



Review Report

Cerpa et al., Unraveling the Effect of Convergence Obliquity on
Overriding-Plate Deformation and Strain Partitioning in Subduction
Zones, TEKTONIKA, 2026.

Table of Contents

1st Round of Revisions	2
Decision Letter.....	2
Comments by Reviewer 1	3
Comments by Reviewer 2	16
Authors' Reply to Reviewer 1	17
Authors' Reply to Reviewer 2	18
2nd Round of Revisions	27
Decision Letter.....	27
Comments by Reviewer 2	28

1st Round of Revisions

Decision Letter

Dear Nestor,

We have finally received two reviews on your article and have reached a decision regarding your submission to tektonika, "Unraveling the effect of convergence obliquity on overriding-plate deformation and strain partitioning in subduction zones".

Both reviews are positive, although Mohamed Gouiza has made some suggestions where the manuscript could be strengthened. If you can address these comments from both reviewers it is unlikely that we will need a second review round.

Thank you for your patience, and for submitting to Tektonika

Our decision is: Revisions Required

All the best,

Dave

Comments by Reviewer 1

Tektonika peer-review form

> This form is **mandatory**, but highly flexible.

> We encourage reviewers to read the guidance below and familiarise themselves with the form's content before starting the review.

> An annotated version of the manuscript may be uploaded as part of the review.

We remind reviewers that by accepting to review a manuscript for Tektonika, you agree to abide by our [Code of Conduct](#). No regard should be given to gender, race, age, career stage, ethnic origin or citizenship, religious belief, or political or scientific alignment of the Author(s). All reviews should be respectful to the author(s) and unacceptable behaviours will not be tolerated.

This review form aims to streamline Tektonika's peer-review process and provide a structure that supports constructive feedback to authors. It is meant to guide unambiguous comments by reviewers on different aspects of the manuscript, facilitate revision and response by the authors, and swift and fair decisions by the editors. This form contains the following sections:

Section A - Overall evaluation

A1 Overall evaluation, general comments and summary

A2 Main merits, and main points of improvement

Section B - Detailed evaluation

B1 Title and abstract

B2 Introduction

B3 Datasets and methods

B4 Results

B5 Discussion and conclusions

B6 Figures, tables and citations

Section C - Additional comments

Section D - Feedback (about this review form)

Within each form section, the form has three subsections.

(i) For reviewers: YES/NO statements to evaluate manuscript *form*

YES/NO in statements aimed at qualifying the submission clarity in presenting the research (e.g. clear structure, effective knowledge transfer). The statements may also be used as prompts for structuring reviewer comments.

(ii) For reviewers: Free-form text to evaluate manuscript *content*

Comments on scientific merit, originality and validity of the research presented, and its relevance to the journal's [scope](#).

(iii) For authors: Free-form text to answer reviewers' comments

Authors should answer all reviewers' comments, point-by-point, including submitted and modified versions of text passages, and any other relevant information to allow assessing how reviewers' comments have been addressed.

In addition, both authors and reviewers may provide feedback to Tektonika about this form, and the overall peer-review process using Section D (or by email, to jtektonika@gmail.com).

Reviewers must complete Section A, and are strongly encouraged to fill Section B, especially for first submissions (see examples below). Sections C-D may be completed at reviewers' discretion.

Examples on how to fill section B "as needed":

- Should research be presented with insufficient clarity for the reviewer to easily assess its quality, reviewers may choose to answer to YES/NO statements only, and provide small comments to help improve the manuscript's clarity or structure.
- Should research be clearly and effectively communicated, reviewers may choose to review exclusively the manuscript's scientific content (merit, originality, validity and relevance), using the free text boxes predominantly while skipping or answering only a few of the YES/NO statements.

Section A: Overview of manuscript

A1) Overall evaluation, general comments & summary

A1.1) Reviewer's comments

A1.1.1) General evaluation and publication suggestion – Required:

Please use this space to describe, in your own words, the core subject of the submission and your overall assessment of its suitability for publication.

This is an excellent and well thought out research extending existing database, which sheds new light on overriding plate deformation, and the partitioning of plate driving forces at subduction zones. I appreciated the clarity of the writing, the well explained definitions and the well-presented figures. The manuscript suggest a tighter, more quantitative definition of overriding plate deformation style across the major subduction zones and draws on the relationship between subduction angle and the overriding plate deformation – while the latter has been explored previously in numerical studies, the authors quantify this relationship from a variety of real world data (GPS data, plate models, Wadi-Benioff seismicity etc..) to quantify this relationship for real world subduction zones. This has important implications for our understanding of subduction

zone kinematics, slab dynamics and surface deformation.

