Amélie Viger
Université de Montpellier
Géoscience Montpellier
Place E. Bataillon
F34095 Montpellier

Friday 17 May 2024

Professor Stefano Tavani
Handling topic editor
Solid Earth
EGUsphere -2024-85

Dear Pr. Stefano Tavani,

Please find below our responses to reviewer Marta Tiberti and corresponding additions and corrections to our manuscript (Text modifications / Track changes).

As recommended, we also made a last round of English corrections.

We think we have answered all pending questions and comments.

Should you require any further information, please do not hesitate to contact us.

Respectfully yours,

Amélie Viger

P.S: The supplementary material section, the GNSS and PS-InSAR datasets used in our study have been also deposited in the Easy Data repository (RI Data Terra, France, https://rec.easydata.earth/#/home). The DOI reference will be soon available.

TEXT MODIFICATIONS - TRACK CHANGES

RC1: Mara Monica TIBERTI

Main Comments: The authors managed to address most of the issues indicated. However, two main points remain unresolved.
1) The geometry of the top of the oceanic crust.
The authors need a 3D model of the top of the oceanic crust. Both the 3D models available in the literature, the one by Hayes et al. (2018) used in their work, and the one by Maesano et al. (2017) proposed by me as an alternative, actually reconstruct the subduction interface, which does not coincide with the top of the oceanic crust in its shallowest portion (<15 km). For the first 15 km, they should rely only on the seismic refraction profiles by Dellong et al., possibly integrated with the interpretation of other seismic reflection profiles available in the area; otherwise, the depth of the oceanic crust would remain unconstrained.
2) The role of the Alfeo fault system
The Alfeo-Etna fault system is considered not mature enough to significantly alter the mechanical properties of the crustal/lithospheric blocks. This assumption, which implies that the COT has a rigid and strong rheology, is not completely justified. Actually, other authors clearly identify the Alfeo fault system as a slab tear that cuts the entire lithosphere (e.g. Gutscher et al., 2016; Maesano et al., 2017; 2020). The authors need to address this point in the text and discuss the implications of neglecting the role of the Alfeo fault system in their model.
Other minor technical issues are in the annotated file.

Authors response to RC1's main comments (published on-line the 09 May 2024):

First of all, thank you for your comments.

1) The geometry of the top of the oceanic crust.

In fact, we think we've already answered this comment in the revised version of our manuscript. In the supplementary section, we added a specific figure comparing the Hayes et al. (2018), Maesano et al. (2017) and Dellong et al. (2018, 2020) datasets. It appeared clearly that there is a pretty good match between the Hayes et al. (2017) top of the slab geometry and the Dellong et al. (2018, 2020) top of the oceanic crust depths. For this reason, we decided to use the Hayes et al. datasets to constrain the long wavelength geometry of the subducting Ionian oceanic crust off the East coast of Sicily.
To better convince the readers, we have improved figure S10 by adding a projection on our CD profile of the slab profile and seismicity of Figure 8 section 3 in Maesano et al. (2017).

We also added, in figure 5, the depths of the top of the Ionian oceanic crust derived from the refraction profiles published in Dellong et al., 2018, 2020. In the figure 5 caption, we recommend that the reader also refers to figure S10.

New L333-334: Interval symbols outline the top of the Ionian crust derived from seismic refraction profiles (Supplementary Figure S10).

2) The role of the Alfeo fault system

In our opinion, the role of the Alfeo-Etna Fault system (AEF) is still under debate: even though it cuts the entire lithosphere starting from recent times (probably middle-late Pleistocene), we are not convinced that it has reached the stage of a slab tear (STEP). In the Conclusions of the paper Polonia et al. (2016), we wrote:

The AEF is not activated by STEP propagation related to the SW edge of the Calabrian slab and its tectonics might be the result of regional scale lithospheric deformation connecting the thrust zone along the northern margin of Sicily with the Calabrian subduction, which gives rise to a dextral shear corridor including the Etna volcano and segments of the Malta escarpment. Both the IF (Ionian Fault) and AEF are predominantly dextral, with varying degrees of transtension. Whereas downbending of the lithosphere is proposed as the specific cause of the tensional component for (the NW part of) the IF, the tensional component for AEF is considered to be part of the regional strain field associated with Africa–Eurasia relative motion.

We therefore consider that the AEF can be regarded as an incipient STEP fault that has not yet significantly affected the rheological properties of the TOC in our study region.

We added a few sentences to adress this point:

New L590-L595: The role of the nearby Alfeo-Etna Fault system (AEF) is still under debate: even though it cuts the entire lithosphere strating in recent times (probably middle-late Pleistocene), it has probably not reached yet the stage of a slab tear (STEP) (Polonia et al., 2016, Gambino et al., 2022a). We, therefore, considered the AEF not mature enough offshore SE Sicily to significantly alter the mechanical properties of the above-mentionned crustal/lithosphere blocks.

