

Interactive comment on “Virtual industrial water usage and wastewater generation in the Middle East/North African region” by S. R. Sakhel et al.

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Referee number 2:

We thank Referee number 2 for his valuable and insightful comments. In what follows, we reply to his comments point by point:

Referee number 2: “The relevance of the specific focus in the manuscript, relating water system impacts of the industrial sector to trade flows with EU27 does not become clear“

Authors: We do not agree with the referee as the impact is even described in the abstract

Referee number 2: “At the conceptual level, the paper is very loose. Where industrial

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water use is related to water scarcity indicators in the paper, neither water use (or other components in the physical water balance) nor water scarcity are defined in a rigorous way. It is generally unclear whether water use relates to withdrawal from the water system, gross use by industries or consumptive uses by industry. Water scarcity indicators similarly relate water use to a loosely used term water availability, sometimes phrased as adequate renewable water (3.1.2 even seems to frame water availability as the difference between renewable water and withdrawal; this is very unusual). At various occasions, the ratio of industrial and domestic water use is presented as an indicator (and similar constructs for wastewater), where this value hardly seems interpretable as an indicator of scarcity. A wide body of literature discusses these indicator issues (e.g. on the consideration of return flows), and the paper only very briefly refers to the (only somewhat older) contributions to this literature and does not seriously discuss it“

Authors: 1) We are going to define water use and shall select another definition for water availability. Further we shall address whether water use relates to withdrawal from the system, gross use by industries, or consumptive uses by industry. 2) We did not include water scarcity indicators because we estimated the water use by 8 industries only out of the many industries in the MENA region. Further, we did not do any estimations of agricultural and domestic water use and therefore we cannot calculate indices based on the supply-demand concept. Applying the most widely used water scarcity indicator (Falkenmark indicator) does not make use of the estimations we did for the industrial water use, so this was not taken into consideration. 3) The ratio of industrial to domestic water use is not meant to be a water scarcity indicator. It just shows a percentage with regard to domestic water use which is the most important use of water (water for drinking, personal hygiene, for cooking). As it is known, the water required by agriculture to grow food is massive with regard to what is used by the population in households, but the food can be imported and therefore there is an alternative to growing food locally. Regarding the water used in households there is no alternative and one has to use the local water resources. This is why we used the ratio of industrial to domestic water use. Referee number 2:

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“For the wastewater part, volumetric estimates are given, that are hard to interpret: are they to be considered as positive impact, restricting the net water use of industry, or as a negative impact. Information given on total BOD/COD is much more relevant, but still not an indicator of the impact to the receiving water body; concepts such as the grey water footprint could prove helpful here“

Authors: We are going to include a table with BOD/COD ratios for each industry and calculate the grey water footprint based on the biological oxygen demand concentrations. There are no references indicating whether wastewater is recycled or not in the industries studied, so that it would restrict the net water use.

Referee number 2: “The selection of sub-sectors is somewhat surprising, giving focus to aggregated revenues and some specific branches only. Water use-intensity of industries is nowhere adopted as a criterion for selection, whereas inclusion of a slaughterhouses based on food-security policies does not seem justified“

Authors: 1) What the referee mentions about aggregated revenues are one of the criteria used to classify companies not industries as being large sized or not and as mentioned they are European criteria to classify companies. The virtual water usage is the focus of the paper where the production plays a major role. 2) “When are industries considered water intensive?” The Referee number 2 makes a good point here, but this is a difficult question. This is because the criteria to classify industries as being water intensive or not is vaguely defined and there is no legislative definition of water intensive industry. This is basing on personal communications with Jochen Pampel and Susan Staples (email: JPampel@kpmg.com; sstaples@kpmg.com.au). Many industries must rely on large amounts of water to produce a product (e.g., agriculture, food, beverage). However, intensity is relative to the amount of water used per unit of production. Thus it comes more a question of eco-efficiency. Some industries, such as steam-based electrical production can be very water intensive in certain parts of the world because of cooling (thermal pollution) requirements. Other parts of the world don't require intensive water cooling. Plus, within the same industry (power

production), certain technologies such as wind and solar, require basically no water for production. Even agriculture in the dessert can be extremely water efficient (but expensive) with the use of hydroponics, desalination, etc. It is not easy to answer. As such, it depends on the context of where the industry operates. 3) We are going to justify the selection of slaughterhouses based on an environmental point of view.

Referee number 2: “The methodology seems (at times) unbalanced in the level of detail on some subjects and very generic assumptions on others, while some of the information sources are of such a quality that they would need a critical evaluation (e.g. references to internet blogs). In particular the fact that, due to lack of data, European specific water usage and wastewater generation figures are used in a quite generic way, reduces the value-added of the current paper“

Authors: What does the referee mean by unbalanced? Can the referee please specify where? Sometimes assumptions are necessary due to lack of information from this water impoverished region. We made a great effort in gathering the references in this manuscript. It is impossible to find better references in the MENA region. As the referee mentioned correctly, we used the European specific water and wastewater generation figures. This is because data from this region was not available and we had no alternative but to present what we have now.

Referee number 2: “The presentation of results is not as structured as the rest of the paper. A clear table of water use in industrial production by country and sub-sector, and a similar one for BOD/COD would be a good summary of most marked contribution of the paper. Some of the tables given have a big overlap. The comparisons given to values in literature are valuable, and could be extended by comparisons with data from global assessments (Aquastat, or PNAS paper Hoekstra and Mekonnen, 2012)“

Authors: We are going to better present our results by providing a table of water use by each industry for the relevant country and a similar one for BOD/COD. We are going to omit the overlaps happening in the tables. We are going to extend the comparisons of

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our results with data from global assessments. What does the referee mean by global? Is that the total industrial water use by each country?

Referee number 2: “The conclusions section of the paper only presents the newly generated insights, supported by evidence presented very briefly. It quickly turns to policy suggestions that are not based on evidence presented, and some do not relate to any of the contents of the paper (e.g. advertisement of tax reductions in particular situations: the paper does not contribute to assessing economic instruments)”

Authors: We are going to delete any conclusions that do not relate to the contents of the paper and that are not based on evidence presented.

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