I recommend manuscript for publication with some minor clarifications detailed below

A1.1.2) What does the submission need to be publishable? (select as needed; comment for all cases)

- ☐ No changes required
- ☐ Rewriting
- ☐ Reorganising
- ☐ More data/figures
- ☐ Condensing
- ☐ Reinterpretation
- ☒ Other

Comments:

This is an excellent manuscript, of a well thought out study. The writing is clear and detailed however some minor clarifications and corrections of typos are needed. These are minor and mostly involve clarifications around the pseudo AB regions – i.e. what threshold velocity do you use to delimit this region from the interior? What velocity ranges does a region need to have to be defined as “interior”?

A1.1.3) Can the submission be improved by reducing/adding any of the following? (select as needed; comment for all cases)

- ☐ Text
- ☐ Table
- ☐ Figures
- ☐ Supplementary material

Comments:

[Free form box]

A1.1.4) Please complete the following section if you recommend that the submission is NOT appropriate for publication (select as needed; comment if a box is selected)

- ☐ Quality is poor
- ☐ Research is not reproducible
- ☐ Other

Comments:

[Free form box]

A1.2) Author(s) Responses:

A2) Summary of main merits and main points of improvement

A2.1) Reviewer's comments

Please describe below in a few sentences (100 to 300 words) the main merits of the submission and suggestions for improvements.

The main merits I have found are...

The main merits are:

1. This is an exciting and important contribution to field
2. Clarity and depth

The main points of improvement I have found are...

Expanding on my previous comment above it would be very helpful if the authors discuss threshold values of AB velocities– what was the threshold velocity change between pseudo AB region and the interior of the overriding plate? And was this consistent along the transect of the trench or did pseudo AB regions vary along the same subduction zone? What values did they attribute to the interior?

Also in lines 543-544 you mention that 2/3 of regions exhibiting high partitioning are close to or on a subduction high but what of the remaining 1/3? How do you explain the anomalous partitioning there?

A2.2) Author's responses:

[Free form box]

Section B: Detailed evaluation of manuscript

B1) Title and abstract

B1.1) Reviewer's comments

*These statements are a **guide** to what good Titles and Abstracts include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Title* describes the main topic of the manuscript **accurately** — [YES]

The *Title* describes the main topic of the manuscript **succinctly** — [YES]

The *Title* includes **appropriate key terms** — [YES]

The *Abstract* includes a **clear aim and rationale** — [YES]

The *Abstract* supports the rationale with **sufficient background information** — [YES]

The *Abstract* includes a **well-balanced description of the methods** — [YES]

The *Abstract* describes the **main results sufficiently and adequately** — [YES]

The *Abstract* clearly describes the **importance/impact of the study** — [YES]

The *Abstract* clearly states the **conclusions of the study** — [YES]

The *Abstract* is **clear** and **well structured** — [YES]

Comments:

[Free form box]

B1.2) Author's responses

[Free form box]

B2) Introduction

B2.1) Reviewer's comments

*These statements are a **guide** to what good Introductions include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Introduction* provides **sufficient background and context** for the study — [YES]

The *Introduction* describes the **aim/hypothesis/rationale** clearly, providing **sufficient context** — [YES]

The *objective/hypothesis/rationale* **flows logically from the background** information — [YES]

The *Introduction* describes the study's **objective and approach** (last paragraph) — [YES]

The *Introduction* contains **relevant, suitable citations** — [YES]

The *Introduction* is **organized effectively** — [YES]

Comments:

[Free form box]

B2.2) Author's responses

[Free form box]

B3) Data and methods

B3.1) Reviewer's comments

*These statements are a **guide** to what good Method sections include and good practices for Dataset accessibility. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Methods* are described **concisely and with enough detail** for reproducibility — [YES]

Necessary information about **data sources/acquisition/processing** is included — [YES]

Data used are accessible via either supplementary files or links in the data availability statement — [NO]

The *Dataset and/or Methods* are **organized effectively** — [YES]

Comments:

The data is not yet available but the authors say that they will make it available on their webtool

B3.2) Author's responses

[Free form box]

B4) Results

B4.1) Reviewer's comments

*These statements are a **guide** to what good Result sections include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Results* findings are **supported by data** — [YES]

The *Results* findings are presented **clearly and succinctly** — [YES]

The text in the *Result* section **cites tables and figures appropriately** — [YES]

The *Results* directly **relate to the study objectives** — [YES]

The *Results* present **data for all the approaches** described in the *Methods* section — [YES]

