

# On the stability of regional reference frames in Greece using GNSS permanent stations.

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**REFAG** | 2022  
THESSALONIKI - GREECE

# Presentation Structure

Introduction

GPS/GNSS Networks in Greece

Processing

Results & Outputs

Discussion / Conclusions



## DSO Recent Activity

Dionysos Satellite Observatory (DSO) and Higher Geodesy Laboratory of the National Technical University of Athens, have developed an automated processing scheme to accommodate the routine analysis of all available continuous GNSS stations in Greece.

This daily analysis process, is implemented for the last two years, yielding results which help us further understand the complicated tectonic setting of Greece and nearby regions.

Important results, include:

- the recent volcanic activity in *Santorini* (e.g. **papoutsis**),
- the 2014 *Kefallonia* earthquakes (e.g. **sarkefalonia, sakkas**)

# Motivation

Via our contribution to EUREF and interaction with its community, we hope to:

- expand & modernize our research activity,
- contribute to the GNSS community,
- take part in ongoing/future projects,
- expand our knowlegdbase,
- improve our academic services (NTUA is a University)

# Densification Network Selection

To contribute to the Densification we have to establish a credible dataset (network). This has proven to be rather challenging !

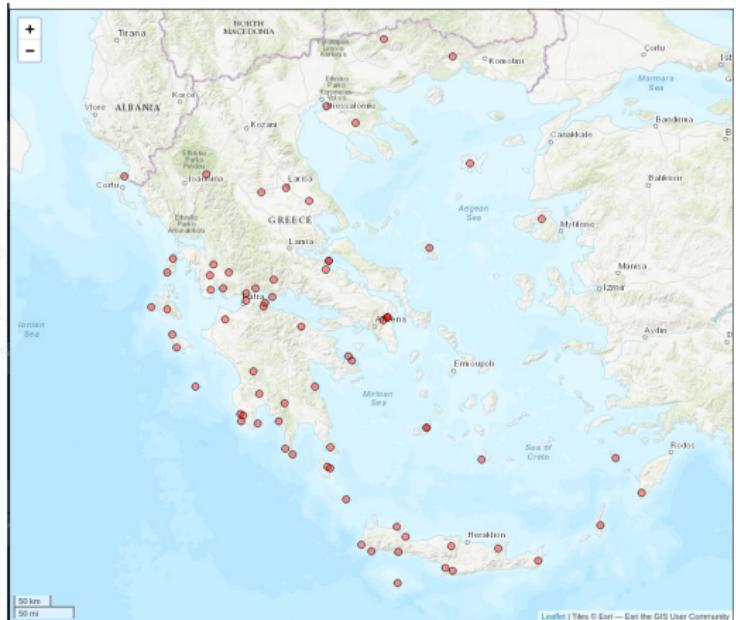
Currently we process whatever we can get our hands on ...

Problems:

- Inhomogenous dataset (**RINEX**, raw files, etc).
- Various maintainers, different mentalities.
- Different aquisition methods/rates.
- Hardly any log files.
- Wide variety of equipment (not always included in **atx** files).

# Network GREECE

- Region of Greece
- different (geodetic type) equipment
- credible time-span (early 2004 - late 2020)
- All free available GNSS data

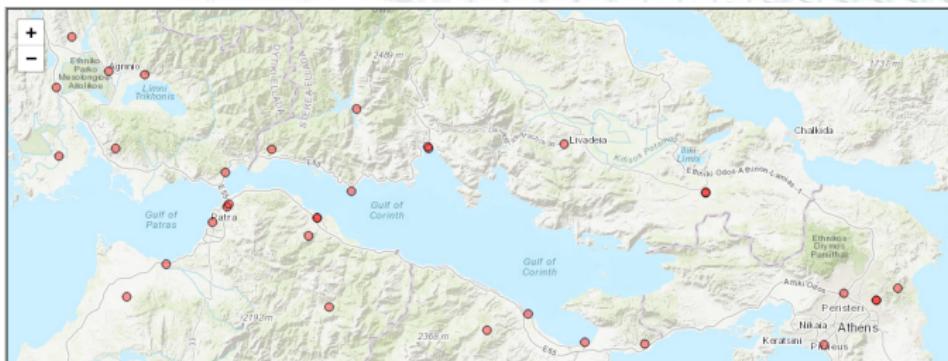


Network GREECE

# Local Networks

## Corinth Rift.

- credible time-span
- only covers the Corinth Rift
- inconsistent providers
- no log files & equipment changes



