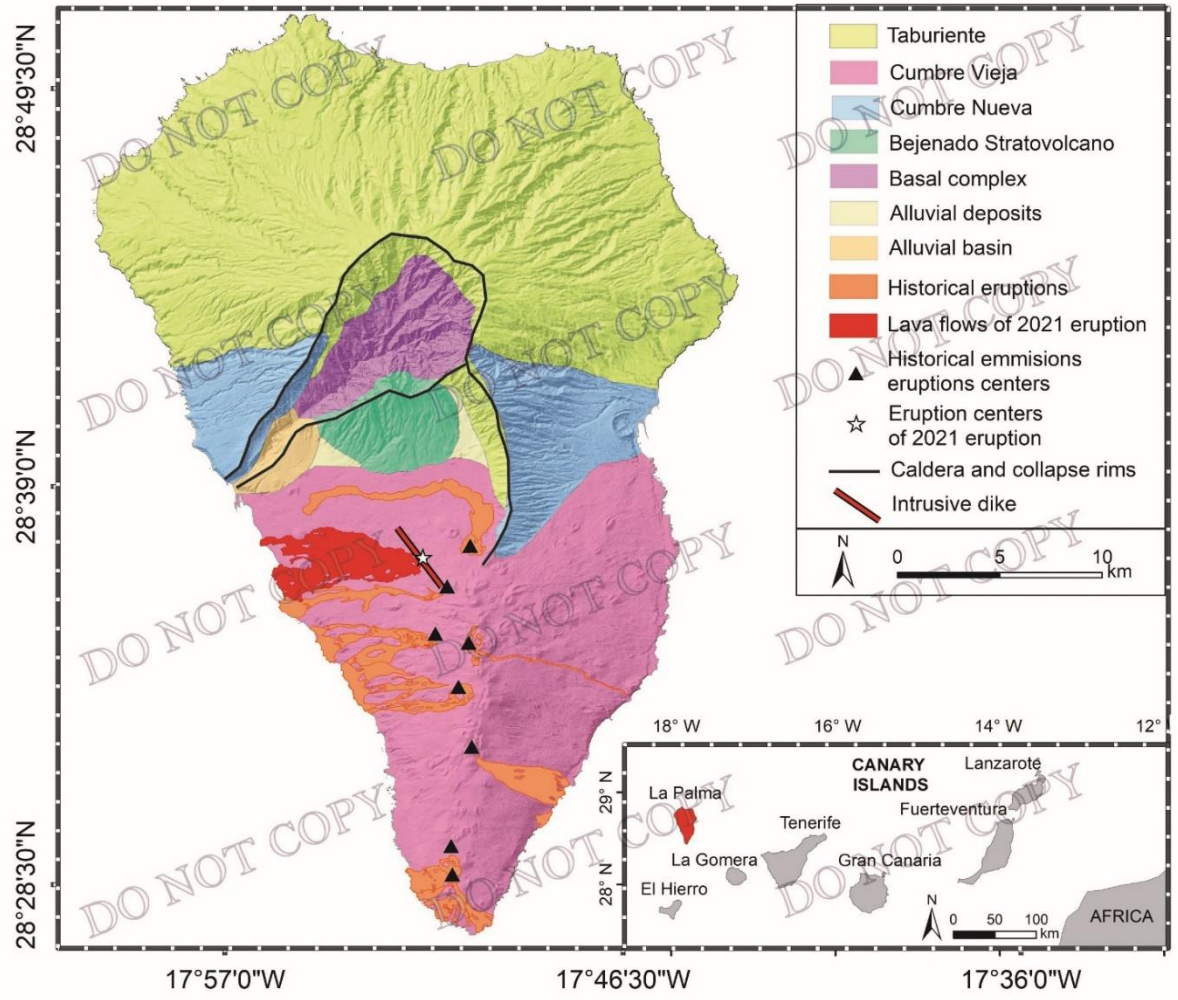
# Geodetic imaging of the magma ascent process during the 2021 Cumbre Vieja (La Palma, Canary Islands) eruption