The *Results* **text belongs to the Results section**, not to *Introduction*, *Methods*, or *Discussion*. — [YES]

The *Results* section is **organised effectively** — [YES]

Comments:

[Free form box]

B4.2) Author's responses

[Free form box]

B5) Discussion and conclusions

B5.1) Reviewer's comments

*These statements are a **guide** to what good Discussions and Conclusions include. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

The *Discussion* is **focused on the objectives** of the study — [YES]

The *Discussion* **addresses all major results** of this study, which are shown in *Results* — [YES]

The *Discussion* section makes **comparisons with other studies** that are relevant and informative — [YES]

The *Discussion* section properly identifies all **speculative statements** — [YES]

The *Discussion* section presents the **implications of the study** persuasively — [YES]

The *Discussion* section **highlights novel contributions** appropriately — [YES]

The *Discussion* section **addresses the limitations** of the study appropriately — [YES]

The *Discussion* section is **organised effectively** — [YES]

The *Conclusions* are **consistent** with and **summarise** the rest of the manuscript — [YES]

The *Conclusions* are **supported by the data** in *Results* and **follow logically** from the *Discussion* — [YES]

The *Conclusions* are **clear and concise** — [YES]

Comments:

[Free form box]

B5.2) Author's responses

[Free form box]

B6) Figures, tables and citations

B6.1) Reviewer's comments

*These statements are a **guide** to what good Figures and Tables include and how they are presented. Please select YES or NO to the statements below if you wish and detail in the free form box below your reasons for any box checked with NO, or to comment on any other matter.*

Tables and Figures are **ordered logically** and **numbered sequentially** — [YES]

Tables and Figures have **captions that explain** all their major features — [YES]

Tables and Figures have **captions that complement** the information in the main text — [YES]

Tables and Figures present data that **relate** to the study objective — [YES]

Tables and Figures present data that are **consistent** with and support the description of results — [YES]

Tables and Figures have **succinct and informative titles** — [YES]

Figures are **accessible** (elements are clearly labelled, accessible colour palettes, colour contrasts, font size legible, etc....) — [NO]

Please, check our [\[Figure guidelines\]](#)

Figures with **maps or cross-sections** contain all **elements to be understood** (north arrow orientation, scale, visible coordinates, sufficient coordinate grid intercepts) — [YES]

Figures with **maps** have **sufficient location information** (in the map or caption) — [YES]

Cross-sections have clear labels for **scale and coordinates** at ends and within-section kinks — [YES]

All georeferenced elements are provided in common format (.shp, .geotiff, .kml) [in an open-access repository] - N/A

Citations throughout are relevant, suitable, and comprehensive — [YES]

Comments:

Figure 4 looks like it might not be accessible to colour blind people, it might be better to use a more accessible colour palette.

B6.2) Author's responses

[Free form box]

Section C: Additional comments

C1) Minor/line-numbered comments

C1.1) Reviewer's comments

Please see my comment in section A2.1 above

C1.2) Author's responses

[Free form box]

C2) Other remarks

C2.1) Reviewer's comments

[Free form box]

C2.2) Author's responses

[Free form box]

Section D: Feedback to improve Tektonika's review process

We kindly ask reviewers and authors to provide any feedback that can help improve this review form, or other aspects of the review process.

Feedback can also be emailed at any time to jtektonika@gmail.com

Comments by Reviewer 2

The manuscript by Cerpa et al. presents a new global compilation of overriding-plate deformation in subduction zones based exclusively on geodetic data, with the aim of reassessing the role of convergence obliquity in strain partitioning. The authors develop a kinematic framework based on deformation vectors and obliquity metrics, classify subduction zones into strain regimes, and explore correlations with subduction parameters such as convergence obliquity and slab dip.

The presented dataset and method are strong, however, the manuscript would benefit from some methodological clarification, statistical backing for key conclusions, and clearer articulation of novelty relative to previous studies. I therefore recommend publication after relatively minor to moderate revisions:

1- The manuscript builds on previous work (e.g., Heuret & Lallemand, 2005; Lallemand et al., 2005; Cerpa et al., 2022b), but the distinction between prior work and the present contribution was not always clear to me when reading the manuscript. In particular, it would be helpful to make the text more explicit in stating what aspects of the database are fundamentally new and what analyses/conclusions are significantly different from earlier studies. Maybe be a short dedicated subsection in the discussion outlining “Advances beyond previous Submap-based studies” would greatly improve clarity.

