Ground deformation observed in the western Corinth rift (Greece) by exploiting 22 years of GPS and SAR interferometry measurements

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and the CRL team

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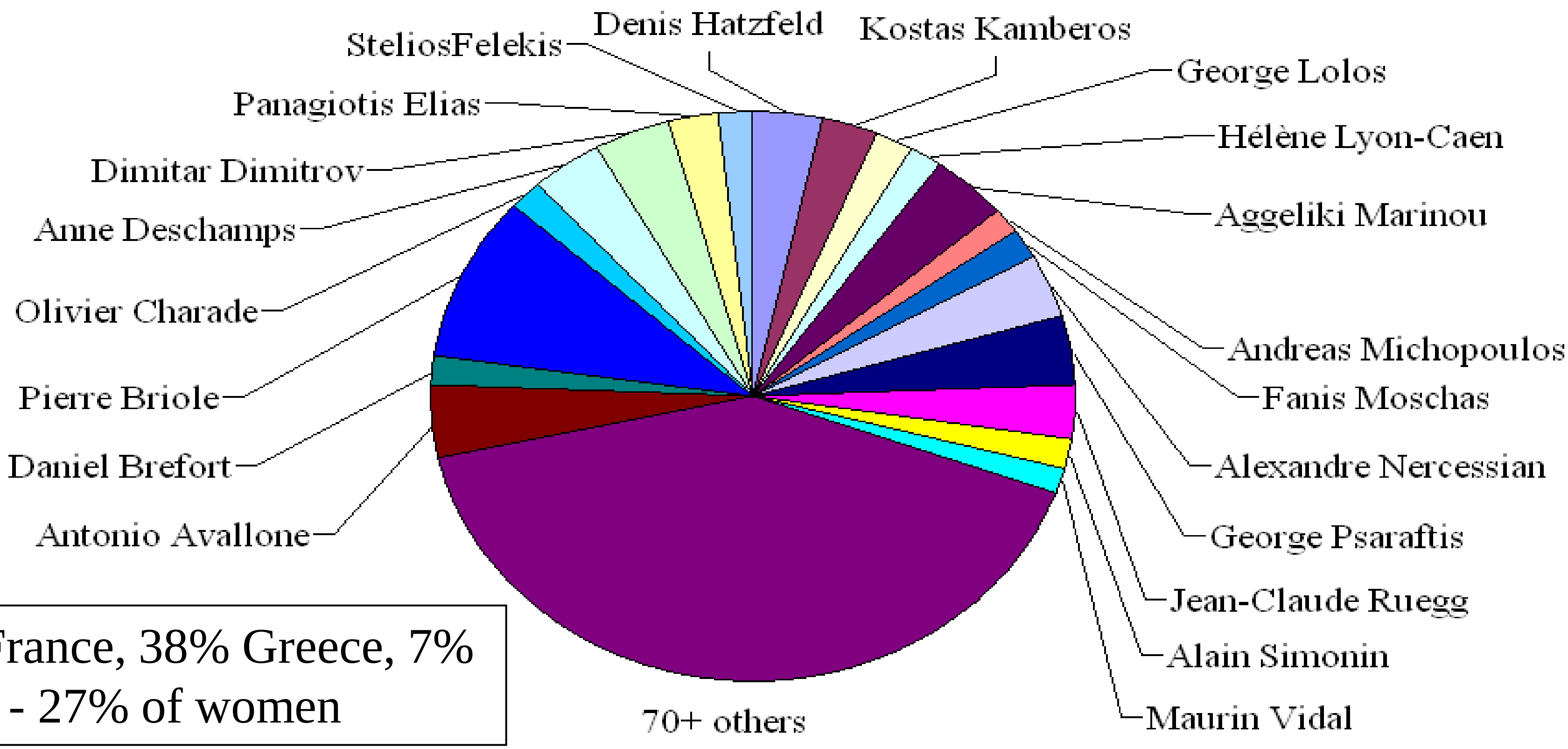
Colloque G2 (Géodesie-Géophysique) 2014
Starburg | France | 17 – 19 November 2014

Fieldwork 1990-2014 (22 campaigns & 95+ participants)



55% France, 38% Greece, 7% others - 27% of women

Luigi Abruzzese, Stamatis Adonakos, Jérôme Ammann, Rolando Armijo, Pascale Bascou, Pascal Bernard, Georges Buffet, Michel Capderou, Yann Capdeville, Rodolphe Cattin, Ferdaous Chaabane, Rana Charara, Jean Chéry, Haroula Chrisofilaki, Marielle Collombet, Jean-Bernard de Chabalier, Marianna Drakontaidi, Thierry Duquesnoy, Grégory Durand, Véronique Farra, Nathaniel Findling, Jean-François Gamond, Emmanuel Gaucher, Roland Gaulon, Omiros Giannakis, Nicolas Houlié, Alexia Karamanou, Kostas Katsambalos, Anastasia Kiratzi, Yann Krien, Kamel Lammali, Cécile Lasserre, Penelope Lopez-Quiroz, Roland Machenbaum, Raul Madariaga, Isabelle Manighetti, Iannis Maris, Joseph Martinod, Antonino Memmolo, Bertrand Meyer, Sylvain Morvan, Antonios Mouratidis, Akis Panagis, George Papaioannou, Demitris Papanastasiou, Epy Papazissi, Frédéric Pesqueira, Patrick Pinettes, George Priovolos, Alexis Rigo, Cyrille Rioux, Frédérique Rolandone, Vassilis Sakkas, Vasso Saltogianni, Paris Savaidis, Dorothée Streiff, Olga Sykioti, Mathieu Sylvander, Christel Tibéri, George Veis, Christophe Vigny, Vangelis Zacharis, …

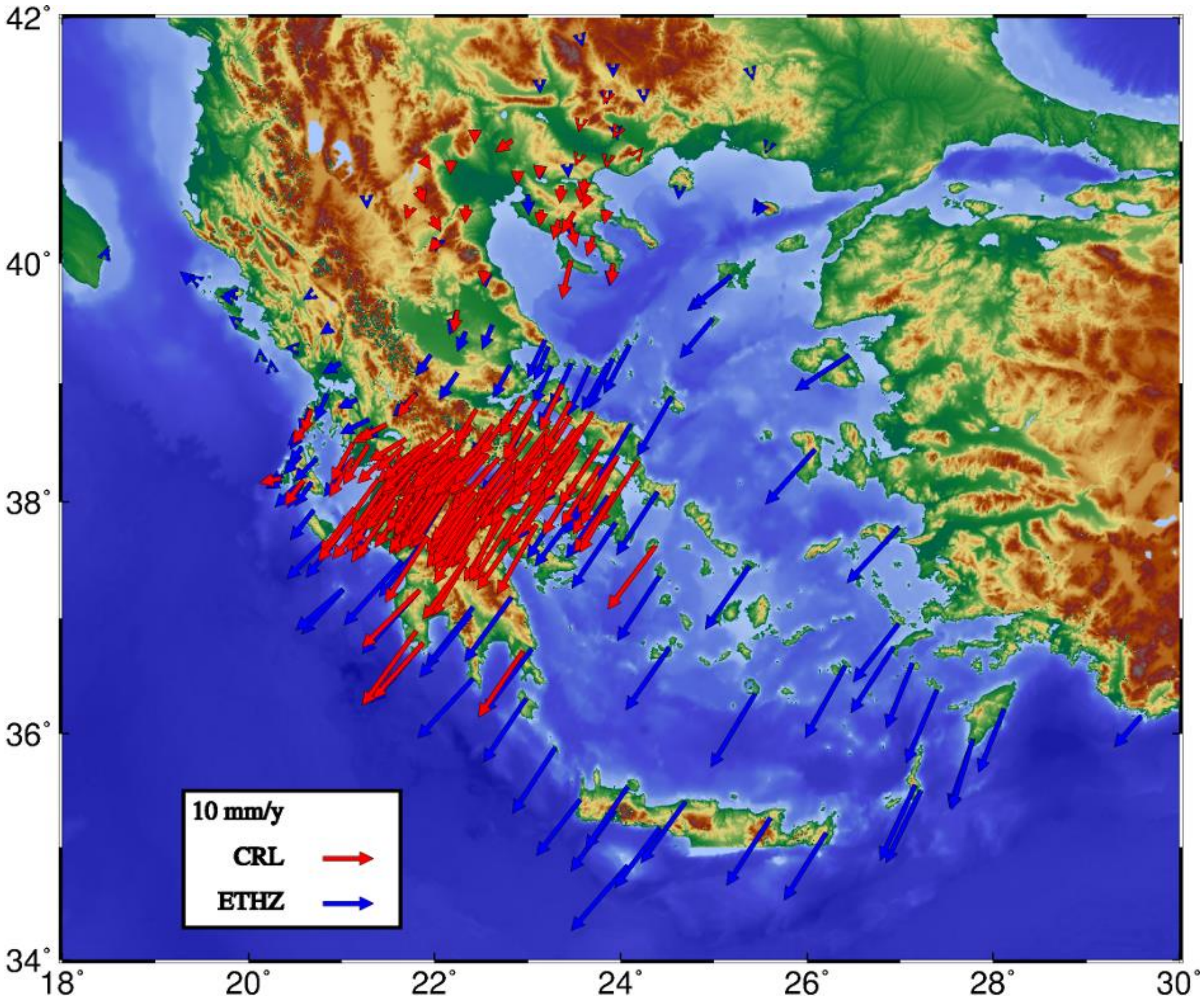

ΑΛΑΜΑΡΙΑ
ΓΑΡΙΔΕΣ
ΙΝΕΣ ΜΠΡΙΖΟΛΕΣ
ΠΙΦΤΕΚΙΑ

The network (218 points)