**Monika Przeor**, José Barrancos, Raffaele Castaldo, Luca D'Auria, Antonio Pepe, Susi Pepe,

Takeshi Sagiya, Giuseppe Solaro and Pietro Tizzani

# INTRODUCTION

## ON 19th OF SEPTEMBER 2021 THE ERUPTION STARTED

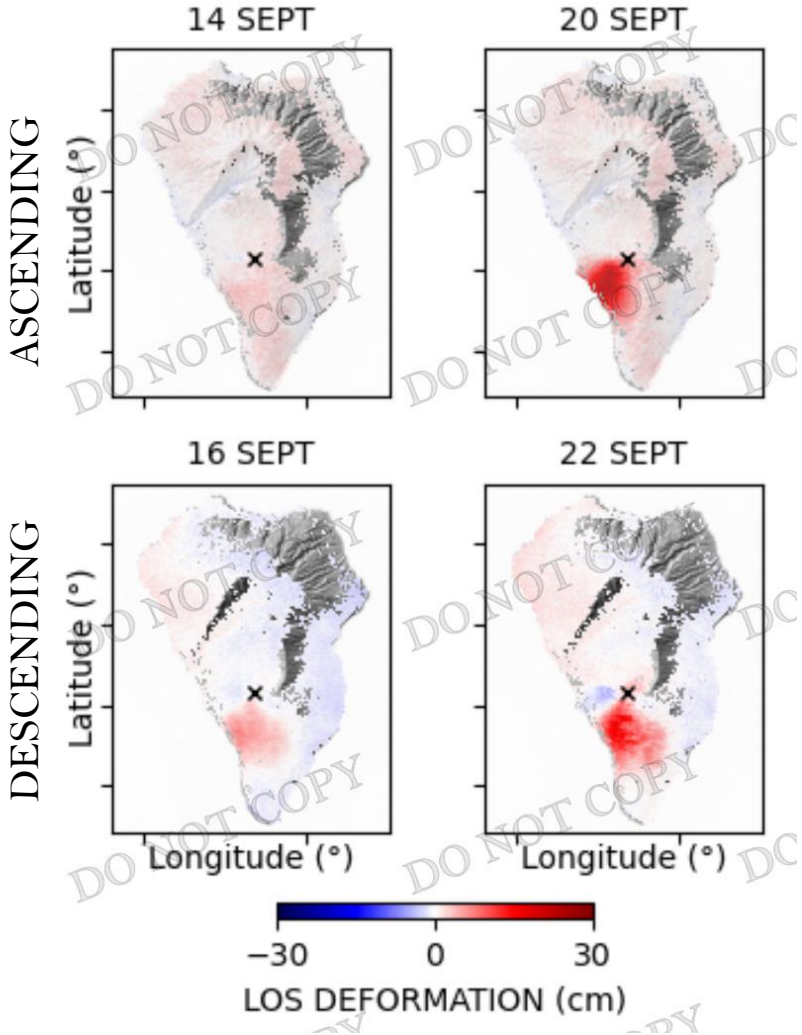



# METHODOLOGY

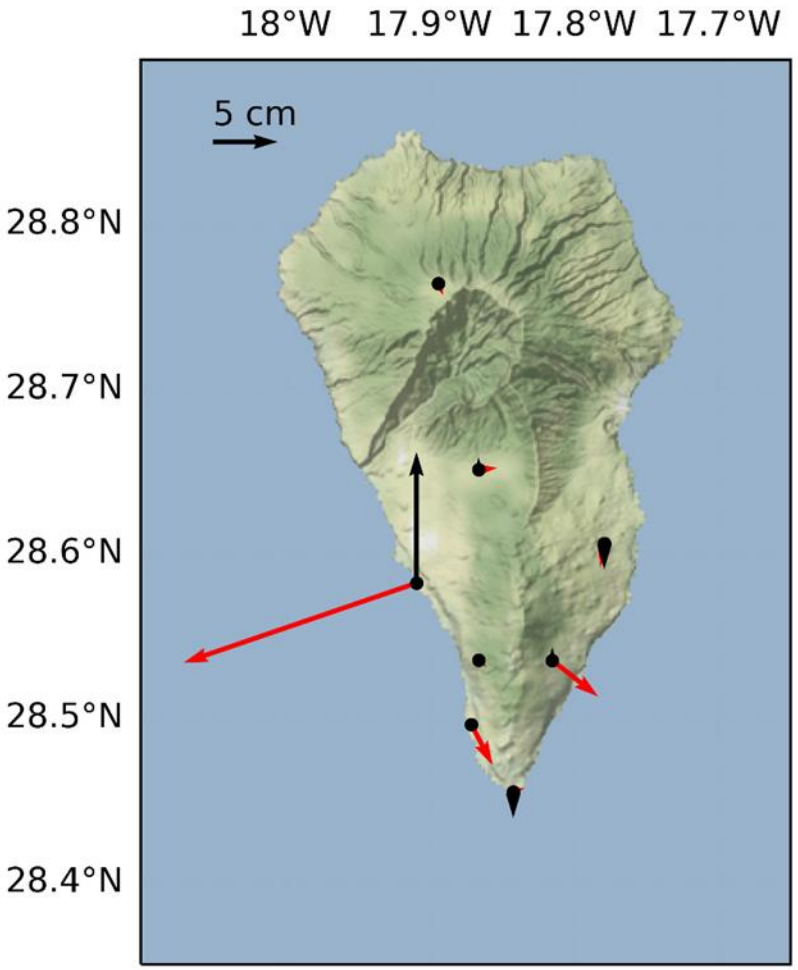
SENTINEL-1
Acquisition from 8 of September to 20 of October.

