

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

Anonymous Referee #1

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Review of the manuscript “The ISC Bulletin as a comprehensive source of earthquake source mechanisms” by K. Lentas and coauthors, submitted to Earth System Science Data Discussion.

This compact paper describes the recompilation of global earthquakes source parameters (focal mechanisms and moment tensor solutions) included in the ISC Bulletin.

I believe that a description of this useful source of information for seismologists deserved to be published, but at the same time I found the paper unclear and incomplete and I have a number of important comments which should be considered in a revised manuscript.

I suggest to reconsider the publication after major revision.

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I list below some main comments and several minor ones.

Main comments

1. On own mechanisms and reported ones Discussing the seismic source catalog at ISC, one wonders why only reported focal mechanisms are discussed in this paper, and not also those computed by ISC itself. Please clarify. This appears first in the abstract, where you mention that “the main sources of focal mechanisms in the ISC Bulletin are reported solutions . . . and ISC computed focal mechanisms...” but then you “focus only on the reported mechanisms”. To me this makes no sense, since the aim of the paper is to discuss ISC as a source of information, but you present only part of it.

2. ISC and other global sources When discussing ISC as a source of information for focal mechanisms and moment tensors on a global base, more reference should be given to those sites/Institutes which provided such information for a long time, and highlight differences (e.g. in terms of geographical and magnitude targets, number of reported solutions, time frame, and provided information). This implies Global CMT at first, but also other sources. Such comparative discussion should point out main differences and complementarity. An interesting aspect, here, is that ISC recompiles and mirrors a number of different solutions, whereas e.g. Global CMT is basically performing its own inversion and provide one solution per event. This has potential positive and negative aspects, as I discuss below.

3. Section 3 restructuring The paragraphs at Pag.3 - lines 20-32 is unclear. I suggest to reformulate these paragraphs. I think the first part of Section 3 reads fine and focus on differences in terms of fitting approach (polarity/amplitudes/amplitude ratios vs waveform based approaches). The continuation is less clear. I would suggest to restructure the text as follow: first discuss point source approximation, then come to point source models (focal mechanisms, moment tensors), then to the approaches to resolve them (polarity, amplitude ratios, waveforms etc.). Here you should also discuss

differences among moment tensors and centroid moment tensors – which are recalled later in the paper. And link focal mechanisms to hypocenters and evtl. moment tensors to centroids, as you mention later differences among hypocenters and centroids.

4. From multiple solutions to interpretations The second part of Section 3 is dedicated to describe a peculiar feature of the catalog, which is the presence – for some events – of multiple solutions. This is potentially a nice feature, but also makes the life of a user more difficult, as it becomes unclear to what solution to believe a) I think authors could discuss more the considered case studies (P. 4 – L. 8-12) b) Suggest if possible, what approach to follow to identify cases of inconsistent solutions (and mention if rotation angles are provided in the catalog or not) and ideally how to choose a reference mechanism c) The discussion of mechanisms variability is very poor, and miss to investigate what are typical reasons for mechanism inconsistency for some events. Are these events located in some specific regions, e.g. where to little or to noisy data are available? Is there a relation to magnitude? Or to depth? Do they involve all type of focal mechanisms? d) Very obscure is how authors go from the multiple solutions to Figure 5. I think there is a step missing in this part of the text. How do you obtain a fault style? How do you handle cases where multiple solutions fall into different styles? How (and if) do you choose one solution out of the multiple solutions.

5. Figures Figures can be improved as follow: a) Figure 1 could be improved by also showing the temporal evolution of target magnitudes, or an histograms discussing magnitude distribution b) Figure 2: institute acronyms should be listed somewhere, perhaps in an additional table. c) Figure 3 would be more readable if a title is included in the figure for the upper and bottom panels (i.e. Regional agencies $M > xx$, Global agencies $M > xx$) d) Figure 5: Add a symbol legend, so that the figure is better readable. e) Figure 5 caption: what are “undefined earthquakes”?

Other minor comments

1. Clarify the meaning of 90% at Pag.1 - Line 8, or reformulate the text.

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2. P. 4 – Line 5: maximum intra-event rotation: I understand what you mean, but feel this needs a better explanation for a broader audience. Please, first introduce this concept clearly.
3. P. 4 – Line 14: "... can be as high as 100°". I think this is not very helpful for a reader, as one cannot get a feeling for this number. Perhaps you could mention what is the maximum possible value for the rotation angle.
4. P. 4 – Line 21: what are "earthquakes for which we could not assign a fault style"? How is a fault style assigned? Not clear at all.
5. P. 5, Line 8 "be aware of the techniques being used". I think this becomes important especially for the cases where multiple, inconsistent solutions are reported. A user would probably rely on a certain technique or based on the data amount used for the inversion, or the azimuthal coverage. IS the Bulletin reporting all these details? If not, the user has no options to be aware. . .
6. P. 5, Line 12 "centroid or not" should be "centroid or hypocenter"
7. P. 5, Line 5 "substantial mislocations" does not seem the proper word here, as this word implies some error in the location. However, you rather discuss here differences among centroid and hypocenters which may be true features. I would use the wording "substantial differences"
8. P. 5, Line 21 a rotation of 20% Kagan angle out of 120% maximal differences, and assuming this linearly maps into focal mechanisms similarity, should then be rather ~80% (not 90%)
9. Bottom of P. 5. While ISC reports both focal mechanisms and moment tensors, there is no discussion at all on the moment tensors, their similarity (the similarity is here discussed only using a Kagan angle, and thus concerns the double couple -DC terms only) and their non-DC terms, and all the discussion is done on DC components. I think this is fair, if you make this clearly explicit.

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