Authors responses to RC1's annotations in the submitted manuscript:

L40-42: This region also suffered the most powerful and devastating earthquake, the 1693 Mw∼7.4 Val-di-Noto earthquake, reported in the Italian seismicity catalog.

RC1-1: Cite Rovida et al., 2022.

Authors: Corrected

New L42-44: This region also suffered the most powerful and devastating earthquake, the 1693 Mw~7.4 Val-di-Noto earthquake, reported in the Italian seismicity catalog (Rovida et al., 2022).

##########

L218-219: This section incorporates part of the Hyblean Platform, the Malta Escarpment, the western Ionian domain, and cut,

RC1-2: cuts

Authors: Corrected

New L218-219: This section incorporates part of the Hyblean Platform, the Malta Escarpment, the western Ionian domain, and cuts,

##########

L220-221: the offshore normal faults along the Malta Escarpment and the Alfeo/Ionian strike-slip fault systems, extending eastward (Figures 2, 3 and 4).

RC1-3: Alfeo and Ionian are two different and separate fault systems.

Authors: Corrected

New L220-221: the offshore normal faults along the Malta Escarpment and the Alfeo and Ionian strike-slip fault systems, extending eastward (Figures 2, 3 and 4).

##########

L226-228: The structure of the western section is constrained by onshore and offhore geology, well log stratigraphy, geophysics, seismic reection profiles, and geological cross-sections

RC1-4: offshore

Authors: Corrected

New L226-228: The structure of the western section is constrained by onshore and offshore geology, well log stratigraphy, geophysics, seismic reection profiles, and geological cross-sections

##########

L236-238: We constrain the geometries of the Quaternary to Mesozoic sedimentary units of the Hyblean Platform and Gela basin are constrain using the Monterosso 1, Plinio Sud 1, Troitta 1, Vittoria 3, Vizzini 1 wells

RC1-5: constrained

Authors: Corrected

New L236-238: We constrain the geometries of the Quaternary to Mesozoic sedimentary units of the Hyblean Platform and Gela basin are constrained using the Monterosso 1, Plinio Sud 1, Troitta 1, Vittoria 3, Vizzini 1 wells

##########

L456-458: Close to the coastline, theoffshore Augusta-Siracusa fault (Figure 7) has also been considered as a potential active fault (e.g., Bianca et al., 1999; Azzaro and Barbano, 2000).

RC1-6: the offshore

Authors: Corrected

New L453-455: Close to the coastline, the offshore Augusta-Siracusa fault (Figure 7) has also been considered a potentially active fault (e.g., Bianca et al., 1999; Azzaro and Barbano, 2000).

##########

L528-530: All this ad-hoc model, illustrates that the short wavelength geodetic signal along the Eastern Hyblean Plateau coast could be explained by ongoing extension tectonics and creep on coastal normal faults.

RC1-7: Add: At present, however, there is no evidence of the existence of faults matching the ones used in the third set of models.

Authors: We add this sentence proposal.

New L522-525: At present, however, there is no evidence of the existence of faults matching the ones used in the third set of models. All these ad-hoc models, illustrate that the short wavelength geodetic signal along the Eastern Hyblean Plateau coast could be explained by ongoing extension tectonics and creep on coastal normal faults.

##########

L605-608: The Alfeo-Etna fault system, in particular, was considered not mature enough offshore SE Sicily to alter signicantly the mechanical properties of the above-mentioned crustal/lithospheric blocks (Gambino et al., 2022a).

RC1-8: Too self-referential. Actually, other authors clearly identify it as a slab tear that cuts the entire lithosphere (e.g. Gutscher et al., 2016; Maesano et al., 2017; 2020). Please address this point in the text and discuss the implications on your model.

Authors: In our opinion, the role of the Alfeo-Etna Fault system (AEF) is still under debate: even though it cuts the entire lithosphere starting from recent times (probably middle-late Pleistocene), we are not convinced that it has reached the stage of a slab tear (STEP). We therefore consider that the AEF can be regarded as an incipient STEP fault that has not yet significantly affected the rheological properties of the TOC in our study region.

New L590-L595: The role of the nearby Alfeo-Etna Fault system (AEF) is still under debate: even though it cuts the entire lithosphere strating in recent times (probably middle-late Pleistocene), it has probably not reached yet the stage of a slab tear (STEP) (Polonia et al., 2016, Gambino et al., 2022a). We therefore considered the AEF not mature enough offshore SE Sicily to significantly alter the mechanical properties of the above-mentionned crustal/lithosphere blocks.

##########

L753: We show that the short wavelength relative coastal uplift, measured geodetically,

RC1-9: to coastal

Authors: Corrected

New L740-L741: We show that the short wavelength relative to the coastal uplift, measured geodetically,