2- The definition of arc blocks (AB) is central to the study but relies on heterogeneous approaches (i.e., MORVEL, GPS-derived, single-station proxies, regions with undefined deformation). While these choices are well described, I feel that the implications for data consistency are not sufficiently quantified. I think it would be useful including a discussion (or, if possible, a quantitative assessment) of uncertainties associated with different AB definitions and clarifying how these uncertainties may affect global trends and correlations.

3- Several important conclusions seem to rely primarily on visual inspection of scatter plots (e.g., Figures 8–10), like the absence of a clear relationship between convergence obliquity and strain partitioning and the weak dependence of partition coefficients on convergence obliquity. While these interpretations may be valid, they would be significantly strengthened by quantitative statistical measures (e.g., correlation coefficients, confidence intervals), tests for significance/robustness, and/or consideration of potential confounding variables (e.g., slab dip, presence of bathymetric features). In addition, cases where correlations improve after excluding certain regions (e.g., Southeast Asia, Mediterranean) raise concerns about selection bias, which should be discussed more explicitly.

I have made additional suggestions (mostly related to the 3 points listed above) on the attached manuscript pdf.

Mohamed Gouiza
University of Leeds
(m.gouiza@leeds.ac.uk)

Authors' Reply to Reviewer 1

This is an excellent and well thought out research extending existing database, which sheds new light on overriding plate deformation, and the partitioning of plate driving forces at subduction zones. I appreciated the clarity of the writing, the well explained definitions and the well-presented figures. The manuscript suggest a tighter, more quantitative definition of overriding plate deformation style across the major subduction zones and draws on the relationship between subduction angle and the overriding plate deformation – while the latter has been explored previously in numerical studies, the authors quantify this relationship from a variety of real world data (GPS data, plate models, Wadi-Benioff seismicity etc..) to quantify this relationship for real world subduction zones. This has important implications for our understanding of subduction zone kinematics, slab dynamics and surface deformation.

I recommend manuscript for publication with some minor clarifications detailed below

We thank the reviewer for the comments which helped to improve the manuscript. We have addressed them as described below.

This is an excellent manuscript, of a well thought out study. The writing is clear and detailed however some minor clarifications and corrections of typos are needed. These are minor and mostly involve clarifications around the pseudo AB regions – i.e. what threshold velocity do you use to delimit this region from the interior? What velocity ranges does a region need to have to be defined as “interior”?

Thank you for requesting this clarification. To avoid confusion, we have removed the term "pseudo-AB" (L 275 and Figure 2). Following the nomenclature in Table 1, we define ideal AB (arc blocks) using one of two approaches:

- Pseudo-rigid blocks (from Morvel56 model or from published works), where we adopt the solutions and definitions proposed by previous work.
- Deformed areas where deformation is assessed using single-GPS station data.

In neither case do we apply a threshold velocity (we have added this clarification to the text L. 229). For deformed areas, we identify the trenchward-most GPS station and use its motion relative to the stable plate interior as our estimate of the deformation velocity. Since this approach is applied in regions such as Taiwan, Luzon, the Philippines, and the Cascades, areas typically characterized by diffuse deformation, our method integrates this deformation to into a single deformation velocity estimate.

Expanding on my previous comment above it would be very helpful if the authors discuss threshold values of AB velocities– what was the threshold velocity change between pseudo AB region and the interior of the overriding plate? And was this consistent along the transect of the trench or did pseudo AB regions vary along the same subduction zone? What values did they attribute to the interior?

We think this comment has been partly answered in treating the previous comment, since we had not to consider any threshold velocity in our work (e.g. L. 229).

Regarding the along-strike variability for a same subduction zone, the answer is yes, the types of AB blocks may change and thus we have added a few lines to clarify this in the new section “Potential limitations” of the Discussion (L. 739-742).

Also in lines 543-544 you mention that 2/3 of regions exhibiting high partitioning are close to or on a subduction high but what of the remaining 1/3? How do you explain the anomalous partitioning there?

We added a few sentences to provide a first-order description of the regions

displaying the highest values of p_i (L 676-682).

Figure 4 looks like it might not be accessible to colour blind people, it might be better to use a more accessible colour palette.

We appreciate the reviewer’s suggestion regarding the accessibility of Figure 4. To address this, we have revised Fig. 4 to use a colorblind-safe color palette (replacing red/green/blue based-palettes with orange/teal/purple). Accordingly, we also modified Fig. 5 to 12, as well as Fig. 14.

Other minor points by reviewer #1 (from annotated pdf):

* L 204 “how do you define relatively small? Do you use a threshold ratio of AB vs rest of the upper plate? And again do you have a threshold velocity?”

