3D Geodynamic Models of the Present-Day Altiplano-Puna Magmatic System

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magma-project.eu

European Research Council

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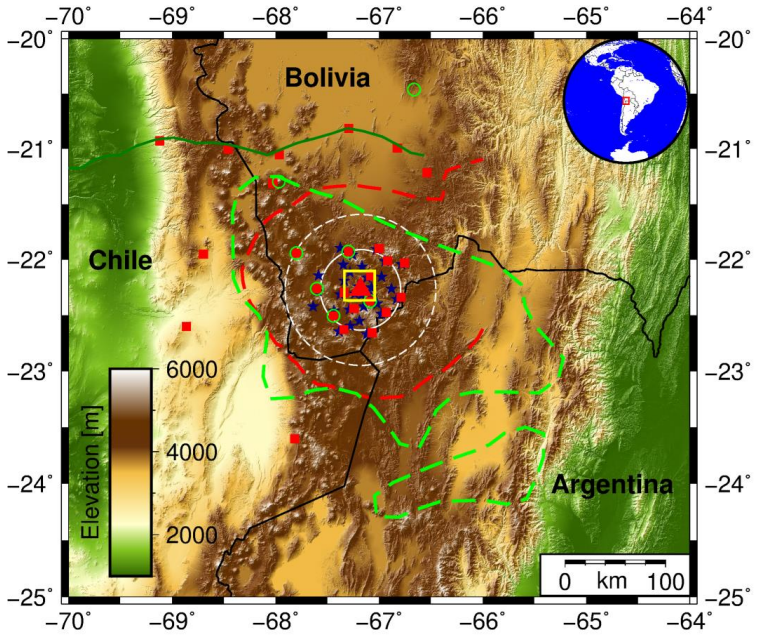
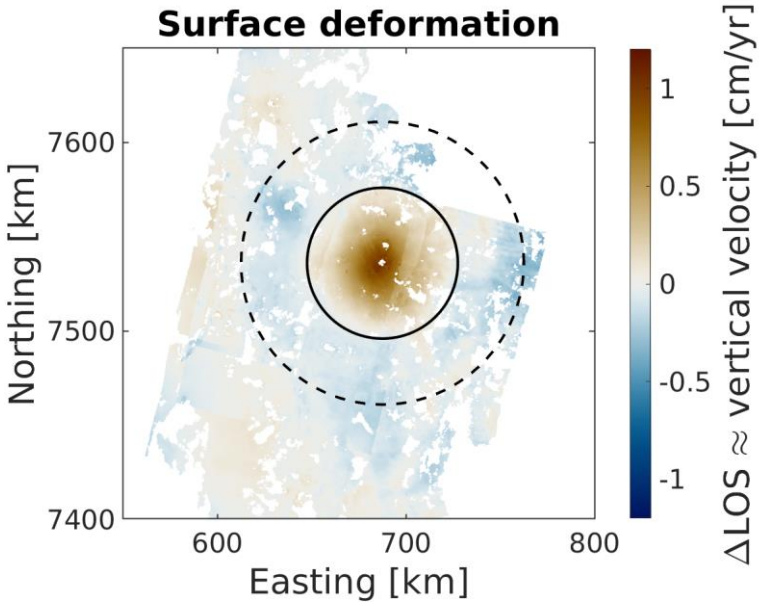
Motivation

- **Combining data** from seismic imaging, gravity anomalies, petrology and geodesy (InSAR) with **geodynamic modelling** (Stokes code LaMEM[1])
- Making magma body **geometry** a **variable quantity**

Area of Interest

- Puna Plateau, Andes
- Concentric uplift at central volcano
- Previous studies: Caused by inflating magma body