<http://dionysos.survey.ntua.gr/dso/enceladus/>

# The Scheme

The core  
tool/software is  
**Bernese GNSS  
Software v5.2bpe.**

Integration with

- MySQL database,
- Python library
- GSAC
- wrappers  
(shell)



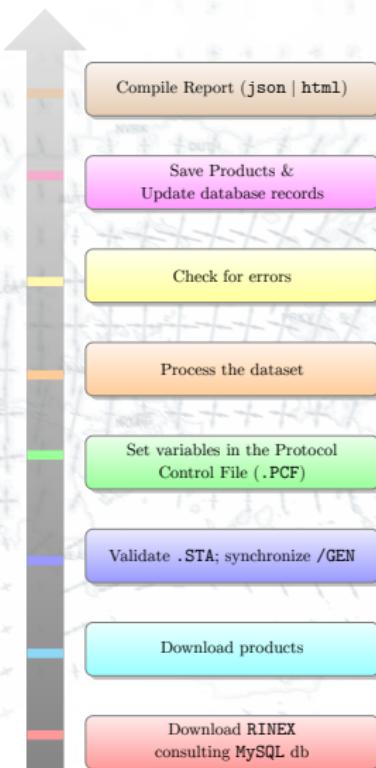
# Compliance wrt EUREF standards

Processing is consistent with EUREFF standards ([Guidelines for Analysis Centres](#)).

- SINEX with required info/blocks,
- Reference frame **IGb14**,
- IERS Conventions 2010,
- IGS/CODE products,
- ocean loading corrections (FES2004),
- atmospheric tidal loading corrections,
- $3^\circ$  elevation cut-off angle; elevation dependent weighting,
- GMF and/or VMF1; Chen-Herring gradient parameter,
- ambiguities fixed (length-dependent algorithm),
- use GLONASS obs (when available)

# Workflow

```
$>ddproces.sh --year= --doy=
--session= --bern-loadgps=
--campaign=
--satellite-system=
--solution-id= --save-dir=
--analysis-center=
--use-ntua-products=
--append-suffix=
--elevation-angle= --update=
--pcv= --apply-exclude-list
```

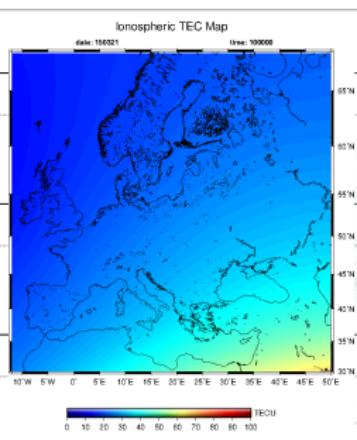


# Results & Output

## 4. Solution Identifiers

Array of Objects

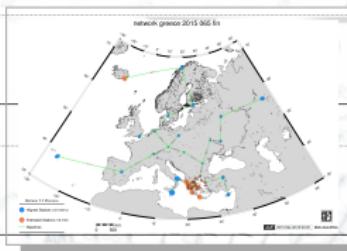
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## 5. PCF Variables

Array of Objects

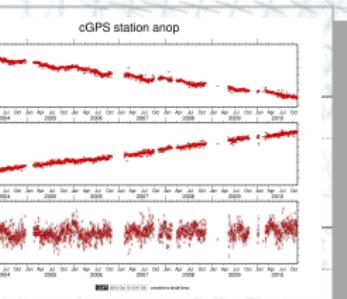
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## 6. Saved products

Array of Objects

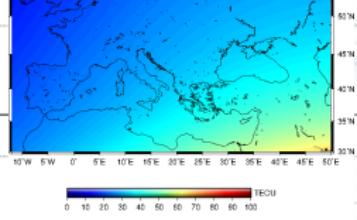
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## 7. Warnings

Array of Objects

[expand](#)