We have added a sentence (L. 209-211) to say that “large plates correspond to those accounted for in lower-resolution plate set models such as MORVEL (DeMets et al., 2010)”. We have not applied any velocity threshold as explained above (L. 229).

* L300 “how do you define this area?”

We added a clarification as follows (L. 298-299): “**Lastly, calculating the distance between the subduction trench and the landward boundary of the AB region for each transect**, we note that our database describes the deformation of the overriding plates within a mean distance of ~340 km, with a minimum of ~100 km (in eastern Philippines) and up to a maximum of 900 km (in the Altiplano region).”

* L 739 “what about the remaining 1/3 transects? What is causing this high partitioning?” Please see our response above. Authors’ Reply to Reviewer 2

The manuscript by Cerpa et al. presents a new global compilation of overriding-plate deformation in subduction zones based exclusively on geodetic data, with the aim of reassessing the role of convergence obliquity in strain partitioning. The authors develop a kinematic framework based on deformation vectors and obliquity metrics, classify subduction zones into strain regimes, and explore correlations with subduction parameters such as convergence obliquity and slab dip. The presented dataset and method are strong, however, the manuscript would benefit from some methodological clarification, statistical backing for key conclusions, and clearer articulation of novelty relative to previous studies. I therefore recommend publication after relatively minor to moderate revisions:

We thank the reviewer for his thorough and constructive comments. We have carefully addressed each of them as detailed below.

1- The manuscript builds on previous work (e.g., Heuret & Lallemand, 2005; Lallemand et al., 2005; Cerpa et al., 2022b), but the distinction between prior work and the present contribution was not always clear to me when reading the manuscript. In particular, it would be helpful to make the text more explicit in stating what aspects of the database are fundamentally new and what analyses/conclusions are significantly different from earlier studies. Maybe be a short dedicated subsection in the discussion outlining “Advances beyond previous Submap-based studies” would greatly improve clarity.

Thanks for the comment. We have included an entire sub-section (**new Section IV.2.1**) in the discussion section to highlight the key improvements of the current version of the database. In addition, a few sentences in that direction have also been added to the Introduction (**L. 89-90**; and re-worked paragraph **L 94-110**) and to the Conclusion (**L 1098-1102**) sections.

2- The definition of arc blocks (AB) is central to the study but relies on heterogeneous approaches (i.e., MORVEL, GPS-derived, single-station proxies, regions with undefined deformation). While these choices are well described, I feel that the implications for data consistency are not sufficiently quantified. I think it would be useful including a discussion (or, if possible, a quantitative assessment) of uncertainties associated with different AB definitions and clarifying how these uncertainties may affect global trends and correlations.

In a **newly added sub-section IV.1 (Potential limitations)** of the Discussion section, we acknowledge that the heterogeneous geodetic data may introduce errors in our estimations. While quantifying these errors is beyond the scope of this study and of our expertise, we emphasize that our primary objective was to improve the accuracy of the kinematic descriptions of subduction zones relative to existing solution, which largely neglect overriding-plate deformation. To address this, we added the following paragraph (**L 741-751**):

“Although we do not quantify the uncertainties introduced by mixing these

data types, we argue that they are likely smaller than those arising from neglecting overriding-plate deformation. For example, ignoring deformation introduces significant errors in regions such as Central America (deformation velocities of 10-15 mm/yr) and the North Andes (deformation velocities of ~10 mm/yr) where we used published rigid blocks, as well as Taiwan (deformation velocities in the order of 50 mm/yr) and Southern Chile (deformation velocities up to 7 mm/yr) deformed areas where we used data from single GPS stations. Thus, we consider our approach a clear improvement over previous compilations."

3- Several important conclusions seem to rely primarily on visual inspection of scatter plots (e.g., Figures 8–10), like the absence of a clear relationship between convergence obliquity and strain partitioning and the weak dependence of partition coefficients on convergence obliquity. While these interpretations may be valid, they would be significantly strengthened by quantitative statistical measures (e.g., correlation

coefficients, confidence intervals), tests for significance/robustness, and/or consideration of potential confounding variables (e.g., slab dip, presence of bathymetric features). In addition, cases where correlations improve after excluding certain regions (e.g., Southeast Asia, Mediterranean) raise concerns about selection bias, which should be discussed more explicitly.