GNSS data of INVOLCAN.
Continuous data since 2010

## Processing of DInSAR

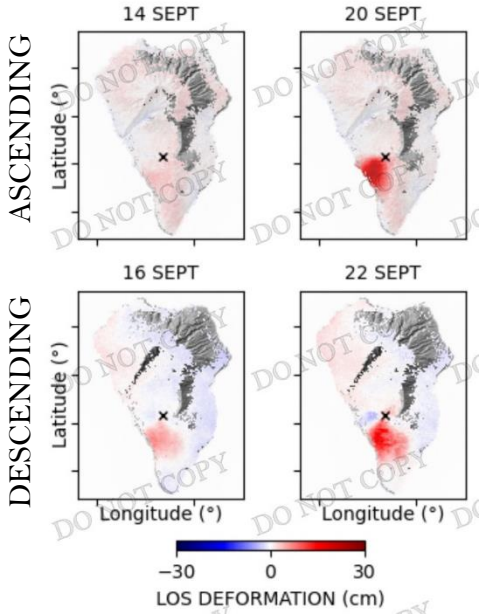


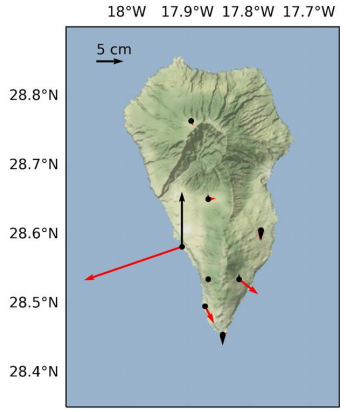

## Processing of GNSS



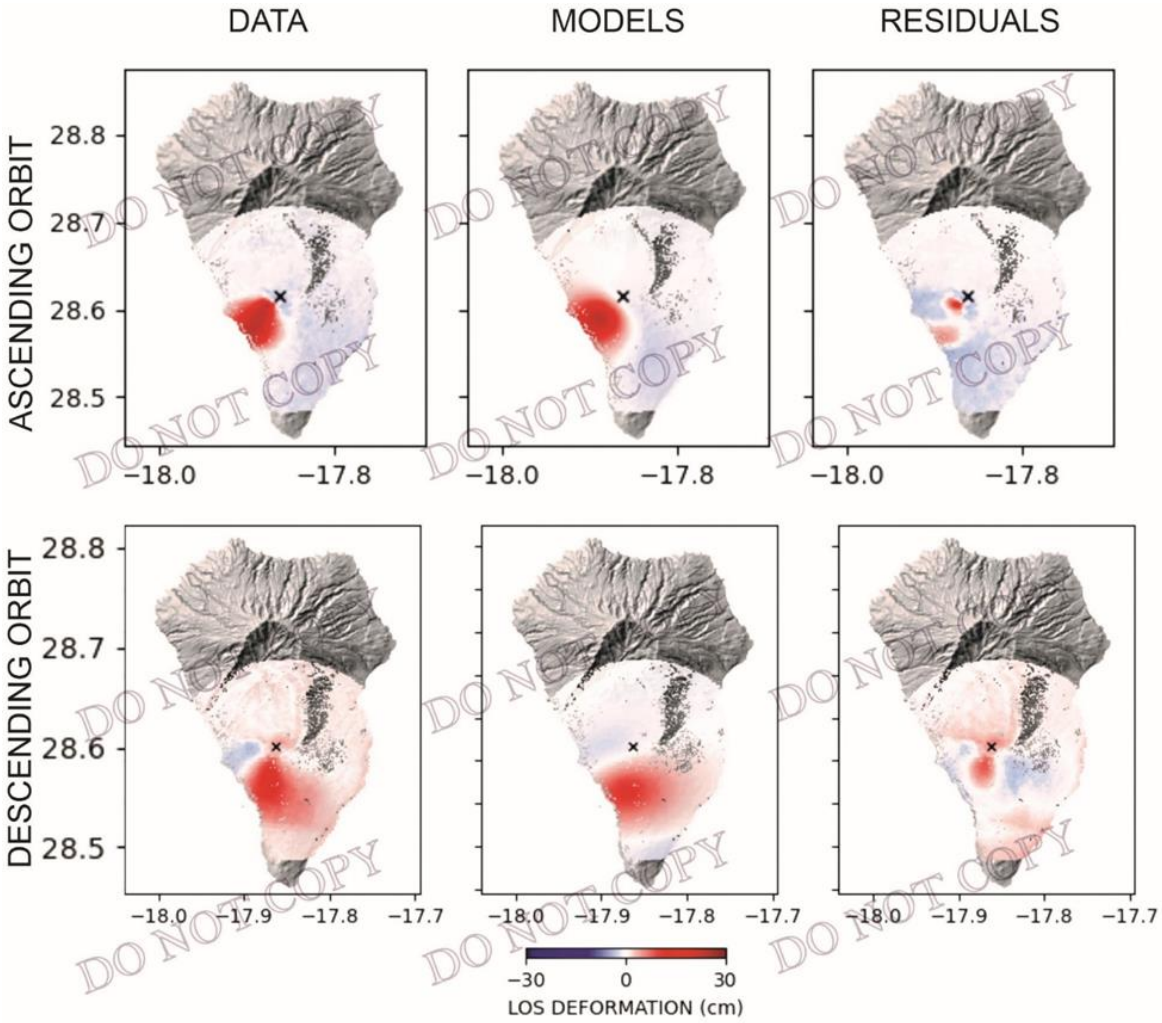
# METHODOLOGY

DInSAR and GNSS data



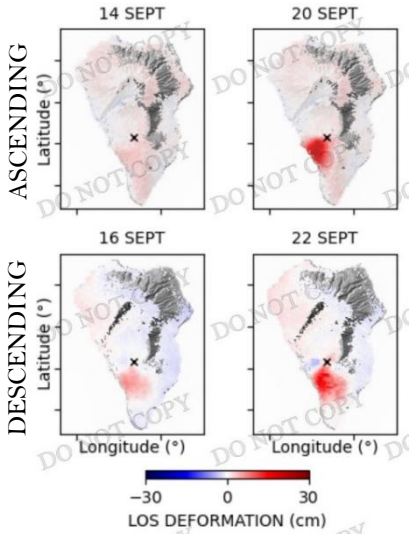



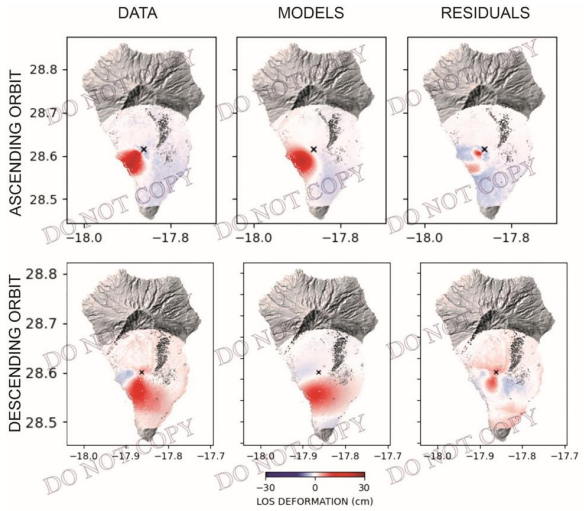