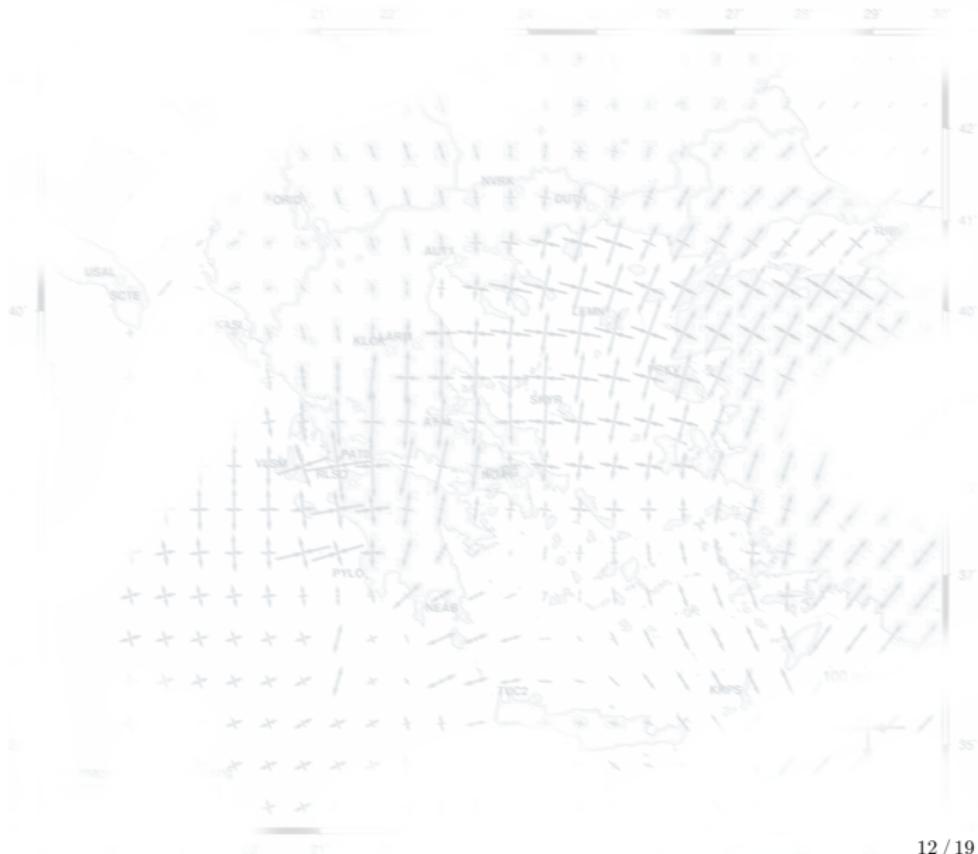


## 8. Ambiguity Resolution Summary

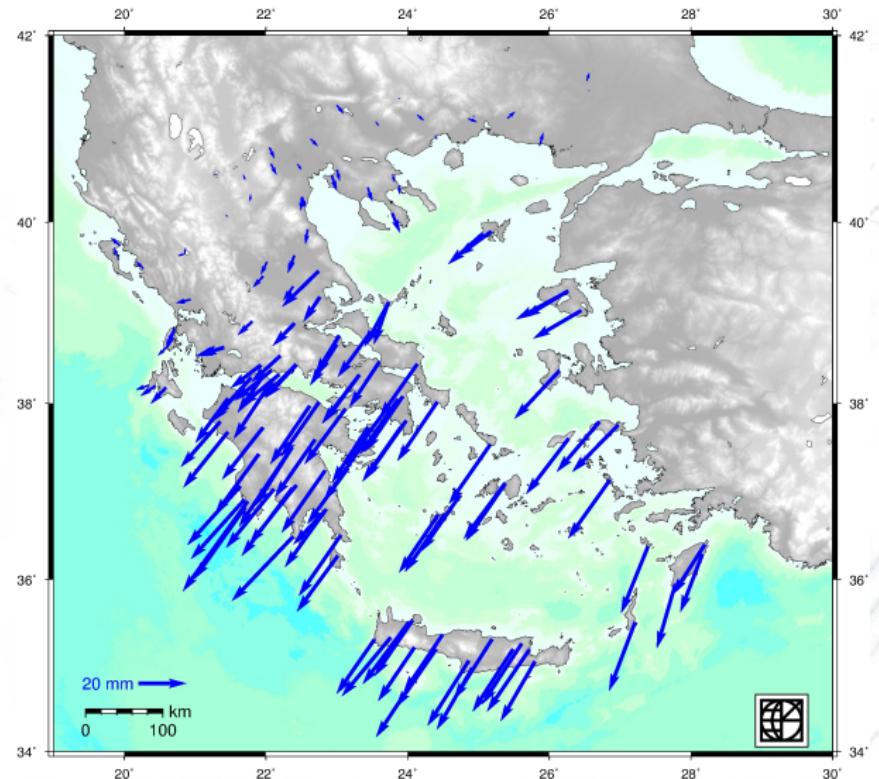
Array of Objects

Baseline	sta1	sta2	length (km)	Method	N. of Amb.	Percentance	Satellite system