We thank the reviewer for making this comment which has led us to improve the quantitative statistical measures of the correlations we discussed for overriding plate deformation. The changes we have made are as follows:

- **Figures 6 and 7:** We have added statistical measures (mean, median, standard deviation) to our histograms describing deformation velocities and coefficient of partitioning.
- In **Section III.3.2** we now briefly present a preliminary step where we investigate the correlation of the deformation obliquity against various relative and absolute kinematic parameters as well as against slab dip (**L. 576-582 in MS and newly added Section S1, Figures S1-S2 in the Supporting Information**). We now quantitatively (with bi-variate correlation plots, Figs S1 and S2) demonstrate that, among all these parameters, the directed deformation obliquity best correlates with the directed convergence obliquity, especially when isolating transects under strike-slip regime (**L. 618-620**).
- In **Section III.3.3:** We have significantly improved our statistical analysis of the lateral partitioning with convergence obliquity for strike-slip transects:
 - We now provide a **new Table S1** where we provide the

transects under strike-slip regime (with $p_i \leq 1$) and

categorize them depending on whether they display: a topographic anomaly entering the trench, a density anomaly at the trench, a

localized deformation structure in the overriding plate, and whether the latter is an intra-arc fault system (L. 688-691).

- We investigate (MS L. 704-712, and SI section S2) how each category behaves in terms of p_i and O_i and we show that any of them can explain, alone, an « efficient »

partitionning (high p_i – low O_i). In contrast, this allows us

to more quantitatively suggest that the transects exhibiting both a density anomaly and a localized deformation partitioning along an intra-arc fault are more likely to display an efficient partitioning.

- For **Sections IV.2.2 and IV.2.3**: We now provide a more detailed criteria for selection of « major » subduction zones (L. 846-855 ; L. 906). Since we try to decipher dynamical controls on overriding plate deformation arising primarily by the SP plate-OP plate interaction, we exclude area near a collision zone or a proximal double-subduction system (with opposite polarity). In addition, we also exclude areas where the total width (along strike) of the subduction zone is less than 1000 km.
- In **Section IV.2.4**: We have also added a quantitative analysis of whether the crust-type of the overriding plate affect the

relationship between p_i and O_i (MS L. 960-966, and SI **Figure**

S4), instead of a qualitative description in our previous version of the manuscript.

I have made additional suggestions (mostly related to the 3 points listed above) on the attached manuscript pdf.

Mohamed
Gouiza

University
of Leeds

Other minor points by reviewer M. Gouiza (from annotated pdf):

* L. 89-90 - I suggest to rephrase to: “lack of a globally consistent, geodetically constrained 2D database...” *Sentence modified according to reviewer’s suggestion.*

* Introduction - *A bit too lengthy description for the introduction. Here you should focus on what is new in this study.*

*We have merged two paragraphs and shortened them as suggested (L 94-110). We have emphasized what is done in the present study “The kinematics component of the Submap database compiles information on the absolute plate motions and relative motions (convergence and subduction rates), as well as on the deformation rate of the overriding plate, **all of which are updated in the present study**” and “[...] we reach a spatial description (full two-dimensional vector $v_{\#}$) for 78% of them, **consistently based on geodetic data**”.*

* L 274: *The classification of AB types (MORVEL, GPS blocks, single stations, undefined) is clear but introduces heterogeneous data quality [...] Is it possible to provide the expected uncertainty level associated with each type?*

*To address this comment along with the reviewer’s major comment 2), we have added a **new section IV. 1 “Potential limitations”** in the Discussion, acknowledging the account of heterogeneous data quality. Please see response above.*

* L226: *“Hsu et al, in press -- It is a bit useless to cite an unpublished paper. It might be out by now if not please remove.”*

We have modified the citation since the paper is now published.

* L321 *Setting v_d as undefined is appropriate. However, the assumption $v_s = v_c$ is strong. Could you discuss explicitly*

This choice is somewhat arbitrary, but we think it make the database more useful than settting v_s as undefined. We have clarified this as (L. 236-241): “For those cases, we set $v_{\#}$ as undefined (rather than 0), to acknowledge the potential for active deformation (see below section II.3). However, for practical use of the database, we make use of the MORVEL-56 solution for $v_{\%}$ and assume that $v_s = v_{\%}$ (blue stripes in Figure2a and Table 2). Although arbitrary, we think that the latter choice is more useful than assigning an undefined v_s and aligns with the choice made in most, if not all, existing subduction kinematic databases (Heuret & Lallemand, 2005; Schellart, 2008b).”

* L379 “Great to see limitations acknowledged [...] quantifying uncertainties where possible would strengthen this section. Also linking limitations to specific results”

We have moved the “Potential Limitations” subsection to the beginning of the Discussion (**new Section IV.1**), where we now explicitly list and qualitatively discuss several potential pitfalls in our approach. While we acknowledge that quantifying the associated uncertainties would be valuable, we consider such an analysis beyond the scope of this study. Nevertheless, in this new section, we identify the regions where these pitfalls are most relevant, as well as those where our approach, despite its limitations, provides a more accurate kinematic description than existing databases.