Non-linear inversion

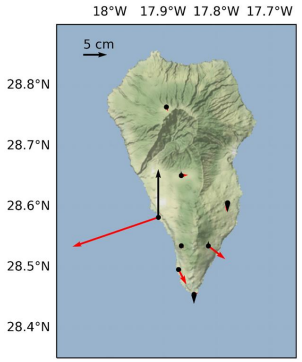


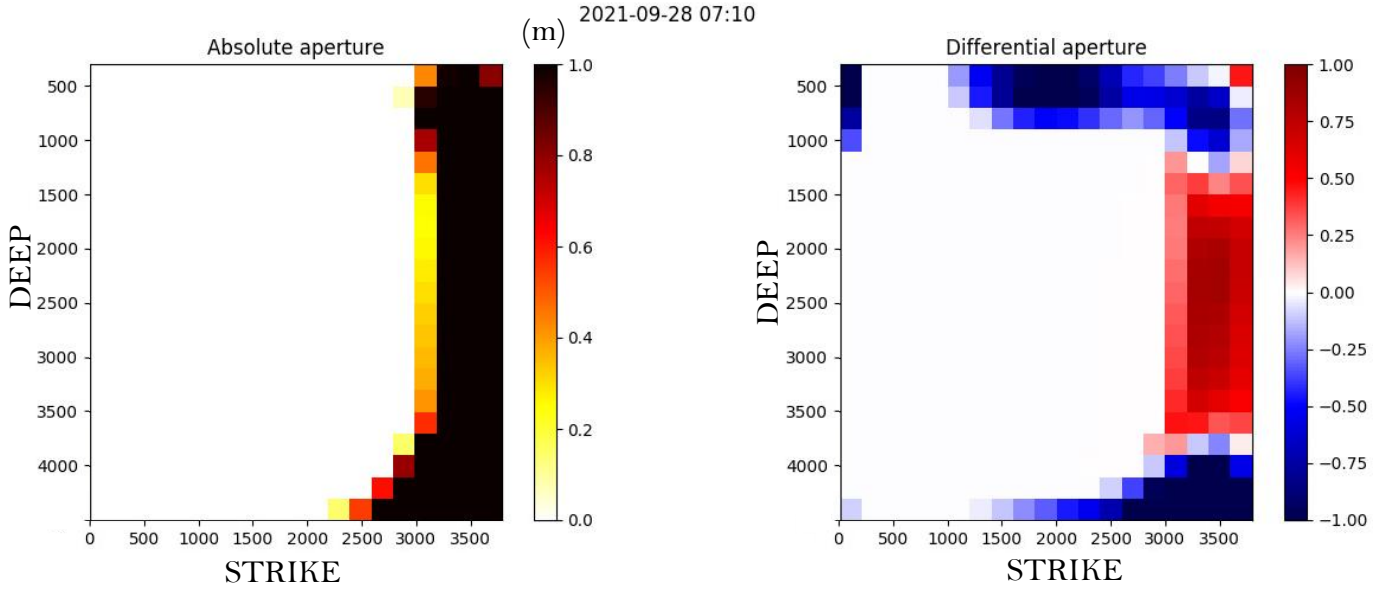
# METHODOLOGY

DInSAR and GNSS data ⟹ Non-linear inversion ⟹ Geodetic imaging approach of D'Auria



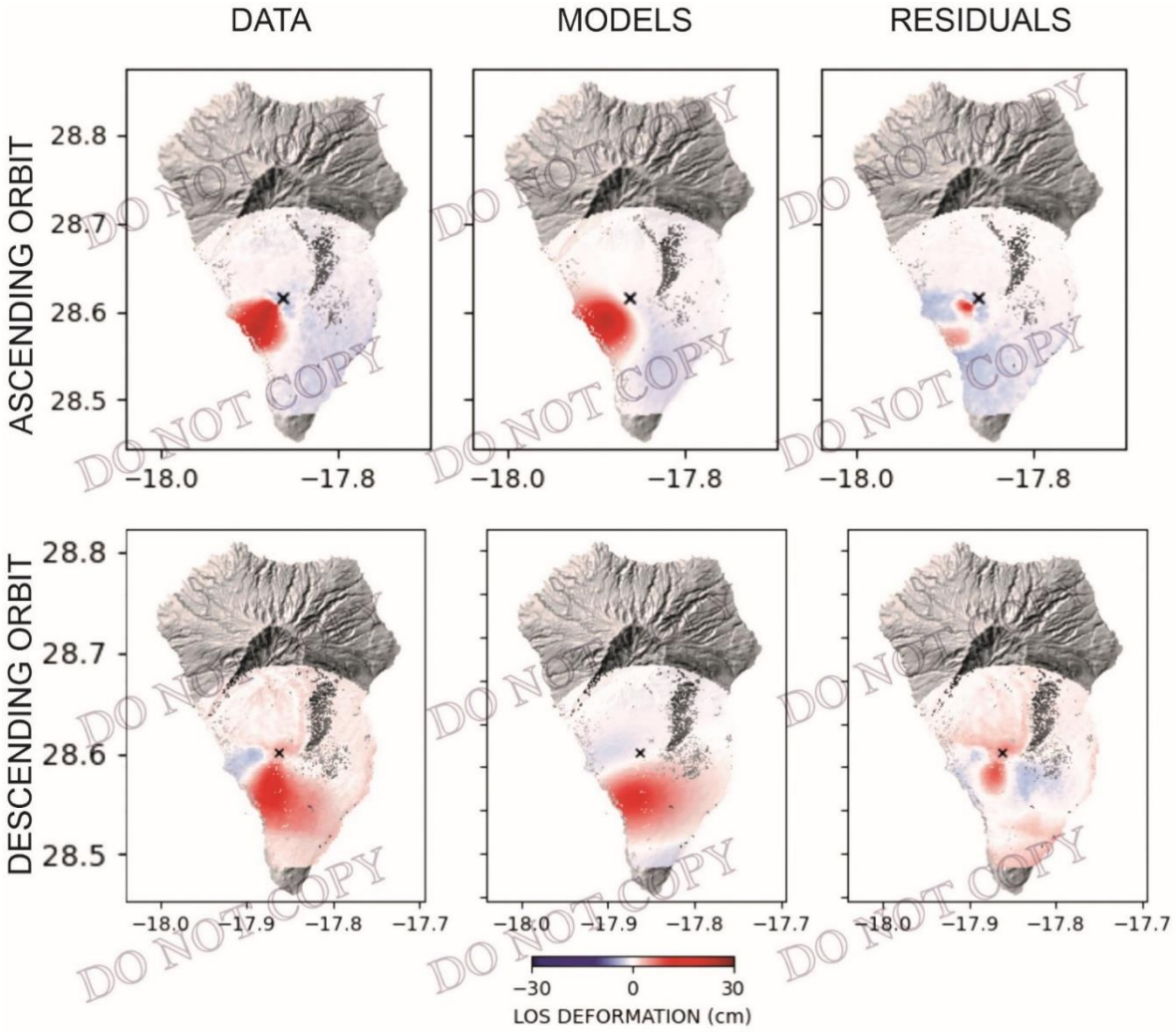




Non-linear inversion of the spatio-temporal pattern with Tikhonov regularization and positivity constraint.