AUKL	AUT1	KLOK	139.7	pbnl	74	54.1	GPS
AULE	AUT1	LEMN	199.6	pbnl	60	55	GPS
KCTL	KATC	TILO	59	pbnl	50	90	GPS
KLRL	KLOK	RLSO	174.2	pbnl	74	41.9	GPS

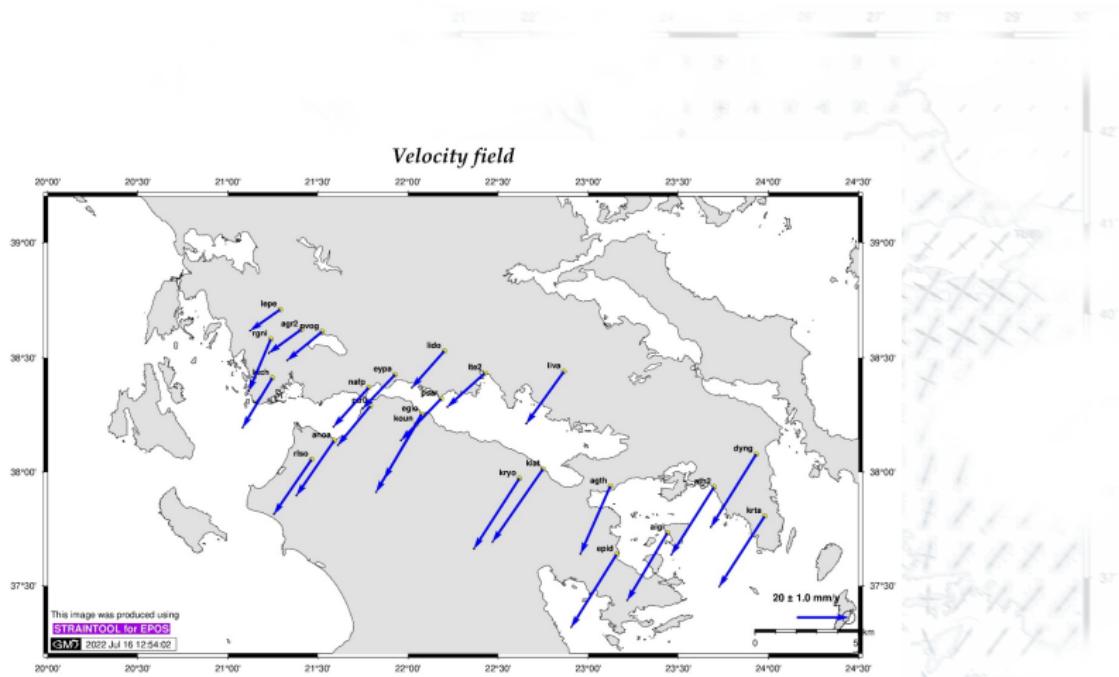
# Coordinate estimates - Time series analysis