Among others, we have added the following remarks:

“ignoring deformation introduces significant errors in regions such as Central America (deformation velocities of 10-15 mm/yr) and the North Andes (deformation velocities of ~10 mm/yr) where we used published rigid blocks, as well as Taiwan (deformation velocities in the order of 50 mm/yr) and Southern Chile (deformation velocities up to 7 mm/yr) deformed areas where we used data from single GPS stations. Thus, we consider our approach a clear improvement over previous compilations. Future work could further refine these estimates by directly processing public GNSS datasets across all subduction zones (Morell et al., 2025).”
(L. 741-751)

“the Eulerian solution for the motion of the Scotia Plate’s western termination (relative to the South America Plate) did not match field observations (Perucca et al., 2016), leading us to omit it from our analysis.”
(L. 755-757)

“our compressive (C,C-SS) and extensive (E, E-SS) classes effectively capture (quasi-)trench normal compressive and extensive tectonics but also comprises (quasi-)trench-normal strike-slip systems such as the Puná-Pallatanga fault system in Ecuador (Alvarado et al., 2016; Jarrin et al., 2023). Likewise, our strike-slip classes (SS-E, SS, SS-C) may correspond, in nature, to trench-parallel extensional or compressional structures such as in the Andaman sea where spreading is quasi-parallel to the subduction trench (Curry, 2005). In other words, while our framework provides a robust directional description of overriding-plate deformation, the real geological structures may not always align perfectly with our (sub)class names” (L. 760-769)

* L 376 “Is it possible to justify the 45 and 135 threshold?”

We have modified the sentence (L. 376) describing our arbitrary definition

of the three dominant regimes using $O_{\dots}$ as: “To account for this, we expand the definition by dividing the angular space into three equal regimes, each corresponding to a dominant strain class”

* It is worth noting that some necessary simplifications underlie our approach to derive strain (sub)classes based on the value of O_{vd} → “These caveats are important. Is there a way to highlight these more prominently? maybe in the limitations section or in the discussion section?”

We have now also recalled these limitations in the **new Subsection 4.1 Potential** in the Discussion.

* L 414 “The dominance of strike-slip regimes in a key result! how does it compare with previous work ?” First of all, to the best of our knowledge, our dataset provides the first classification of subduction zones into 3 dominant strain classes (7 strain classes) as now highlighted in the conclusions (L 1099-1102). Second, focusing on the dominant strike-slip regime, we have added a few sentences in the **new section IV.2.1** to compare our prediction of 60% of transects to the proportions estimated in previous studies (L. 800-811): “Notably, transects under a dominant strike-slip regime account for approximately 60% of all transects with defined deformation velocities, making it the most common strain class in present-day subduction zones. This proportion is comparable, though slightly higher, than the 50% of trenches exhibiting forearc sliver motion recently estimated by Morell et al., (2025) through an analysis of 13 subduction zones.”

* L 507 “Consider adding statistical parameters (e.g., median, variance) in addition to means” We added median and standard-deviation values to the histograms on **Figure 6 and 7**

* L 519 “clarify how the partition coefficient compares to the one in the literature.”

We modified the paragraph to describe how our definition may differ from past definitions of the partition coefficient (L 529-532).

* L 605 “Is it possible to provide a quantitative metric of “compatibility”?”
We now specify what we mean by “compatible” term: it is when directed obliquities of deformation and convergence have the same sign (L 592).

* L 607 (no clear relationship betw O_{vd} and O_{vc}): “I am assuming that this is based on visual inspection. If yes, is this something that can be tested

statistically?”

We softened this assertion given that the two variables display a relative good linear regression coefficient (**L. 593-595 + Figure S2**). We changed this sentence to “*We find that for these transects the two variables display a linear correlation coefficient of approximately 0.76*

despite important scatter”. In addition, we **added a section S1 to the Supporting Information** where we describe a test the correlation

between $\ddot{O}_{1,}$ and various relative and absolute kinematic values, and

we find that it best correlates with $\ddot{O}_{1,} .$

* L664 “*The absence of a trend between partitioning and obliquity is a key conclusion. in my opinion this needs stronger statistical support.*”

We have expanded this statistical analysis, which led to important changes to the text of this section (**L. 670-682**) and **adding Supporting Information Section S2, Figures S3 and S4.**

* L725 : «*The link with bathymetric features is interesting. Could you clarify whether this is a qualitative observation or a statistically testable relationship?*» :

