

## ***Interactive comment on “The ISC Bulletin as a comprehensive source of earthquake source mechanisms” by K. Lentas et al.***

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We have taken the Reviewers' comments into account in the preparation of this revised version of the paper, which contains some text changes and additions, to fully address their requests. Moreover, we extended the data time period covered in this manuscript until the end of the data year 2018, as opposed to October 2018 when the manuscript was first submitted. The data added until the end of 2018 does not change the content and results discussed. Here follows our response to the Reviewers' comments and an explanation of the points that we have changed. Attached to our response is the revised version of manuscript with changes tracked in blue for the text addition/changes and in red for the text deleted.

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### **1 Reviewer 1**

#### **1.1 “ISC computed source mechanisms”**

Reviewer 1 expressed the query on why the ISC computed focal mechanism solutions are not discussed in the paper even though they are briefly mentioned in the abstract. The Reviewer claimed that it does not make sense to omit a part of the source mechanism solutions that can be found in the ISC Bulletin since the scope of the paper is to discuss the ISC as a comprehensive source of information on earthquake source mechanisms.

We appreciated the Reviewer's comment and have now included the ISC computed solutions in our analysis throughout the paper. Text has been added in Section 2 (page 3, lines 3-9) and in Section 5 (page 8, lines 27-29) and all the figures in the revised manuscript have been rebuilt in order to include the ISC computed focal mechanism solutions. The additional data did not change the main points of this paper.

#### **1.2 “ISC and other global sources”**

Reviewer 1 suggested to present more information on the reported mechanism solutions by each agency in the ISC Bulletin in terms of geographical distribution, magnitude range, number of reported mechanisms, time distribution and provided information. The Reviewer proposed to do so at least for the agencies that report solutions more systematically, covering a long period of time in order to point out differences and complementarity.

Information regarding the number of reported solutions, type of methodology being applied (where available) and time distribution has already been presented in Figure 2. In order to address the rest features in the Reviewer's comment we added Table 1 where

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we present the magnitude range covered by each agency and the type of parametric data that is being reported by each agency. Moreover, we added Figure 4 which shows the geographical and magnitude distributions covered by the most systematically reporting agencies hoping to help the users of the ISC Bulletin to identify areas where local/regional agencies offer complementary information to global agencies. Text is also added in Section 2 (page 3, lines 11-25) to give some examples in specific areas on how local agencies cover gaps in magnitude range left by global agencies. Details on the methodologies being applied by different agencies are also presented in Section 3 (page 4, lines 25-35, and page 5, lines 1-15). Implications of combining solutions determined by different agencies using different techniques are discussed in Section 5 (see for example page 8, lines 30-36, and page 9, lines 4-10).

### 1.3 “Section 3 restructuring”

Reviewer 1 had objections regarding the structure of Section 3 entitled “Source mechanism variability” and proposed to restructure it and further discuss some parts of it. Specifically, the Reviewer suggested to start by discussing the point source approximation as a concept, discuss the different types of point source models (focal mechanisms, moment tensors) and finally the data being used in different methodologies (polarities, amplitude ratios, waveform modelling) and differences among moment tensors and centroid moment tensors, and centroid locations and hypocentre locations.

Moreover, the Reviewer suggested to further discuss a couple of examples briefly mentioned in the originally submitted manuscript (page 4, lines 8-12 of the original manuscript) and suggest if possible how to select a reference source mechanism for earthquakes with multiple solutions. Then, to discuss further the reasons why some earthquakes show inconsistency between the reported mechanisms and finally, to give more information on how the fault styles in Figure 5 (in the original manuscript, Figure 6 in the revised manuscript) are obtained.

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Following the Reviewer’s comments, we have rewritten (almost entirely) Section 3 in order to comply with the suggestions mentioned above. Specifically, we added two new paragraphs in the beginning of Section 3 (page 4, lines 1-18) to address the Reviewer’s comments on the point source approximation and point source models. The text has been reformed in page 4 (lines 25-35) and page 5 (lines 1-15) in order to discuss differences in moment tensors and centroid moment tensors, and centroid and hypocentre locations and make it easier for the reader to follow.

Text has been added in page 6 (lines 3-16) in order to discuss more thoroughly two case studies of large variability in reported source models as suggested by the Reviewer. New text in page 6 (lines 23-35) addresses the Reviewer’s comments on identifying cases with large intra-event variability in source models and potential reasons that may contribute in these cases (see also page 6, lines 19-22).

Text in Section 5 (page 8, lines 25-36, and page 9, lines 4-18) explains further the scope of this paper, discusses complexities in different source models and gives some general hints on data quality characteristics which can help user of the ISC Bulletin to select a source model that may be more robust or more appropriate for their research.

Finally, we expanded the text at page 7 (lines 1-25) to better explain how the annual counts of Figure 6 (Figure 5 in the original manuscript) are obtained following the fault styles of Zoback (1992). Examples to events in the ISC Bulletin have also been added with links to specific events.

### 1.4 “Figures”

Reviewer 1 suggested a few improvements in the existing figures, namely:

1. Figure 1: to show the temporal evolution of target magnitudes or and histograms discussing the magnitude distribution. - We split the data period covered in this

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paper in six parts and added a subplot for each time period (decade) in order to show the time evolution in magnitude range coverage in the entire ISC Bulletin.

2. Figure 2: institute acronyms should be listed in an additional table. - We added Table 1 to address this comment.
3. Figure 3: add titles for the upper and bottom panels including information regarding agencies and minimum magnitude. - We addressed this comment accordingly.
4. Figure 5: add a symbol legend. - We added a legend in this figure (Figure 6 in the revised manuscript).
5. Figure 5: what are undefined earthquakes? - We explain this in the revised text (page 7, line 6)

#### 1.5 Other minor comments

We addressed all the other points raised by Reviewer 1 as follows (following the same order as in the Reviewer's text):

1. page 1, line 8: clarify the meaning of 90% or reformulate the text. - We addressed this comment by adding more information (page 1, lines 8-9).
2. page 4, line 5: maximum intra-event rotation (it needs better explanation, introduce the concept clearly). - We added new text in page 5 (lines 28-31) to address this comment.
3. page 4, line 14: "...can be as high as 100°". - We added new text in some earlier stage (page 5, lines 24-28) to address this comment and give an a physical explanation for the rotation angle.

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4. page 5, line 8: "be aware of the techniques being used." Is the bulletin reporting details in techniques, data, azimuthal coverage? - The ISC Bulletin reports the number of stations and errors in the collected source models where available. This varies from agency to agency. This is partly a reason for the existence of this paper, thus, to make users aware of this information. Text was added in pages 6 (lines 20-22) and 8 (lines 24-29).
5. page 5, line 12: "centroid or not" should be "centroid or hypocentre". - We corrected this (page 8, line 22).
6. page 5, line 10: "substantial mislocations" should be "substantial differences". - We corrected this (page 8, line 19).
7. page 5, line 21: should be 80% (not 90%). - This is right, we corrected it (page 9, line 23).
8. bottom of page 6: the similarity of both focal mechanisms and moment tensors is discussed only using a Kagan angle and the discussion is done on DC components. - We added some text to clarify this (page 9, lines 24-27).

## 2 Additional changes

We added a few new references to the manuscript, updated the figures and corresponding captions and at times streamlined the text.

Please also note the supplement to this comment:

<https://www.earth-syst-sci-data-discuss.net/essd-2018-143/essd-2018-143-AC1-supplement.pdf>

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