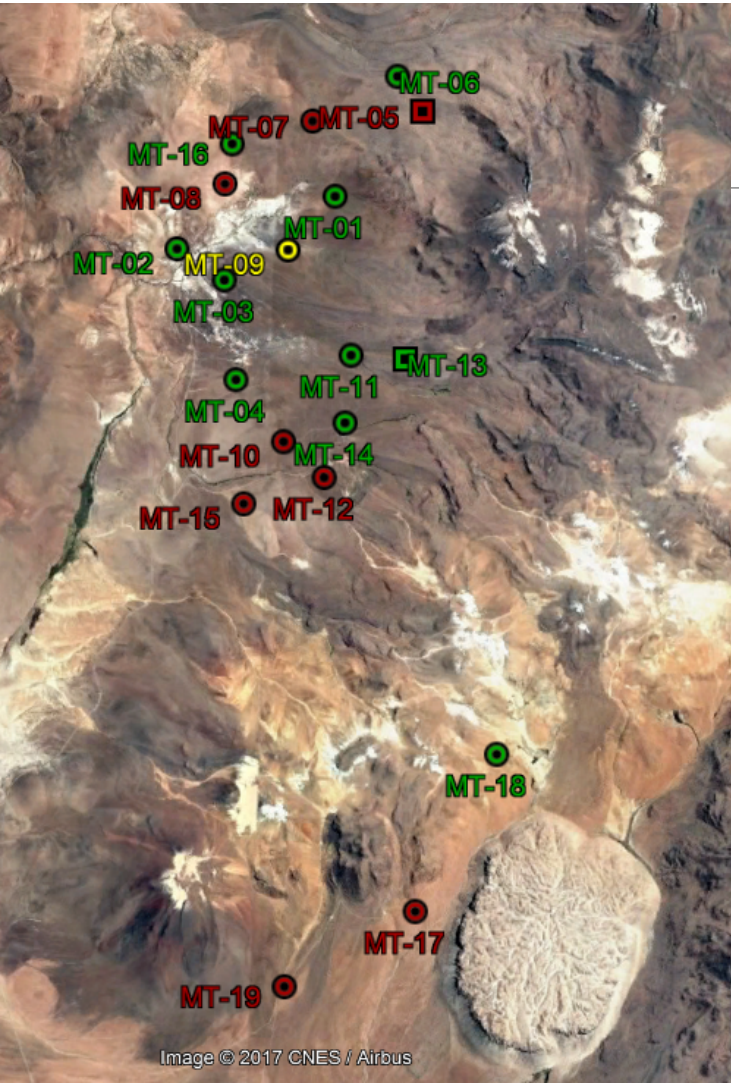
El Tatio – La Torta Geothermal Field

El Tatio geyser field contains more than 80 active geysers (8% of the world) and is largest in the southern hemisphere.

It is located in northern Chile at an elevation of 4200 to 4300 m.

Diverse thermal features have been reported, including geysers, springs, perpetual spouters, mud pools, mud volcanoes, and fumaroles.

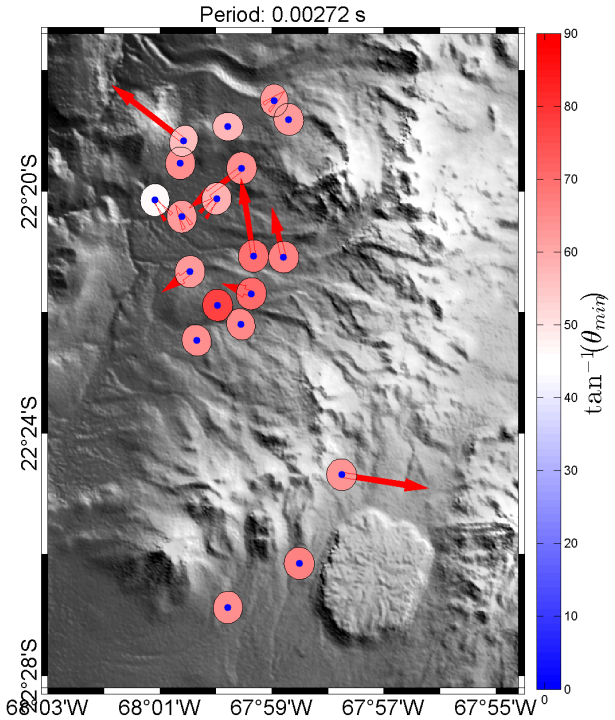
The field is situated among Holocene andesitic stratovolcanoes and domes (La Torta), which might provide the heat for the geothermal system, but no historical eruptions were documented.