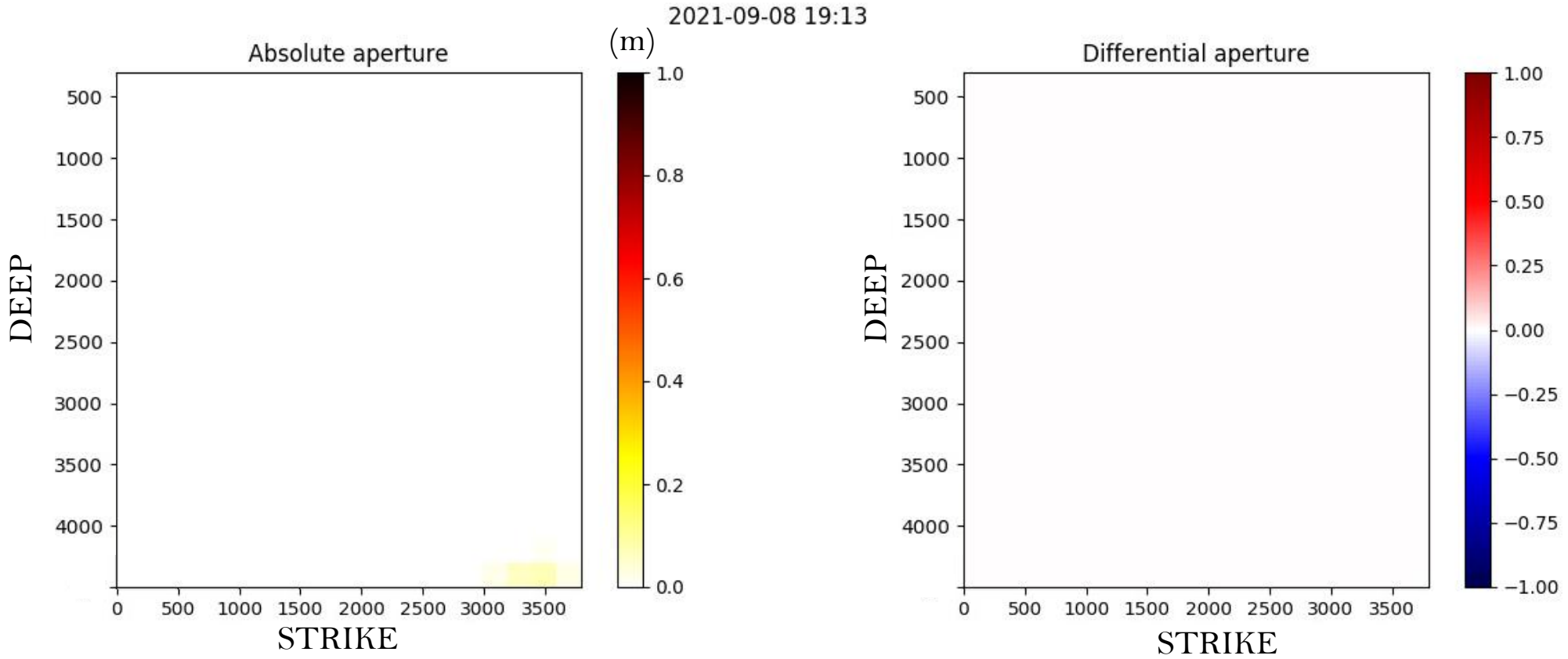
# RESULTS

## NON-LINEAR INVERSE MODELING



# RESULTS

## GEODETIC IMAGING



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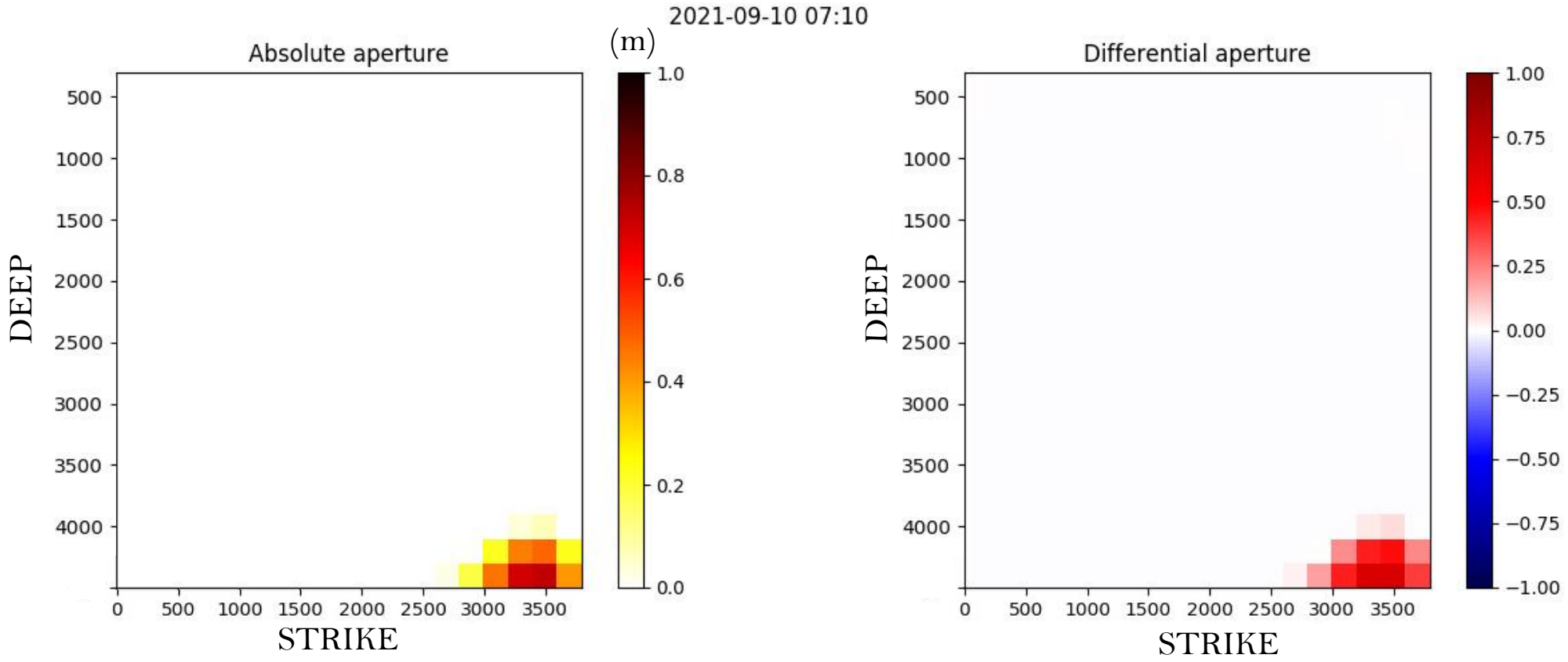