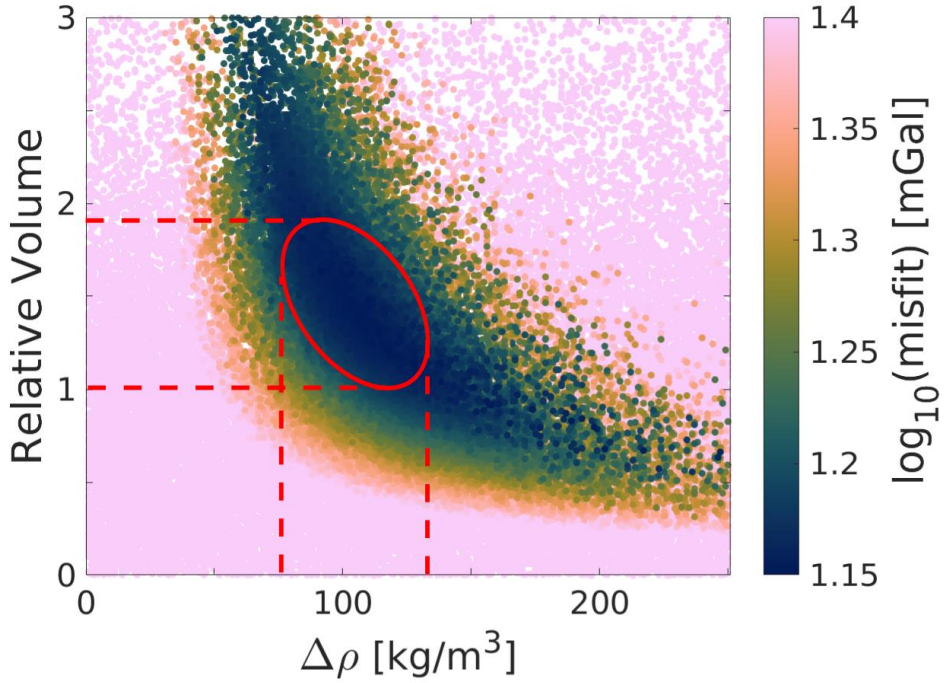
[1] Kaus et. al, 2016

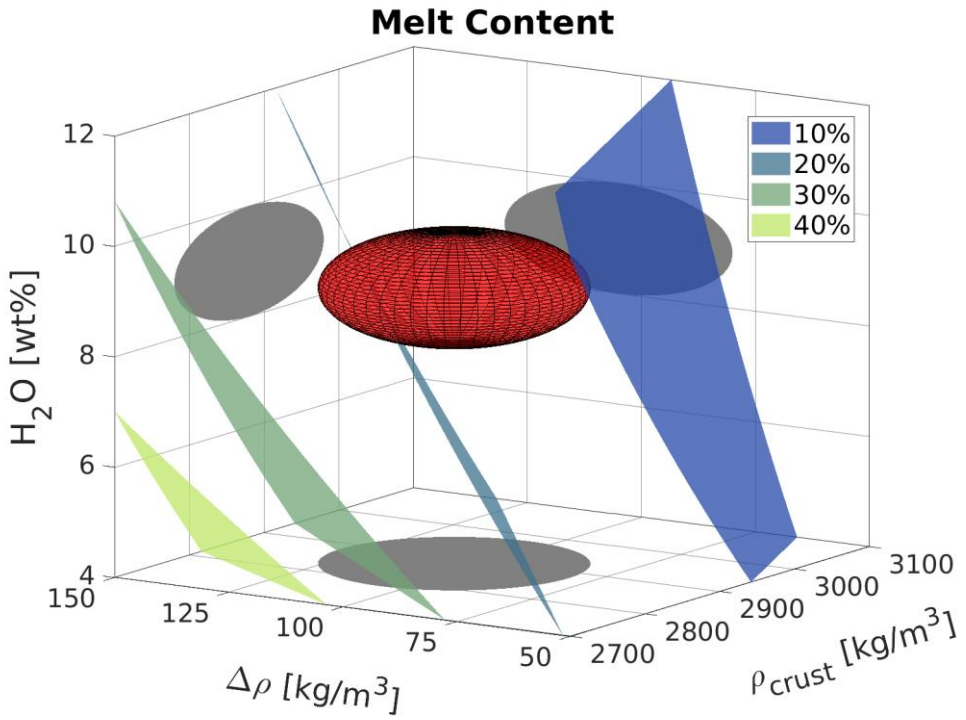
Modified from Fialko & Pearse, 2012

Findings - Gravity

- Magma body could change shape, size and Δρ to the crust
- Bouguer anomaly was computed and compared to data
- Relative Volume = combination of 5 geometric parameters

→ **Δρ = 80 - 130 kg/m³**





- Constraints on Δρ, ρ_{crust} & water content (red ellipsoid) and magma composition (from eruption products) allow for melt content estimation

→ **14-22% melt in magma body**

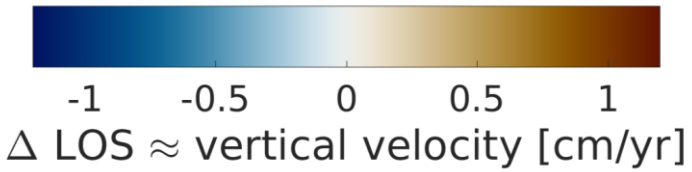
Findings - Geodynamics

- Material flows from outskirts of magma body towards a central rise in the body (Figure A)
- Flow strongly reduced for narrower central rise (half diameter of A) (Figure B)