10+12 permanent stations

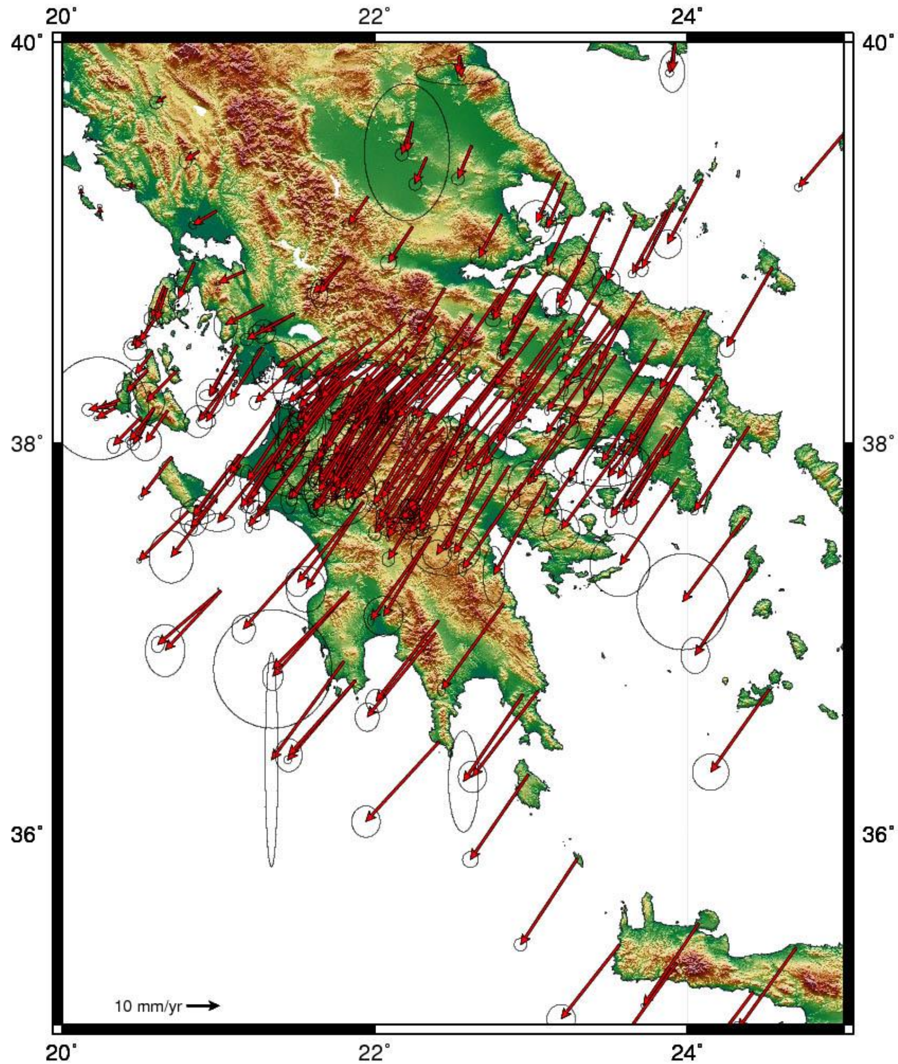
2688 campaign files (duration 2 to 24h)

Data processed with Gipy-Oasis v 6.1.2

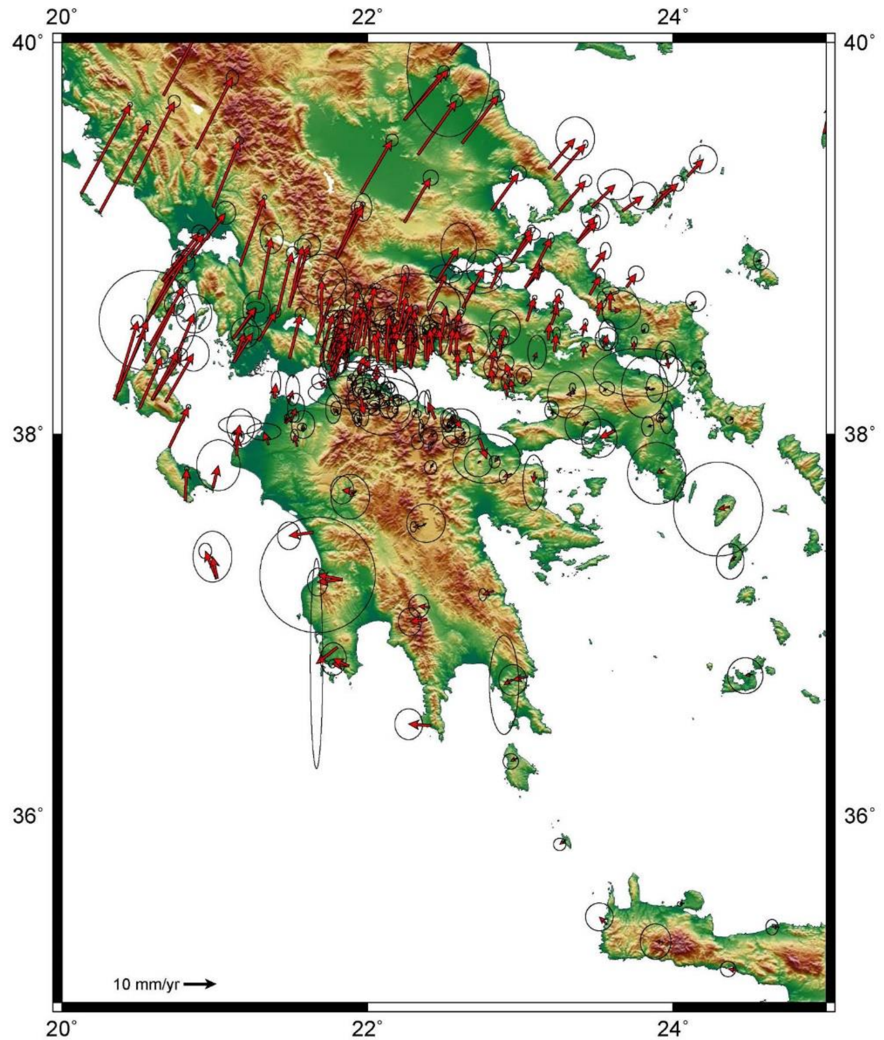


+123 velocities from the ETHZ network (M.D.M. Müller, 2011, Analysis of long-term GPS observations in Greece (1993–2009) and geodynamic implications for the Eastern Mediterranean, Doctorate of Sciences, Diss. ETH No. 19796)