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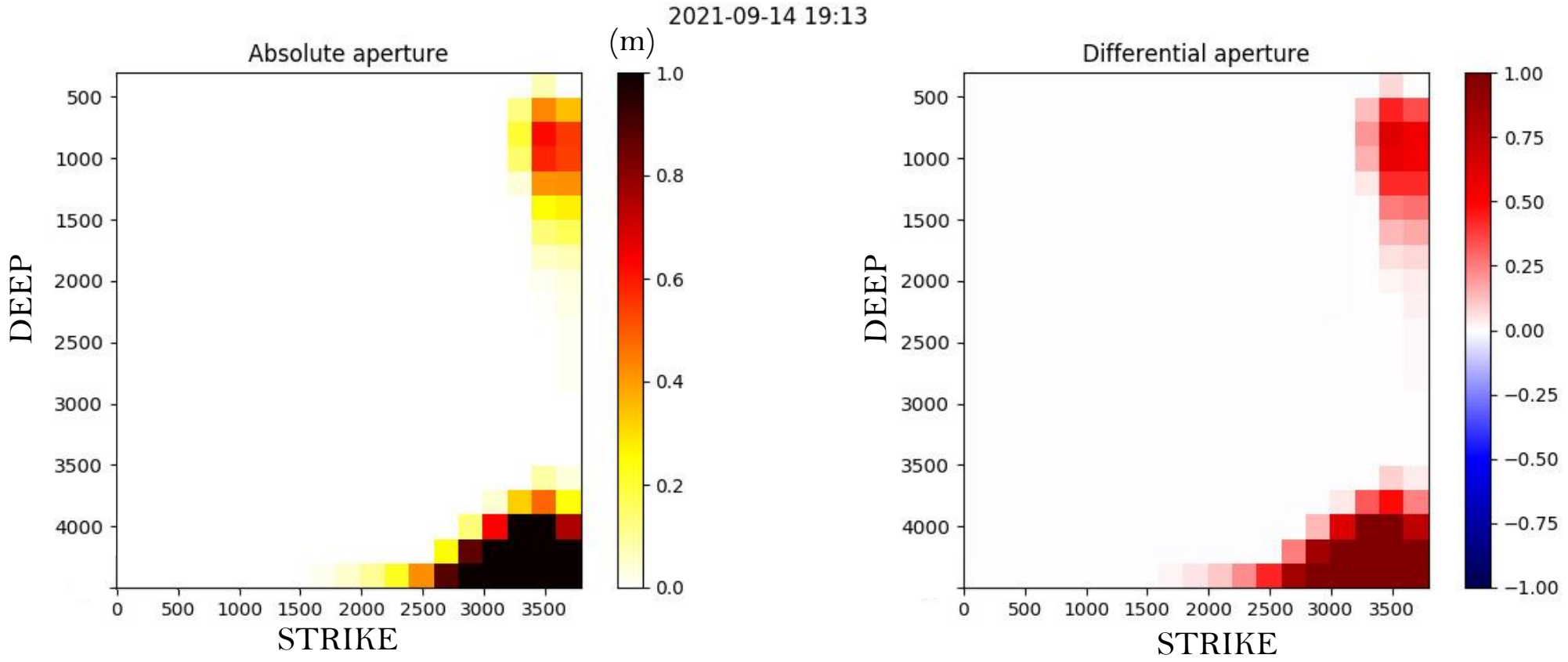

# RESULTS

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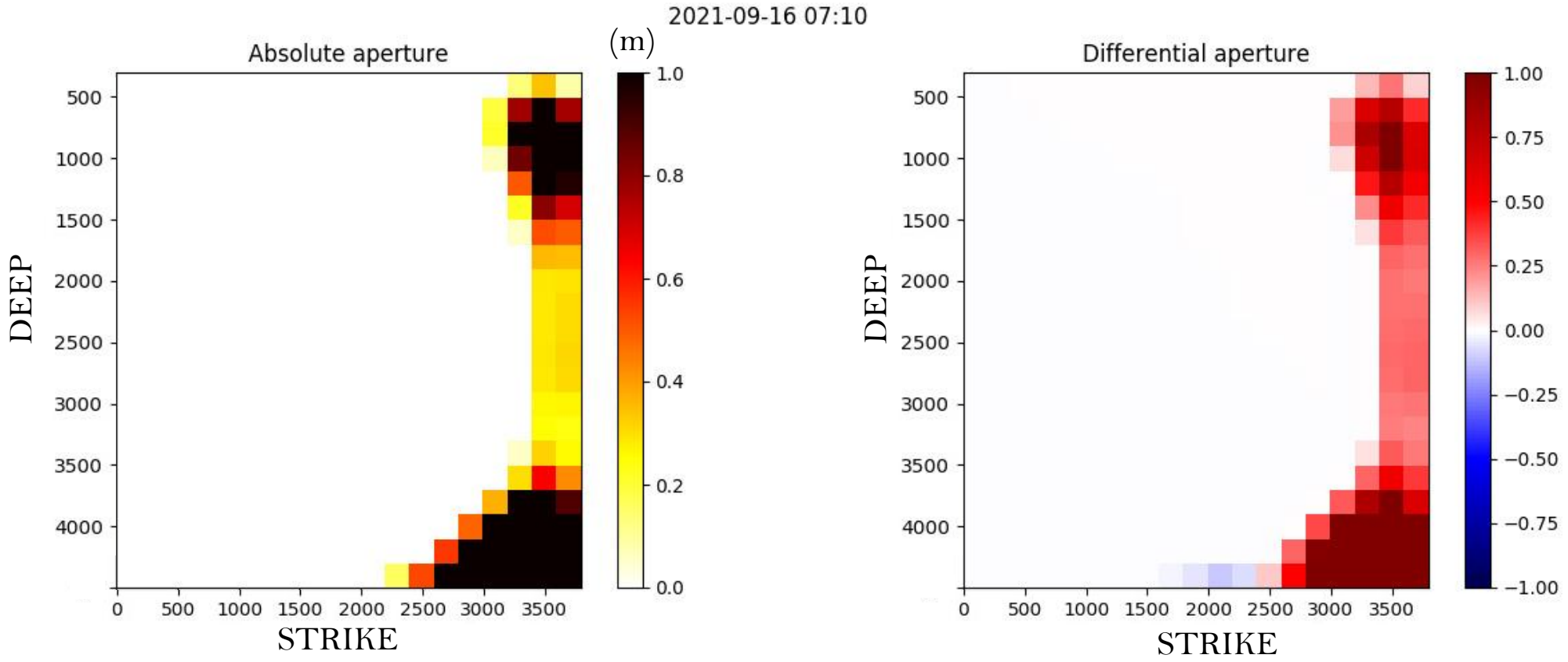