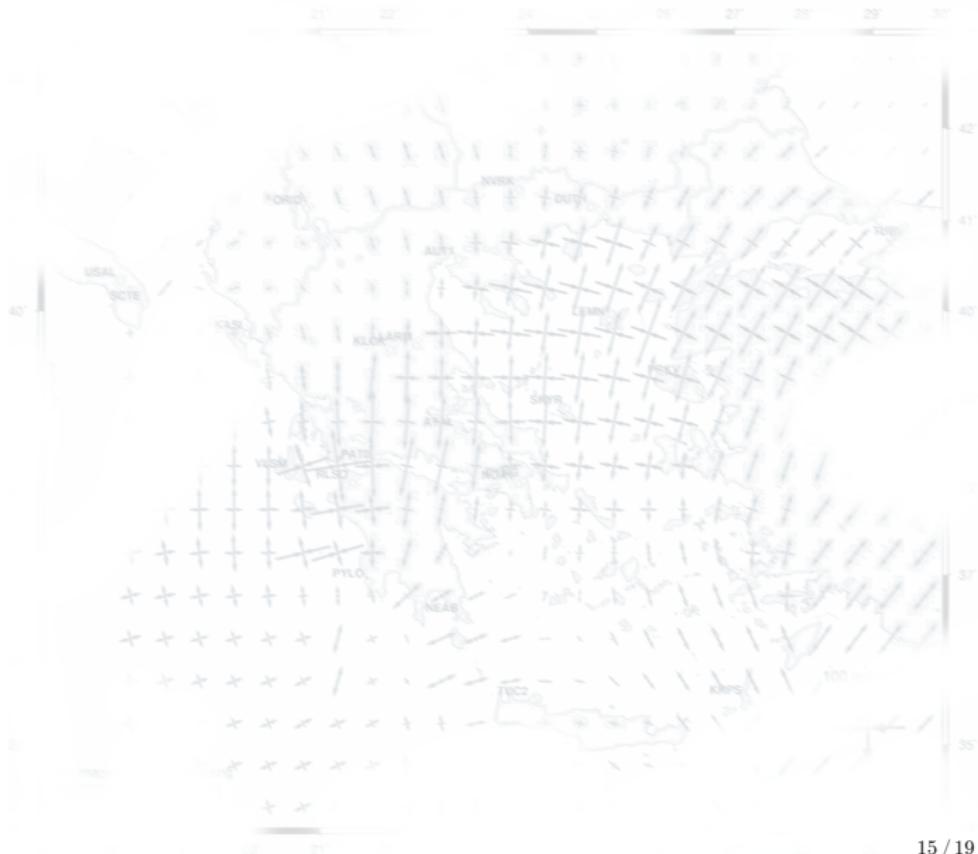
# Velocity field in Greece



# Focus on specific areas - Corinth Gulf

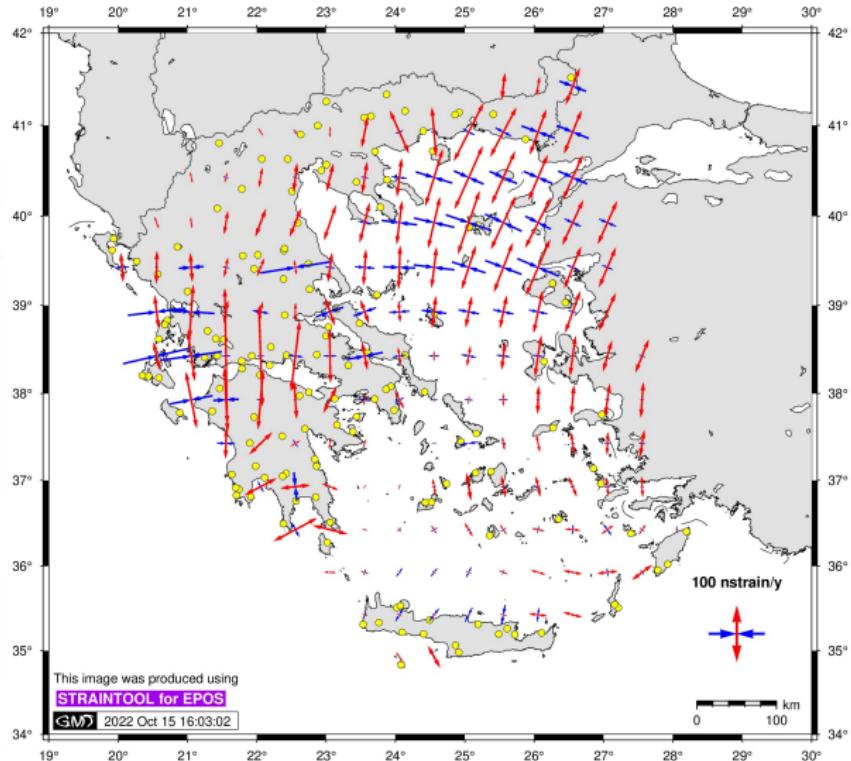


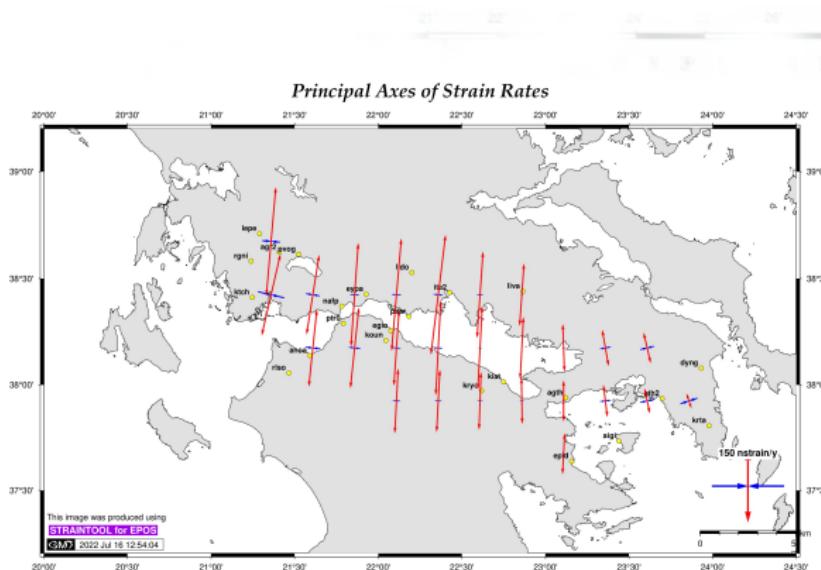