Velocities % stable Europe & Peloponissos

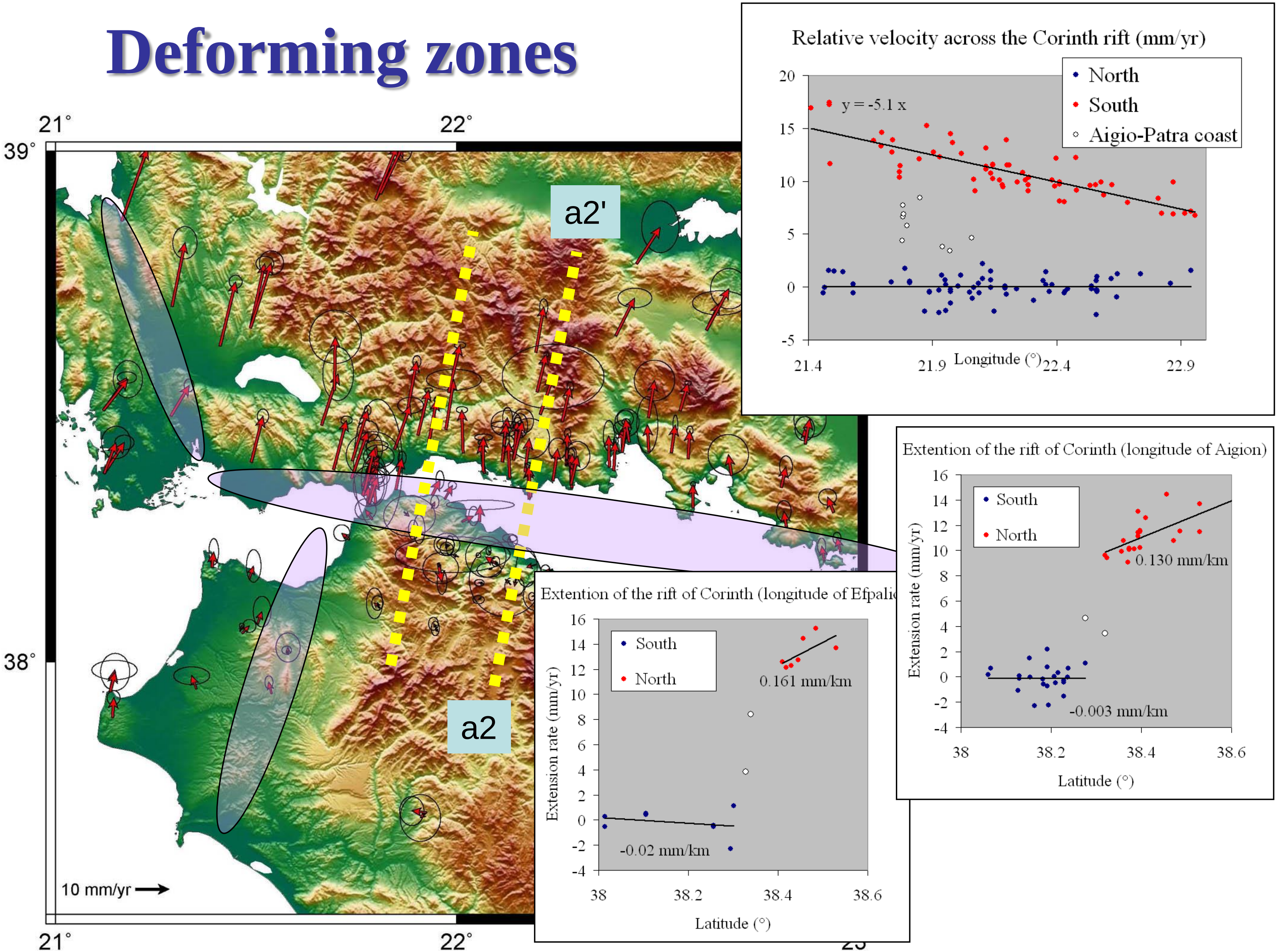


Stable Europe reference frame

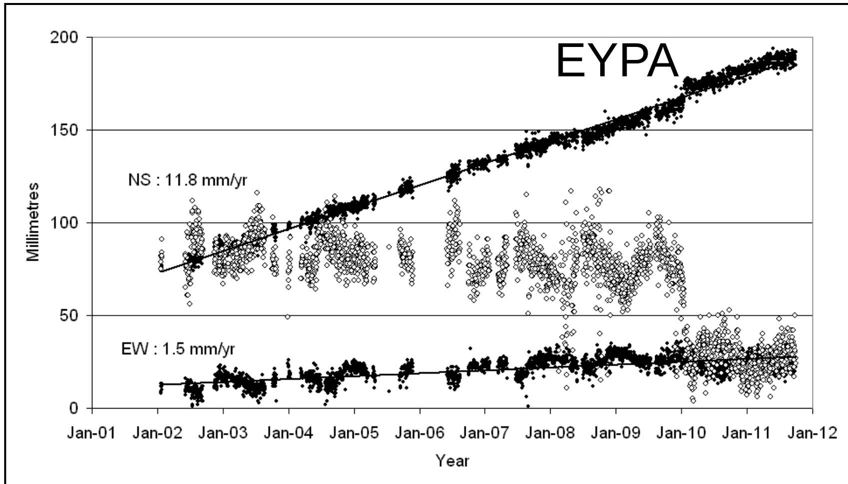


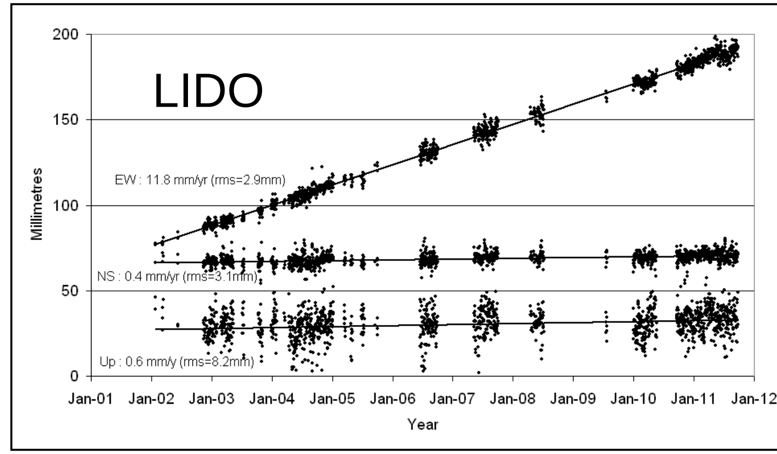
Peloponissos reference frame

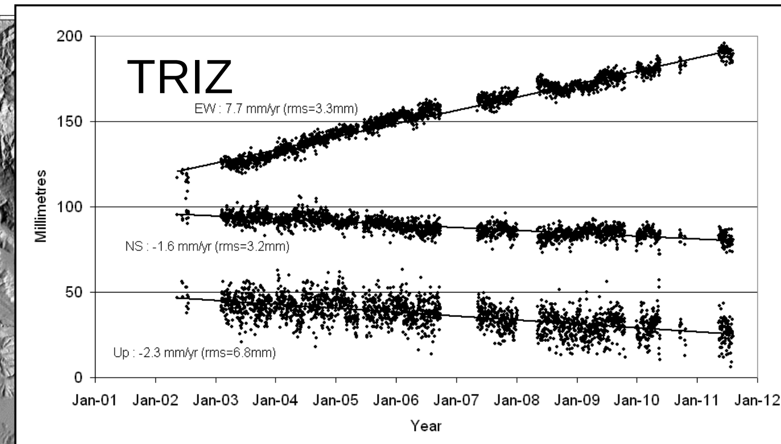
Deforming zones

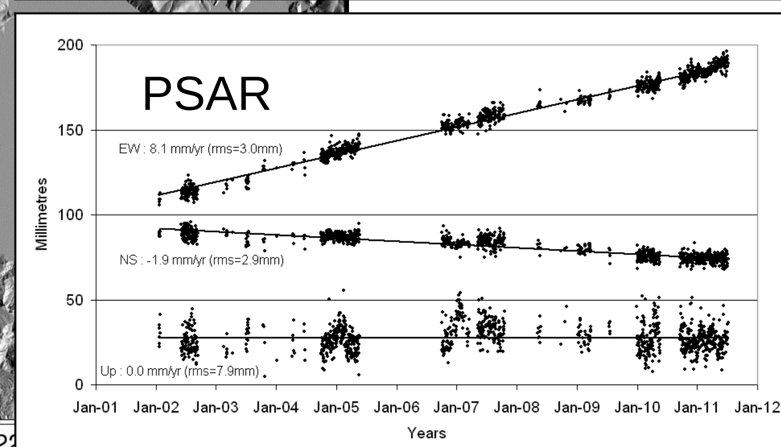


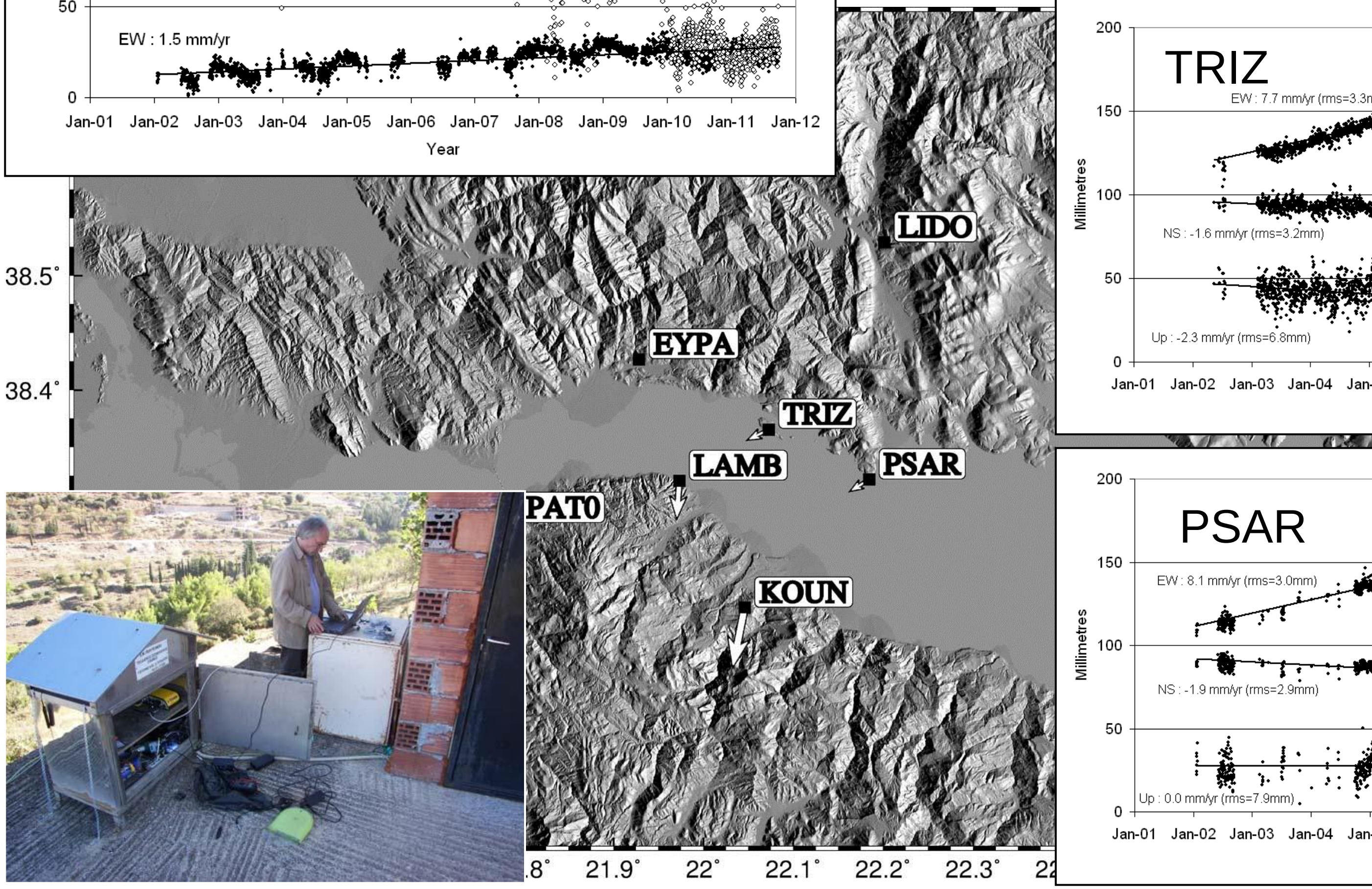
long term Permanent stations





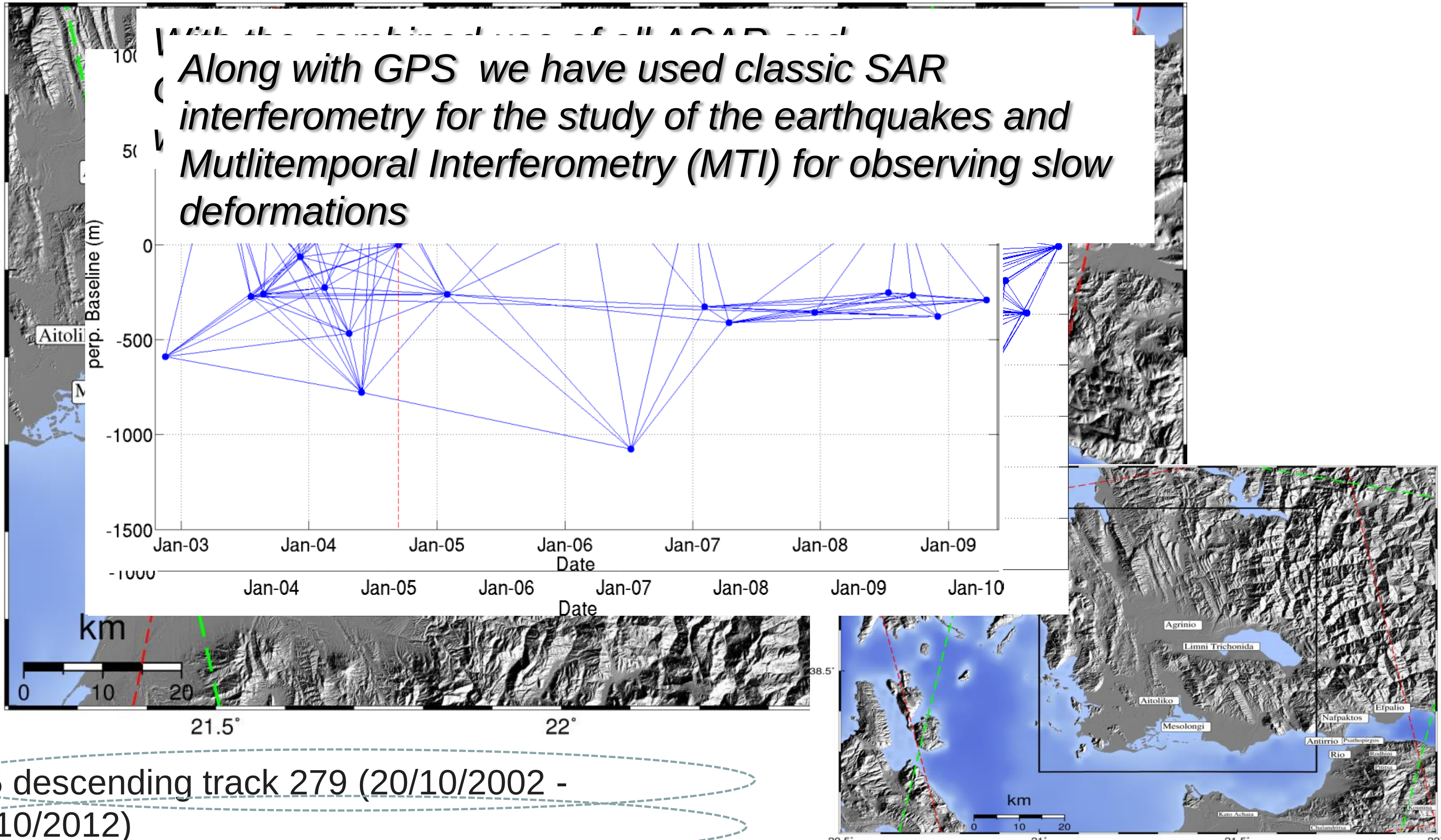