# RESULTS

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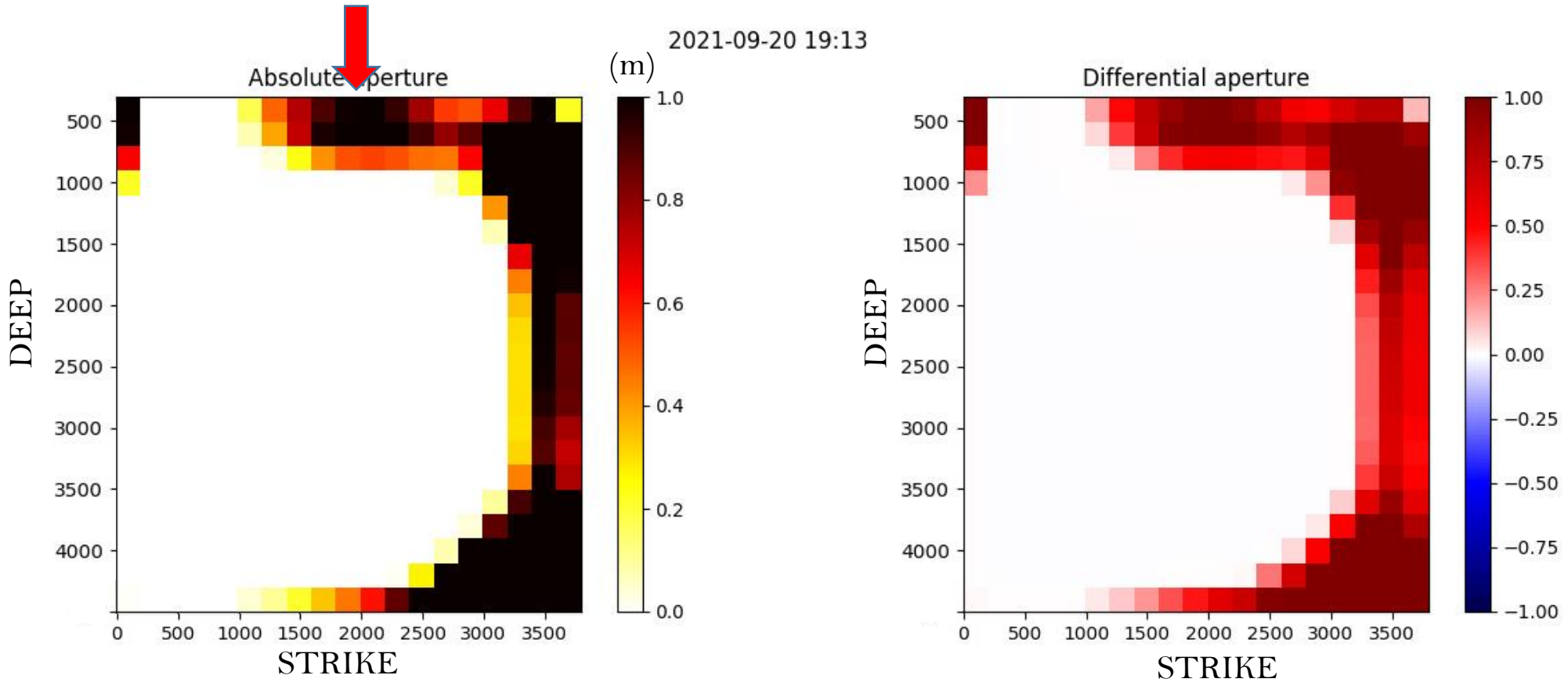