We have added an improved analysis by marking the transects displaying a bathymetric feature. We proceed to the same identification for localized (intra-arc) fault accommodating the partitioning. Our strategy to mark the transects is presented in **newly added Supporting information Section S2** and we now provide a **Table S1** showing the characteristics of all transects displayed in Figure 10. We proceeded to a more systematic quantitative analysis of how isolating transects displaying the explored geodynamic characteristics would affect Figure

10. This has led to the re-writing of a whole paragraph (**L 684-712**)

* L 824: About the relationship the relationship between dip and vd “*Could you justify the exclusion criteria more rigorously? "excluding complex areas" is a vague statement.*”

We have expanded the text (**L 846-855**) to justify the regions that can be excluded from the analysis. In short, the excluded regions are those where we may reasonably think that a single-slab dynamics and

generated interplate force may not be the dominant control on the deformation of the overriding plate. We thus exclude regions proximal to a collision zone, regions with double-subduction system operating in a proximal region and the subduction zones that have a total width of less than 1000 km.

* L 848 *“maybe you can provide the correlation coefficient in the text» :*

We added the linear regression coefficient between α and O_{in} in the text (L 876).

* L 878: *“Is the relationship between deformation rate and slab edge distance region-dependent? if so one needs to avoid overgeneralization”*

We have slightly rephrased to avoid overgeneralization from this paragraph (L 899-904). In particular, we now explicitly say that a closer look, region per region, does not highlight the same simple trends

between v_{in} and X_{edge} , as it is more detailed in the following paragraph.

* L 939: *“This should be reframed and better explained. Could you be more specific about the findings of Jarrad (1986)?”*

We have expanded the explanation of Jarrard’s 1986 findings (L. 960-964). Following other reviewer’s major comments, we also now provide a more quantitative analysis of the non-correlation we found between the crust type on the overriding plate and strain partitioning (L964-966 in the MS, as well as Fig S3 and S4 in the SI).

* L964 *“My understanding is that the hypothesis about interface friction is speculative but interesting. If that's the case, could you clearly label it as such to avoid overinterpretation.”*

We have re-phrased those sentences to be more explicit on the fact that this is our interpretation/speculation given our analysis of our dataset (L 983-991).

* L 1015 *“The magnitude of differences [in thermal parameter] is significant. It might be worth highlighting the implications more explicitly”.*

We have added a paragraph (L. 1064-1071) to highlight studies that have used past estimations of the thermal parameter, which may be influenced by our new estimates.

2nd Round of Revisions

Decision Letter

Dear Nestor Cerpa, Serge Lallemand, Arnauld Heuret:

We have reached a decision regarding your submission to *tektonika*, "Unraveling the effect of convergence obliquity on overriding-plate deformation and strain partitioning in subduction zones".

Our decision is to: Accept Submission

Moh Gouiza reviewed your revised manuscript and had the following to say:

I would like to thank the authors for their detailed responses and the substantial revisions made to the manuscript to address my main concerns, which in my opinion have been adequately resolved. In particular:

- the clearer articulation of the novelty of the database,
- the new discussion of methodological limitations,
- and the additional quantitative analyses of the relationships between overriding-plate deformation, convergence obliquity and other potential controls.

Some limitations remain, particularly regarding the heterogeneous nature of the geodetic constraints and the associated uncertainties. However, these are now explicitly acknowledged and appropriately discussed. I recognise that fully quantifying these uncertainties would require a substantially different and considerably more extensive analysis than is warranted within the scope of the present contribution.

Overall, I think that the implemented revision have considerably strengthened the manuscript and I have no further comments. I recommend the manuscript for publication in *TEKTONIKA*.

Thank you for supporting *Tektonika*, and apologies for the delays in dealing with this manuscript.

Kind regards,

Dave

Comments by Reviewer 2

I would like to thank the authors for their detailed responses and the substantial revisions made to the manuscript to address my main concerns, which in my opinion have been adequately resolved. In particular:

- the clearer articulation of the novelty of the database,
- the new discussion of methodological limitations,
- and the additional quantitative analyses of the relationships between overriding-plate deformation, convergence obliquity and other potential controls.

Some limitations remain, particularly regarding the heterogeneous nature of the geodetic constraints and the associated uncertainties. However, these are now explicitly acknowledged and appropriately discussed. I recognise that fully quantifying these uncertainties would require a substantially different and considerably more extensive analysis than is warranted within the scope of the present contribution.

Overall, I think that the implemented revision have considerably strengthened the manuscript and I have no further comments. I recommend the manuscript for publication in TEKTONIKA.