22 years of SAR data

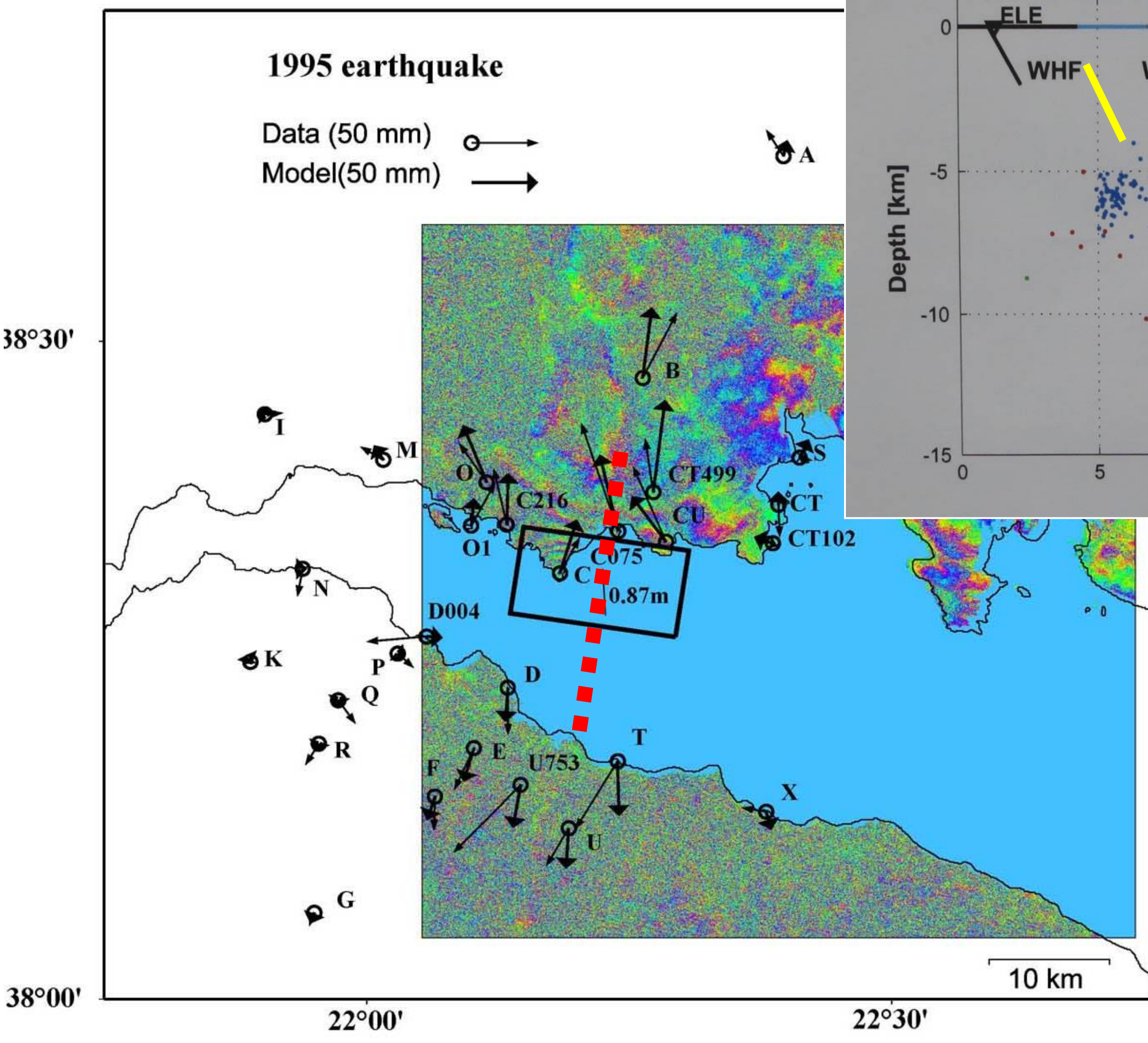
Along with GPS we have used classic SAR interferometry for the study of the earthquakes and Mutlitemporal Interferometry (MTI) for observing slow deformations

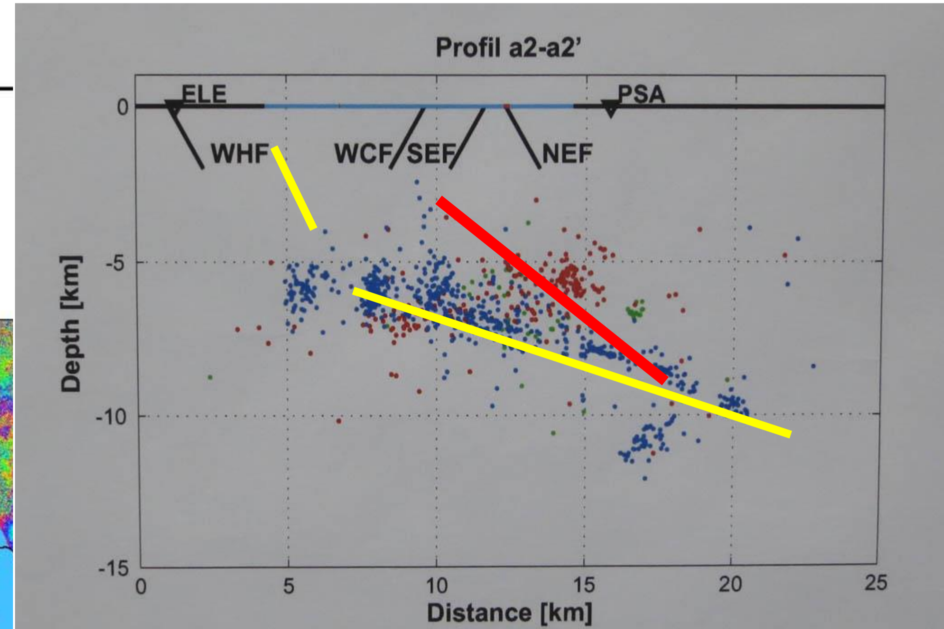


35 descending track 279 (20/10/2002 - 3/10/2012)
29 ascending track 415 (11/2/2003 -9/2/2012)

25 desc. track 50 (2/5/2003 - 4/6/2010)
25 asc. track 186 (17/11/2002 - 19/4/2009)