# RESULTS

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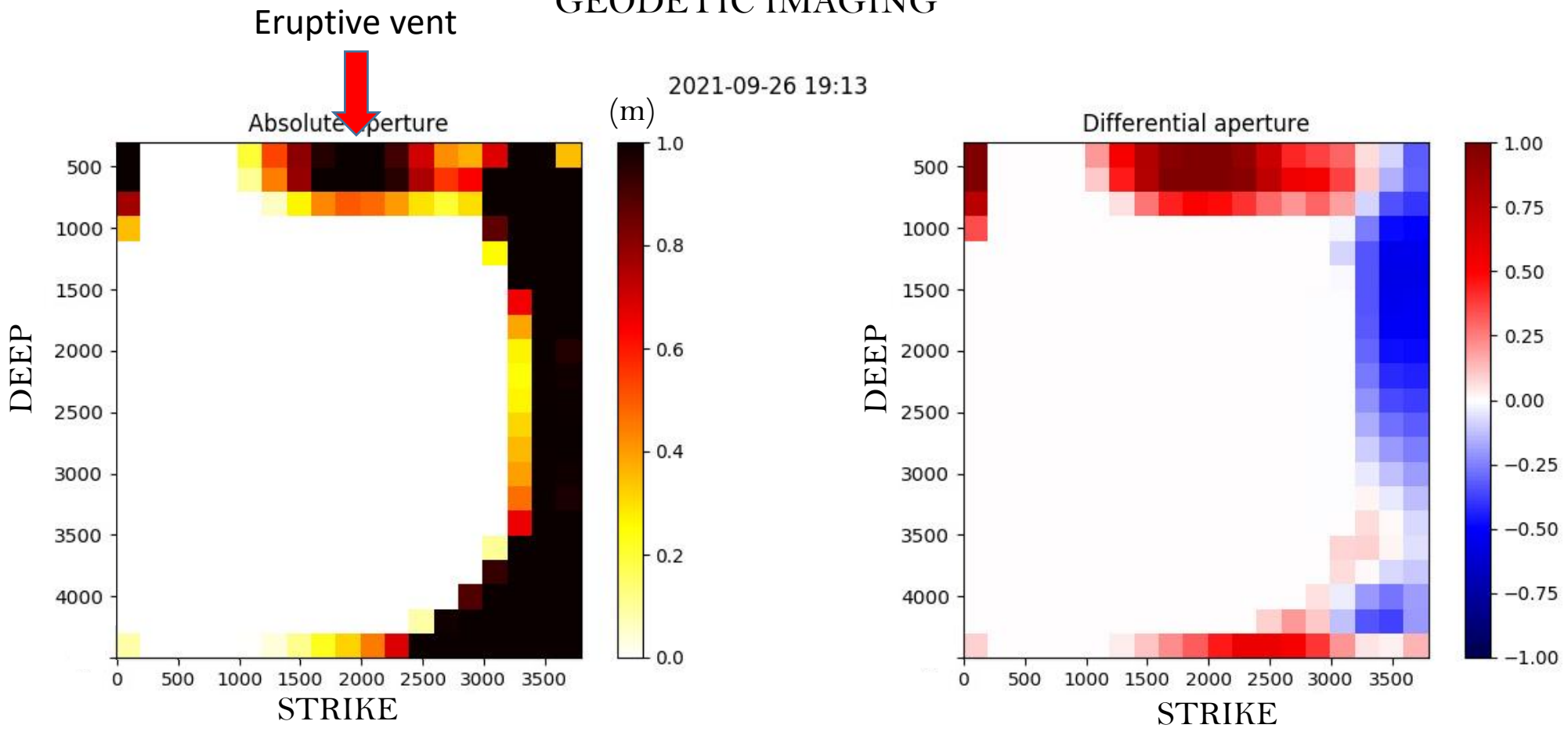


## CONCLUSIONS

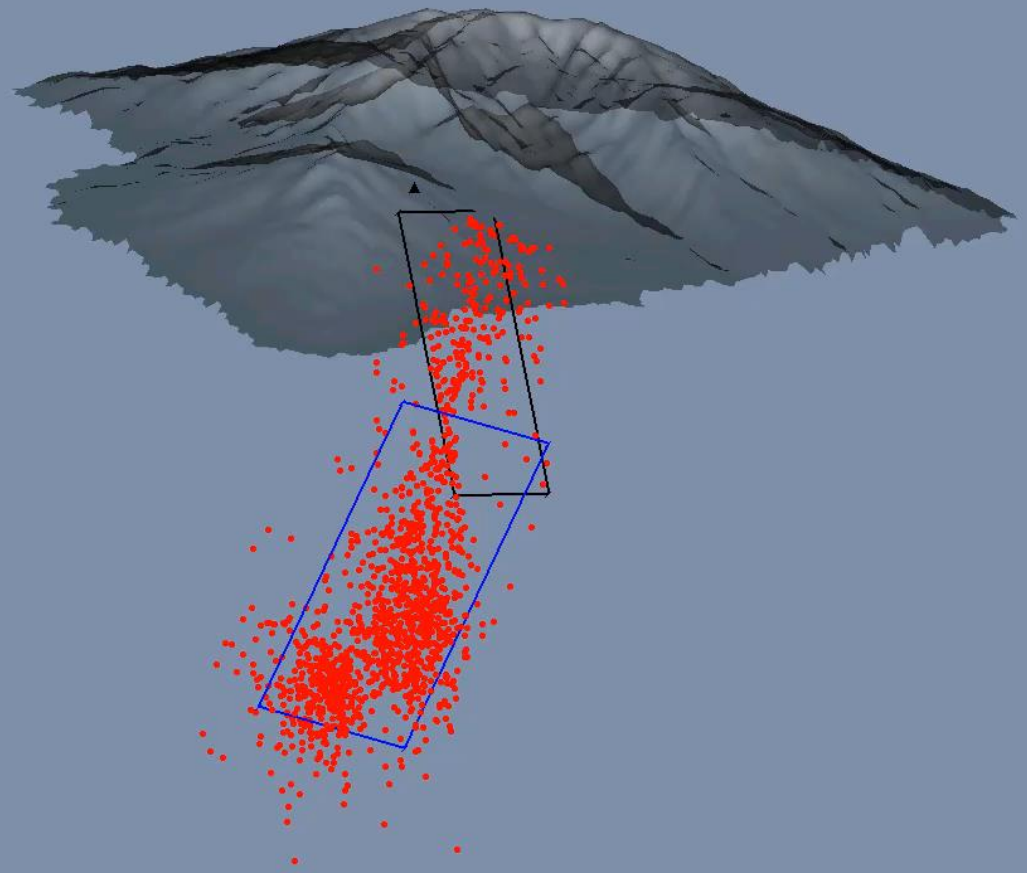
- The whole deformation pattern can be modeled by two dikes:
  - A shallow dike at a depth of 3.5 km and a width of 3.5 km.
  - A deep dike at a depth of 6.5 km and a width of 5 km.

- A shallow deformation source, possibly linked to hydrothermal fluids appears already on September 14th, coinciding with observed shallow hypocenters.

- On September16th, the magma was already close to the surface.

- At the onset of the eruption we observe a NW propagation of the eruptive fracture.

- The upward propagation of the magma was very rapid.



# THANK YOU FOR YOUR ATTENTION