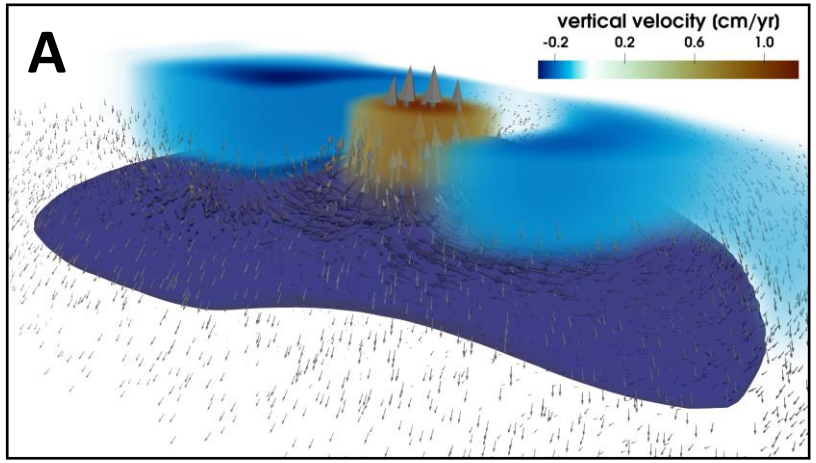
→ Surface velocity **solely** caused by **buoyancy**

→ Flow pattern **develops self-consistently** (no prescribed pressure/inflation)

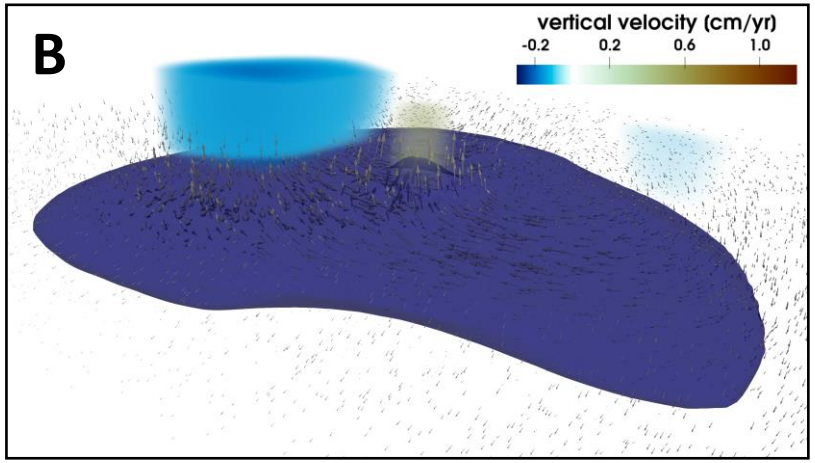
→ Surface velocity strongly depends on **geometry** of **central rise**

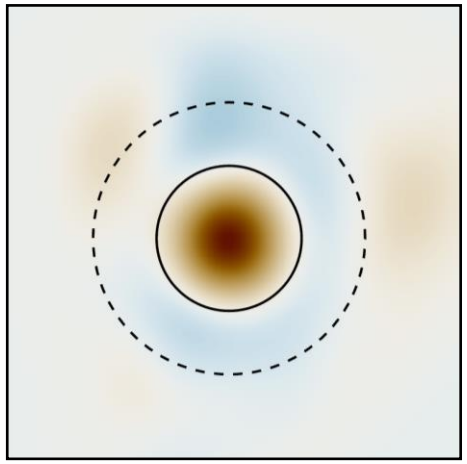


Reference run

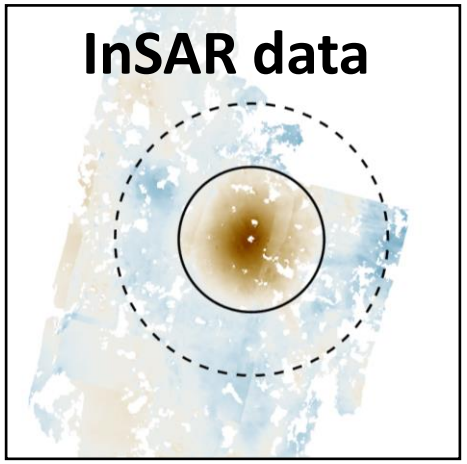


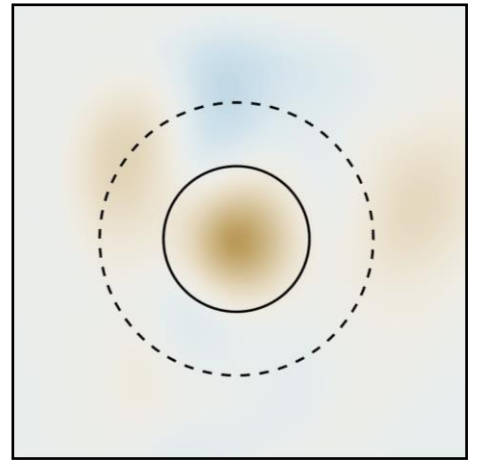
Narrow central rise (50%)





InSAR data





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