M_s= 6.2 June 15, 1995, Aigion earthquake

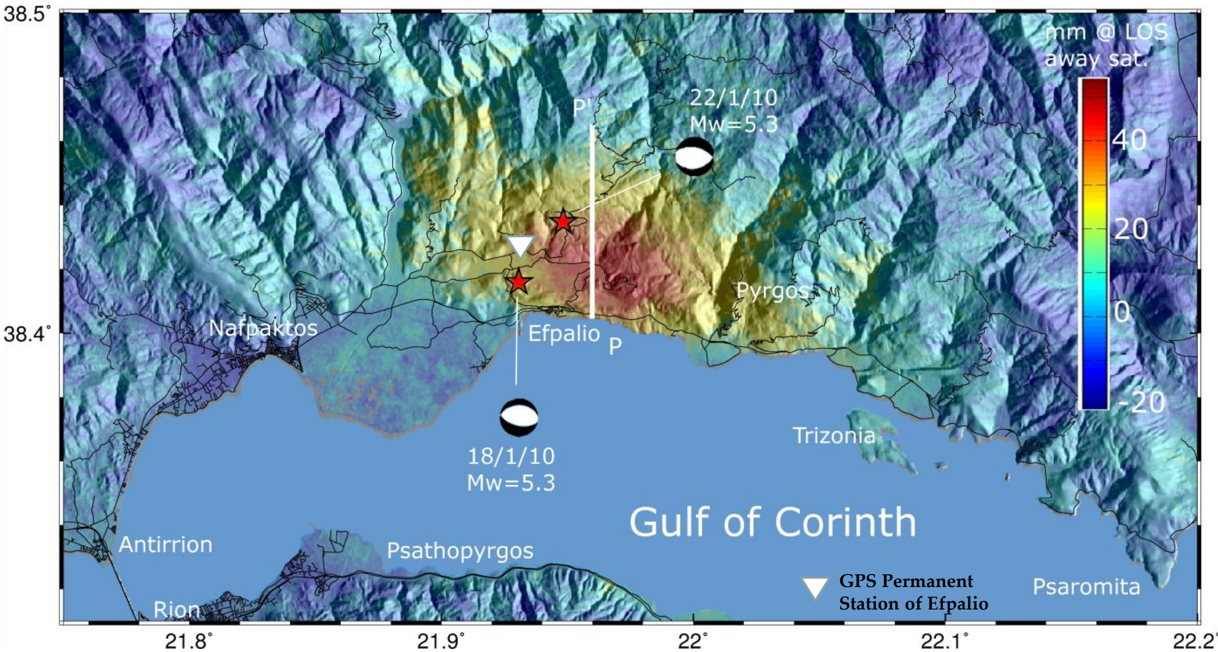




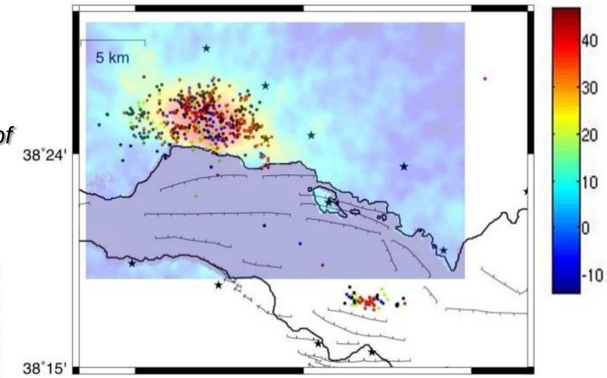
Upper limit of the rupture at ~3km depth

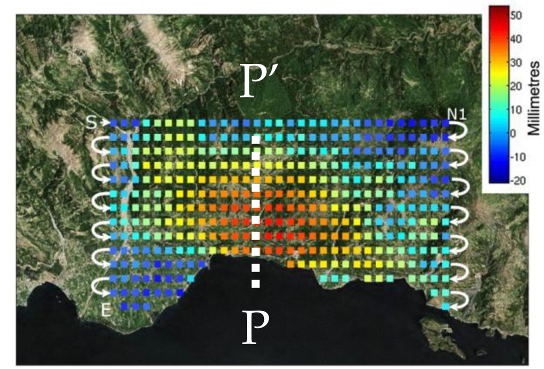
Efpalio 2010

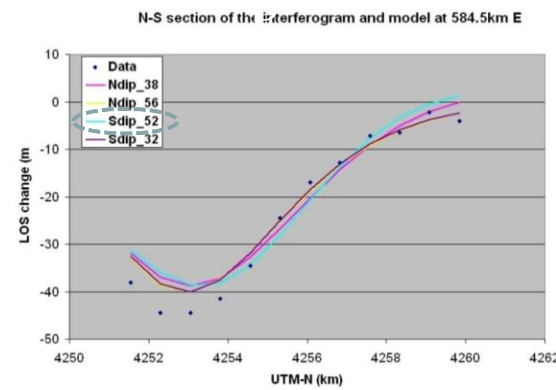
Two main shocks (18/1 and 22/1/10 of Mw=5.3 each). No ASAR/ENVISAT acquisition between



Relocation of the aftershocks: Courtesy of Lyon Caen et. al. in preparation, 2013







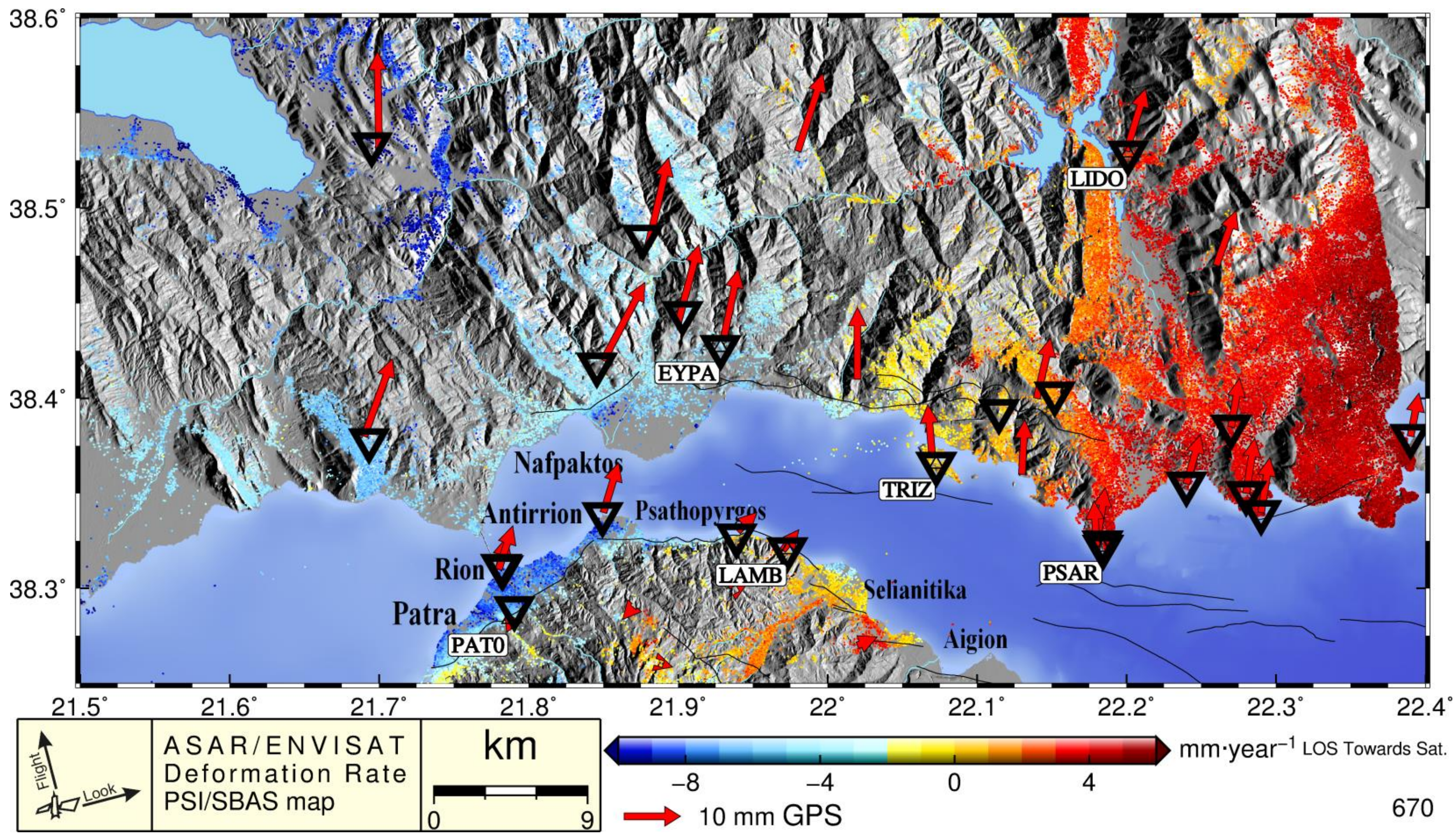
InSAR could not constrain the fault parameters very well because of the mixed double shock event.

