Hydrol. Earth Syst. Sci. Discuss., 9, C5226–C5230, 2012
www.hydrol-earth-syst-sci-discuss.net/9/C5226/2012/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Global hydrobelts: improved reporting scale for water-related issues?" *by* M. Meybeck et al.

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Received and published: 9 November 2012

We appreciate a lot the careful work of the reviewer #1 and his thoughtful comments on the manuscript. The manuscript has been revised following the comments and suggestions, as detailed below. We believe that these revisions have led to a significant improvement of our manuscript.

REVIEWER #1: This manuscript describes a new (hierarchical) classification of the global terrestrial hydro-system. The manuscript falls within the scope of HESS. The manuscript is very well written. I can see an enormous amount of work has been done to undertake the classification.

RESPONSE: We thank you for this comment. We have somewhat simplified our outline now in the revised manuscript. The application to the population distribution is now revised and presented at the end of the paper, under Discussion –including a new detailed discussion of the population over runoff ratio, used as a potential pressure indicator. At the end of revised discussion the representation of population in the T° vs q domain for different political entities vs hydrobelts, hydroregions and coastal catchments. The results (figures and tables) are not modified but the text has been revised and somewhat simplified, and the structure is modified.

REVIEWER #1: My main scientific query related to water resource development. In particular, how was development handled in the underlying source runoff data (i.e. Fekete et al 2002 in Table 2)? This needs to be described in more detail. For example, were the runoff classifications (in Table 1) based on actual observed flows, or the so-called "naturalised flows"?

RESPONSE: We agree that this issue was not clearly stated in the manuscript. We used the runoff field from Fekete et al 2002, as stated in the manuscript. This runoff field is modelled and calibrated based on the observed discharges (mostly for the 1960-1990 period), as detailed in Fekete et al. 2002. It can be argued that in some places the naturalised discharge could offer better runoff field for our purposes. We use, however, also precipitation in our belt delineation, so we think that the impact of using Fekete et al. 2002 runoff field instead of naturalised ones on our analysis is marginal. This needs to be tested in further studies. We have clarified this in the revised version.

REVIEWER #1: I was especially interested in the whole question of development because I was looking forward to seeing a map and summary table of the available surface water (i.e., runoff) per person in each of the 29 hydroregions. I think this would give a very different perspective and would love to see it added as an additional example of the application of the approach. (It would be an excellent example of the utility of your classification!) Even better would be a map (and Table) that distinguished between current water extractions per person and the total available surface water that could

be extracted per person. This would, at a glance, identify those regions that are water stressed and those that are not. Of course to do that requires detailed knowledge of existing development. I accept that this type of data may not yet exist but it sure would be interesting to see such a map.

RESPONSE: We do agree that it would be highly interesting to work in this direction. This will be our next target in the following paper. To follow your suggestion, however, we have now considered the water-population relation and its global distribution through a new indicator: the potential pressure indicator. Indicator is normalised to the minimum pressure we found (in North America Boreal region). This indicator is calculated as follows: (dpop/q)hydroregion / (dpop/q)N.Am Boreal. It is dimensionless and varies from 1.0 to about 300. The population pressure on river basin is now discussed by hydroregions under Discussion section.

REVIEWER #1: 1. Groundwater was not dealt with? Perhaps some comment on that might be useful. It will certainly be an important water source in some hydroregions.

RESPONSE: We agree that this is an important issue to clear with in the manuscript. In the Fekete paper the groundwater infiltration is integrated with the surficial runoff. In the dry regions it may be the dominant water path, but we cannot have access to this information. It will be described in details in revised manuscript.

REVIEWER #1: 2. Line 104. Replace damming with dam construction

RESPONSE: We replaced the term as suggested

REVIEWER #1: 3. Page 9. When describing the datasets here (and elsewhere) it would be useful to give the typical spatial resolution in km as well as the geographic distances (minutes of arc).

RESPONSE: The resolution is now given in km at the equator, for each resolution, when introduced first time.

REVIEWER #1: 4. Line 300. I did not understand the comment ..... “During at least

one of the Quaternary ice ages ....” . This was also a footnote to that effect in Table 3 as well. Do you mean something like .... In one of the last x ice ages? Please elaborate on the significance.

RESPONSE: We modified the text as follows: "The maximum Quaternary glacial extend is derived from the global scale maps of Gerasimov atlas (1964) digitized by Dürr (2003); according to Gerasimov it mostly corresponds to the Late Glacial Maximum." We hope that it is now clearer.

REVIEWER #1: 5. Line 397. Instead of L/km2/yr why not the same units throughout (mm/yr)?

RESPONSE: We are now using mm/yr throughout the whole article, as adviced

REVIEWER #1: 6. Line 482. ETP? More generally, your data are for Prec and Runoff, e.g. in Tables 3 and 4. Your estimates of ET given a few times throughout the text are for steady state conditions (i.e., Prec – Runoff). Why use ET at all – why not just use Prec and Runoff?

RESPONSE: We agree that it is better to use only precipitation and runoff, and thus the ETP has been deleted from the text.

REVIEWER #1: 7. Line 539. NML is much colder then SML because of continentality as you mentioned but I suspect that elevation probably plays a major role as well. More generally, elevation was not really used as an attribute. I wonder if it would be useful to consider it.

RESPONSE: We agree that altitude is an important control factor, particularly for temperature. We calculated the mean altitude for each hydrobelt and hydroregion. Regarding to NML and SML, we found that the mean altitude of NML (761 m) is only slightly higher than the mean altitude of SML (507 m). Typically the temperature increase is around 0.5 $^{\circ}$C per each 100 m and thus, the altitude explains only part of the temperature difference between these belts. This discussion is added into the manuscript. We

have further added the altitude in the description of the belts. Many thanks for your valuable remark.

REVIEWER #1: 8. Table 4. What are the units of Runoff?

RESPONSE: The units are in mm/yr; the units are now added to each table

REVIEWER #1: 9. Figure 2. I was very pleased to see NZ lumped in with the AUS continent. (The editor may not like that!).

RESPONSE: Lumping Eastern Australia with NZ is still a challenge, as they are very different. We chose to include the Murray in this Mid –Latitude belt, also considering the population distribution. We have now pointed this in the text.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 9119, 2012.