# Recent Earthquakes



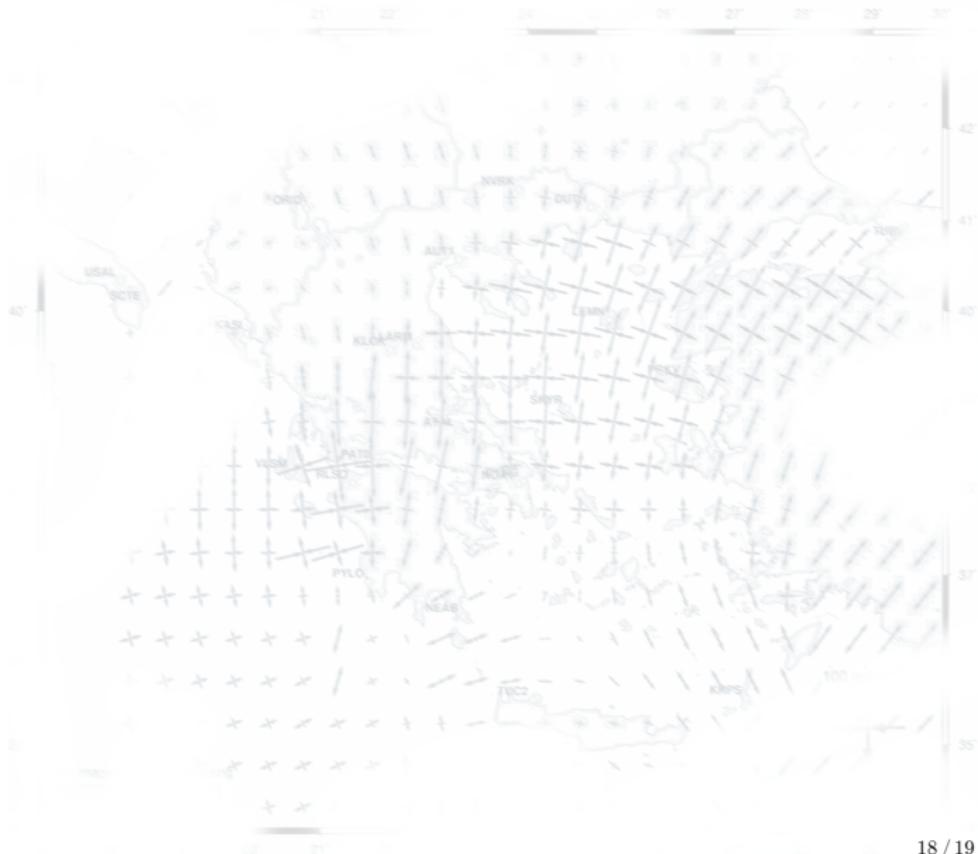
# Strain rates

## *Principal Axes of Strain Rates*





# Discussion / Conclusions





Thank you for your attention!

# References I