The existence of an acquisition between the events would solve this ambiguity

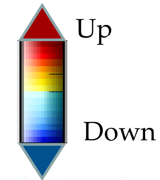
Vertical and horizontal deformation Observations

Efficient combination of the GPS observations

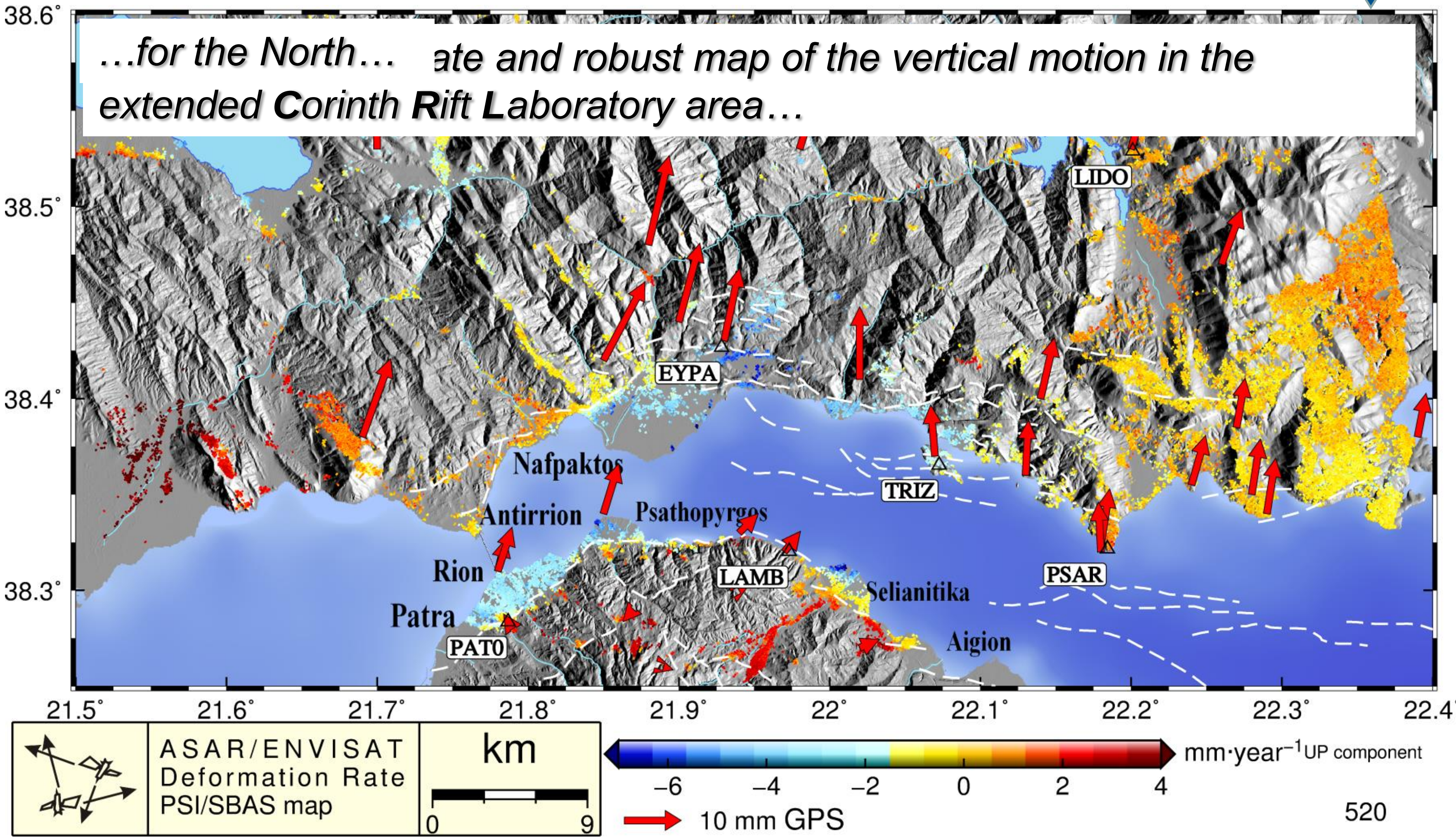
…and the MTI deformation maps of both ascending and descending tracks…



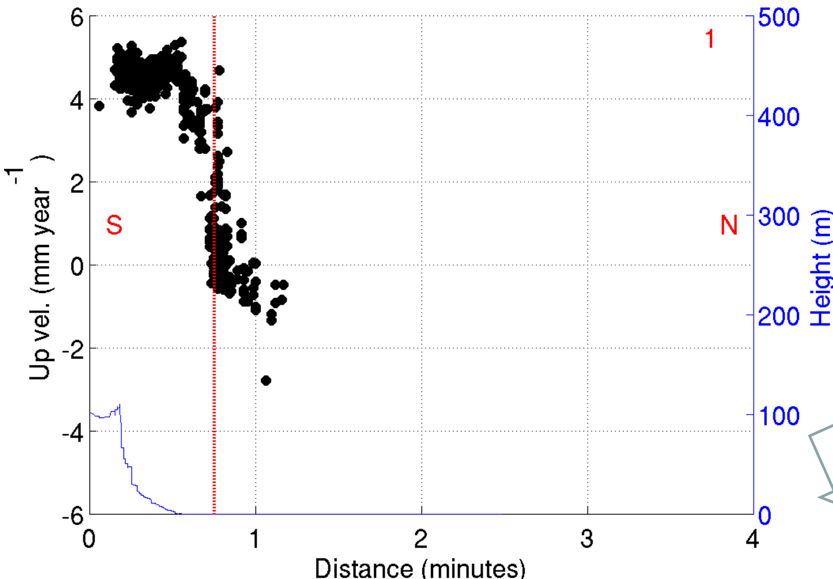
Final Deformation map on the Vertical deformation

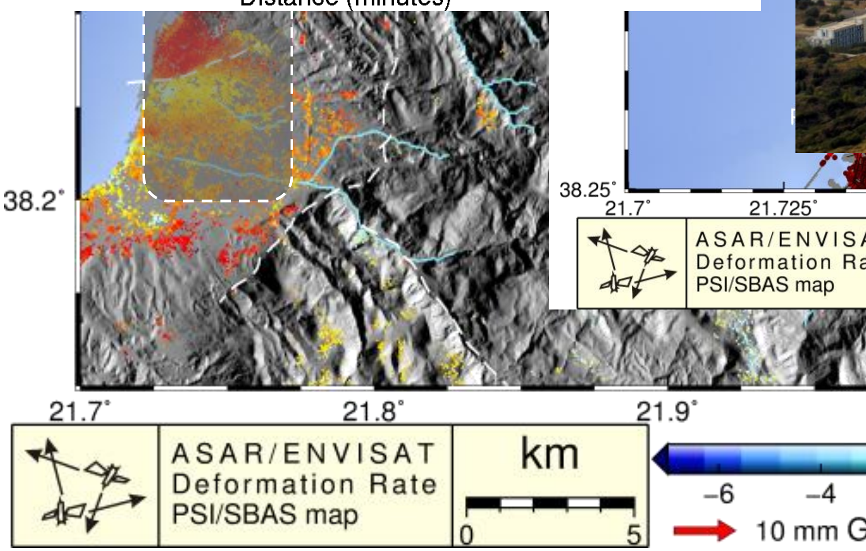


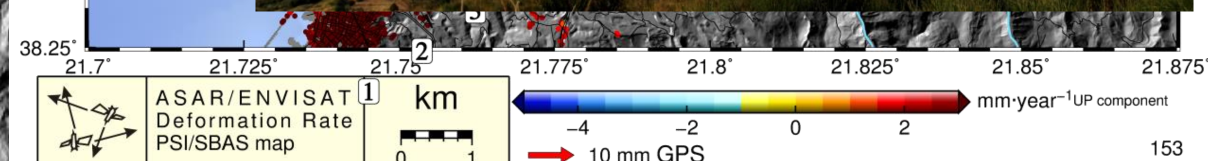
…for the North… ate and robust map of the vertical motion in the extended **C**orinth **R**ift **L**aboratory area…