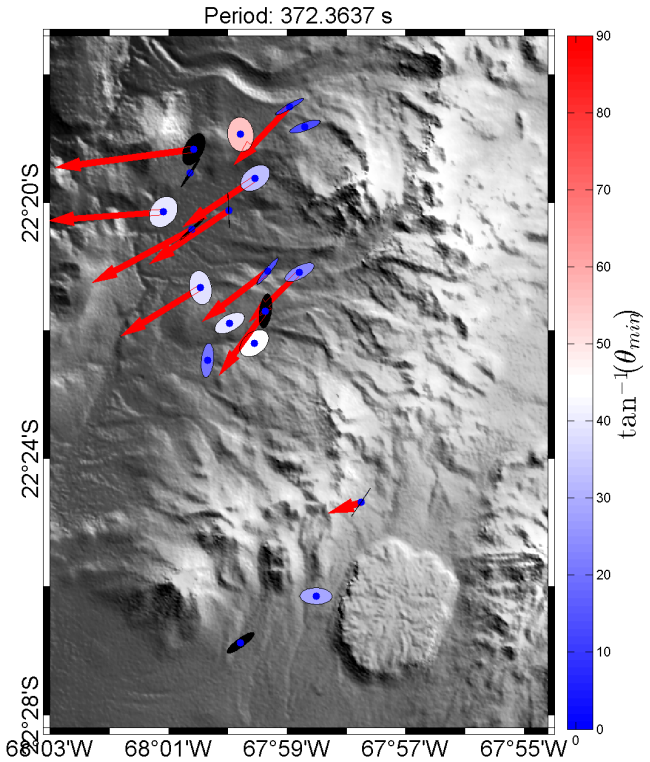


MT Points in El Tatio

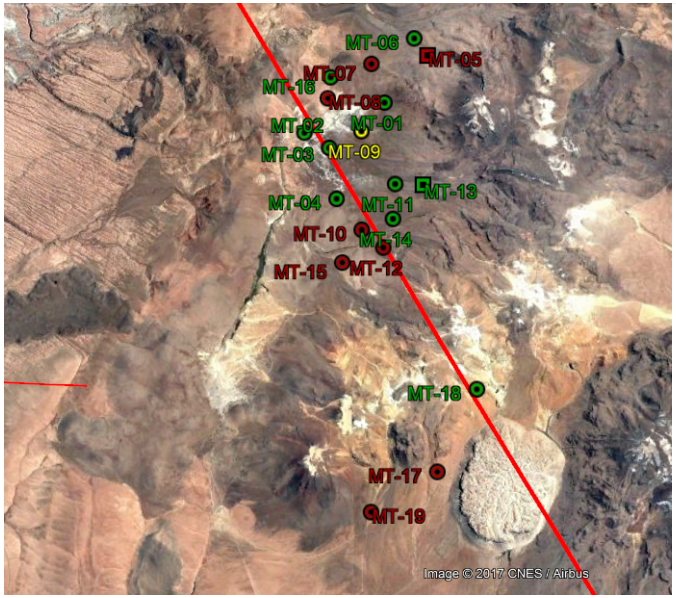
19 mt points were measured during this year

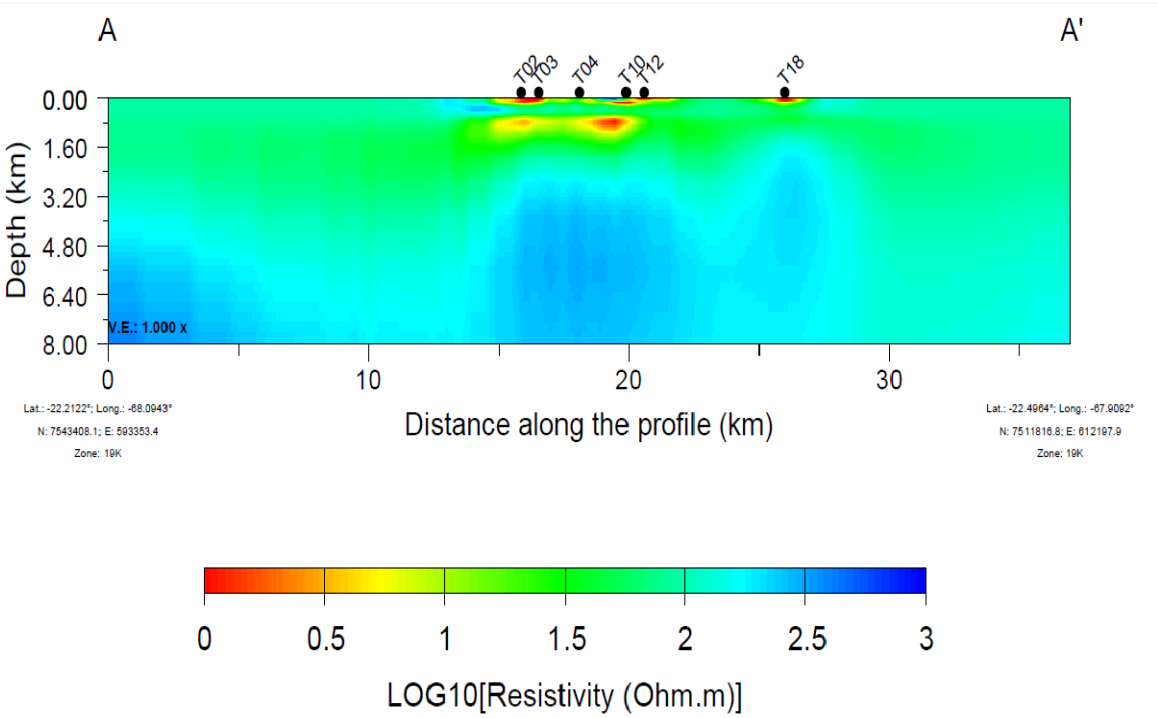
Dimensional analysis





Preliminary results: inversion model (rms: 1.59)





Data fitting