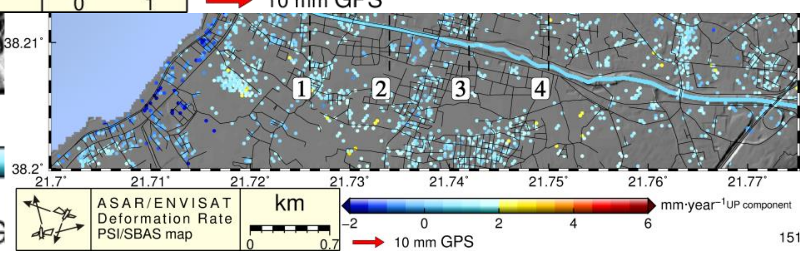


Final Deformation map on the Vertical deformation

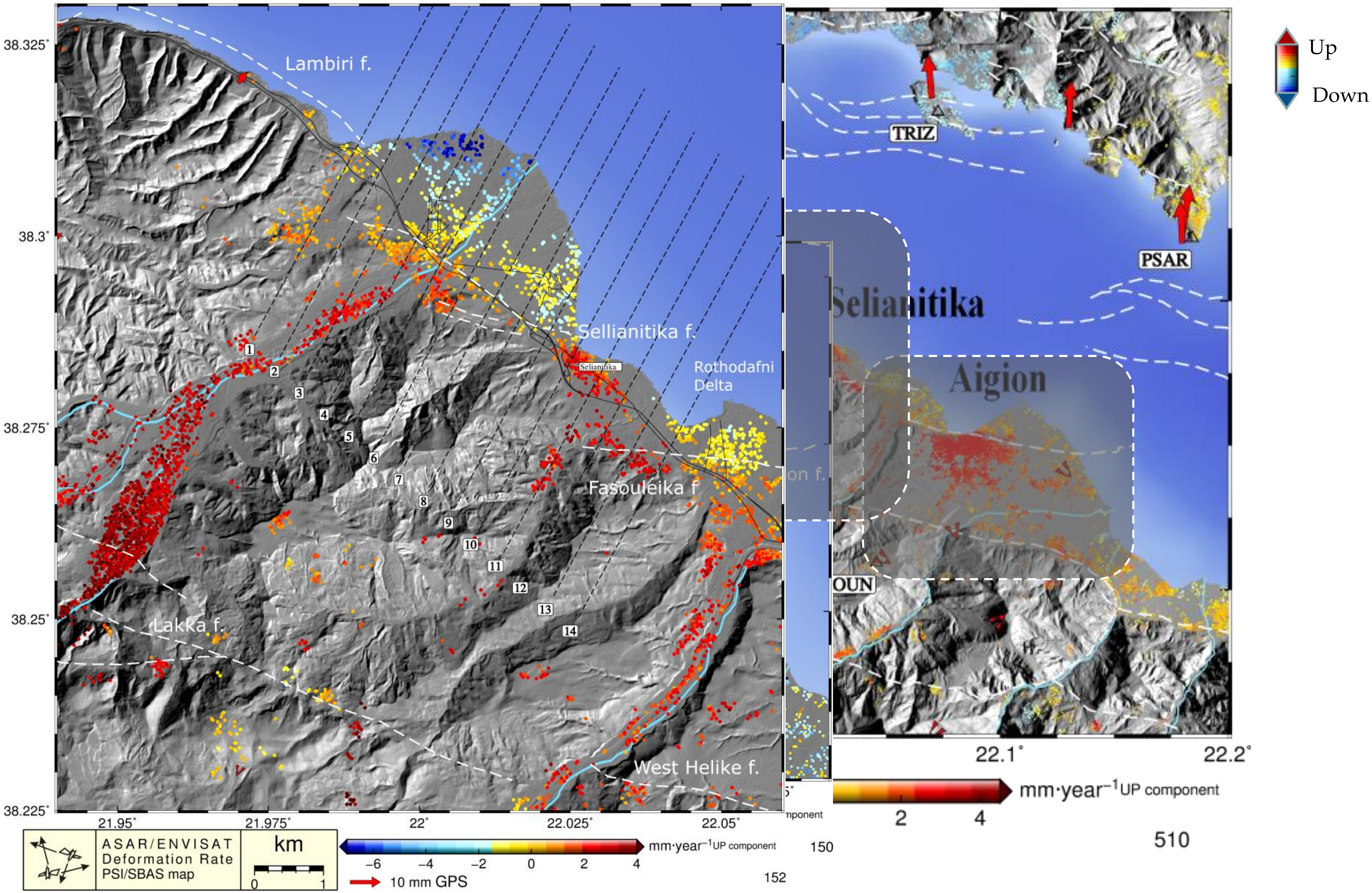




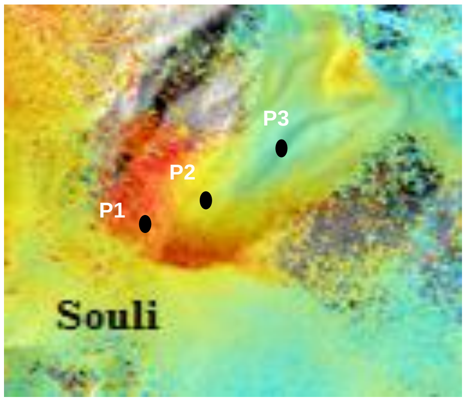


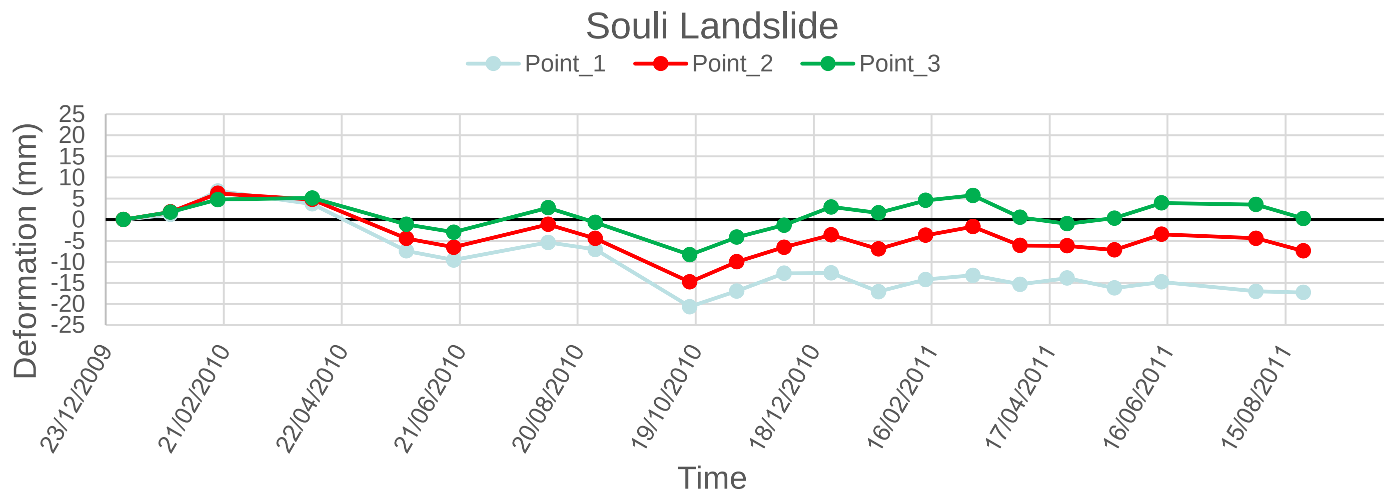


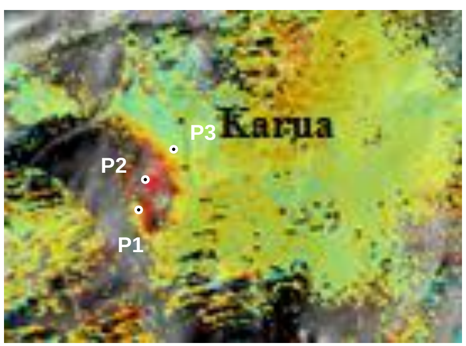
Final Deformation map on the Vertical deformation

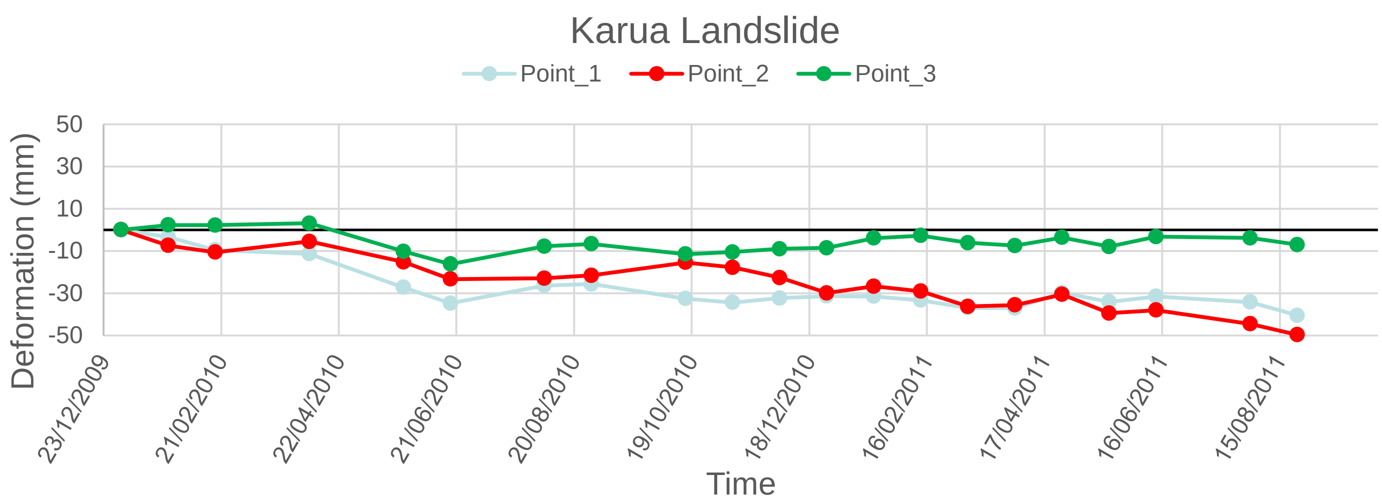


Very high resolution SAR data and landslides and time series



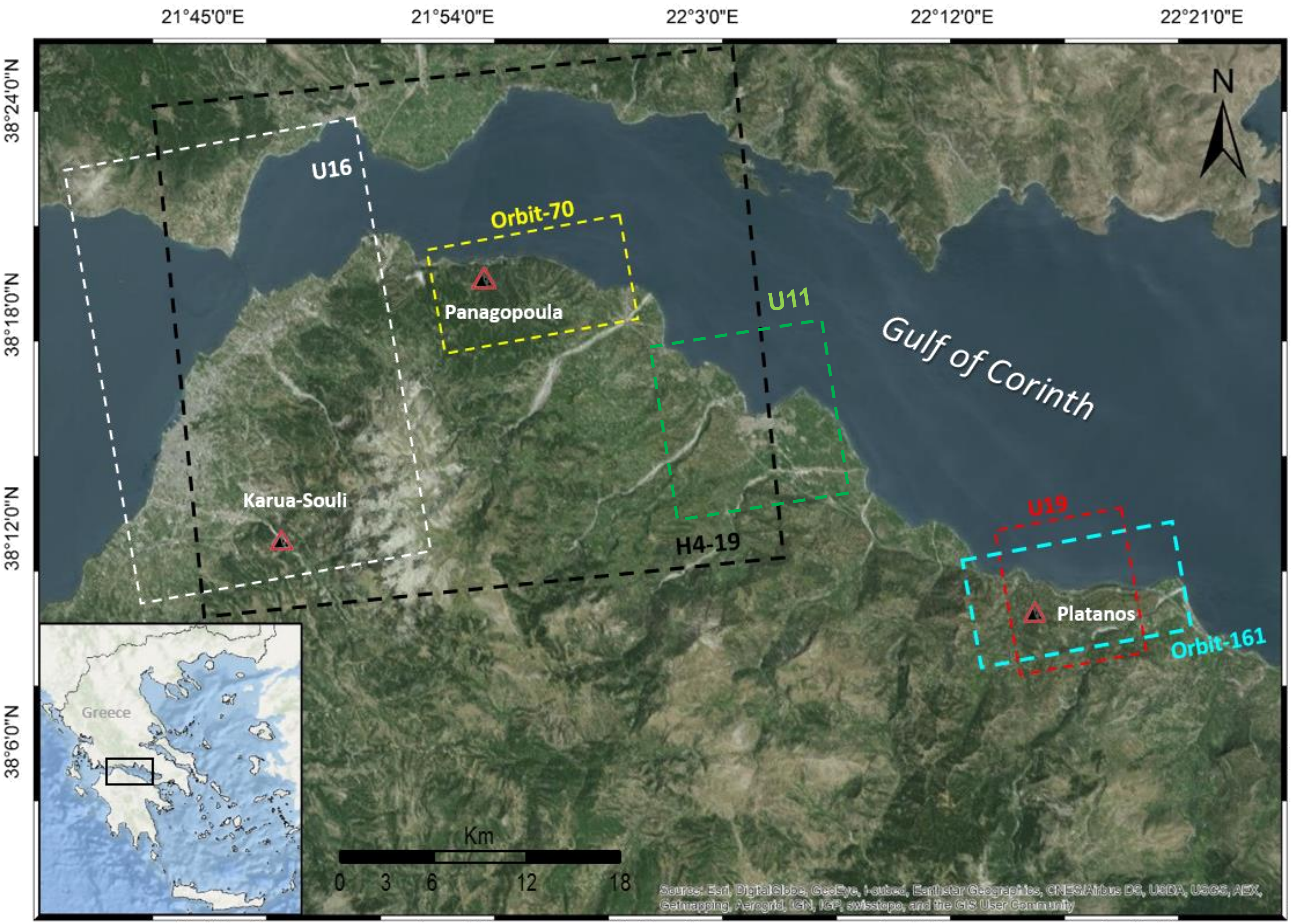




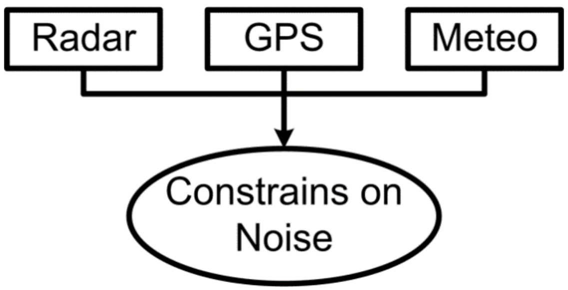


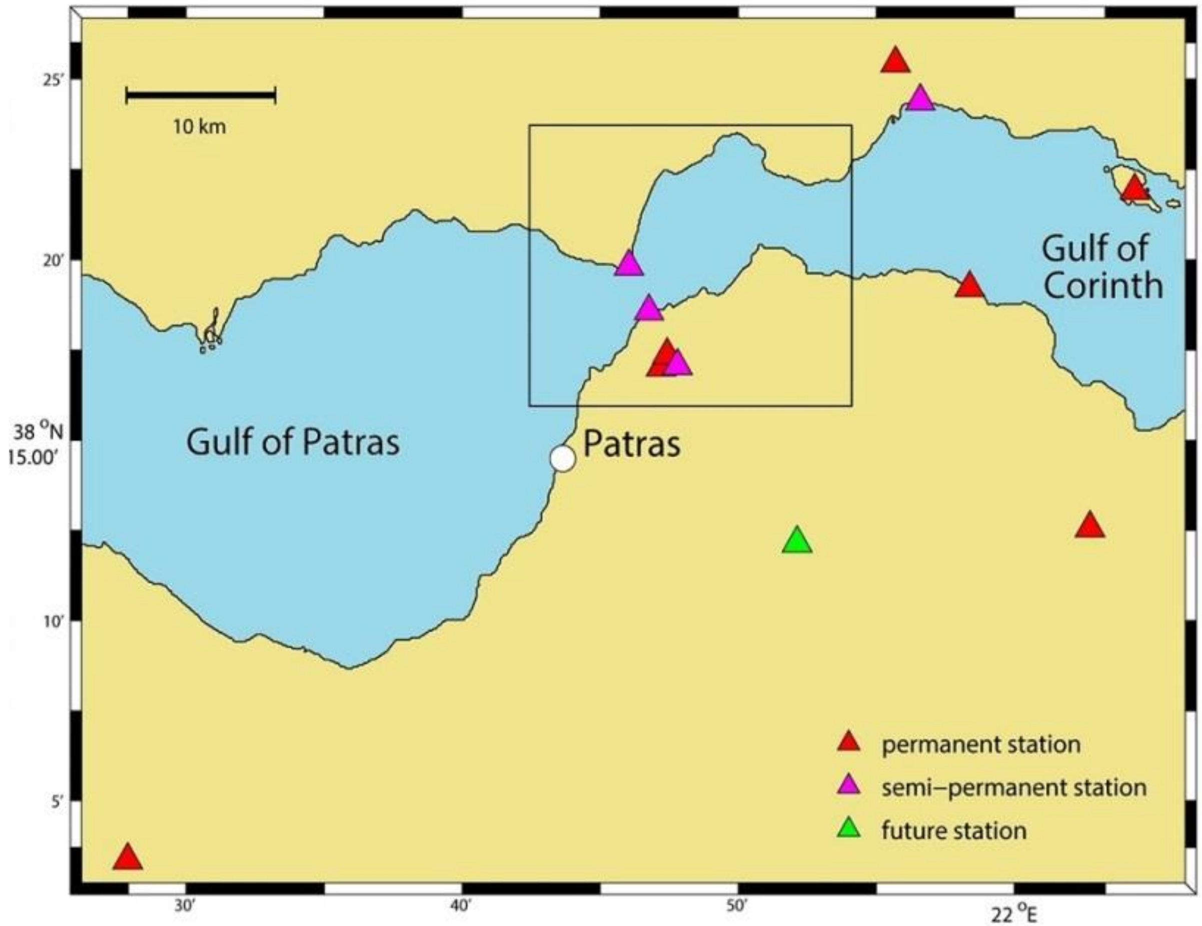
(Semi) permanent stations installed before and since last June (2014)

Very high resolution SAR data are being acquired



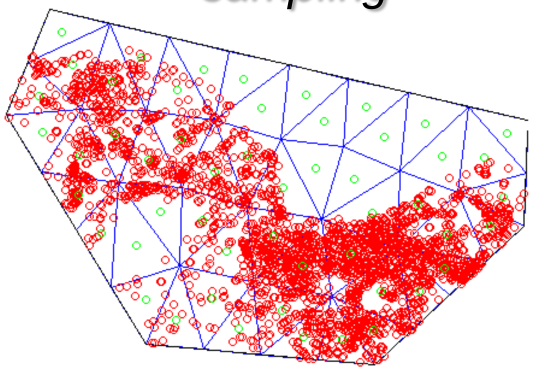
Currently we are focusing on the extraction of atmospheric conditions over the CRL area, for the time slots of SAR acquisitions, combining the available GPS and Meteo observations for the correction of tropospheric INSAR noise



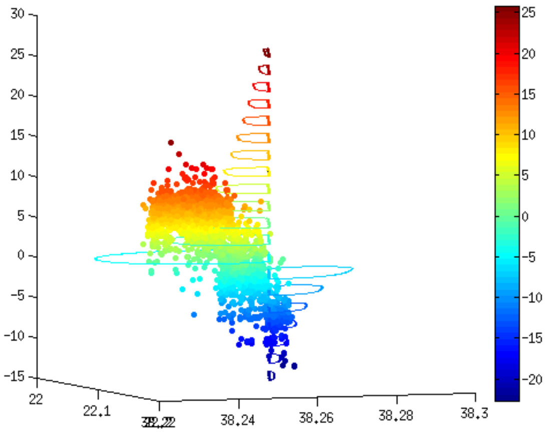


…and in the modeling of creeping faults to estimate the locking depth and the slip rate

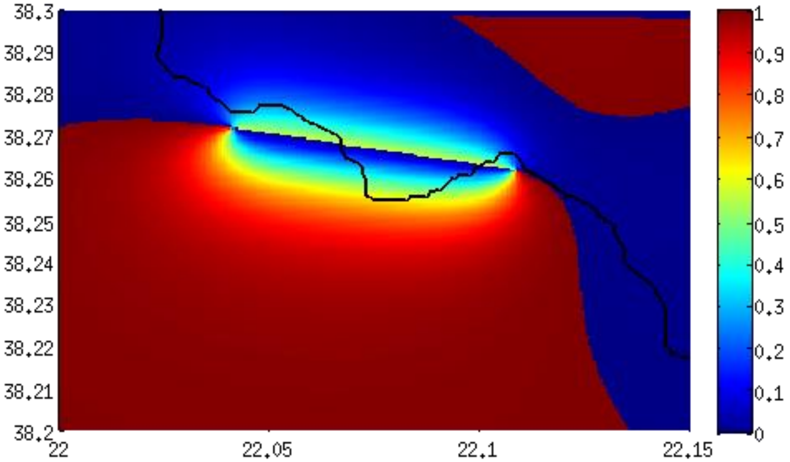
sampling



inversion



model



Conclusions

1. **More permanent GPS stations and very high SAR data needed: crucial for the vertical, for the measurements of moderate events (M=5.5), for the analysis of places of interest based on InSAR (Aigion)**

2. **Dense campaign GPS network crucial to sample each individual fault**

3. **GPS and InSAR are complementary. This synergy is needed to achieve high accuracy with dense coverage and to model aseismic faults**

Web: http://crlab.eu