

## ***Interactive comment on “Hydrological education and training needs in Sub-Saharan Africa: requirements, constraints and progress” by D. A. Hughes***

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Hughes (2011) raises important questions, but have they not already been partially addressed?

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1. This paper deals with an important and very relevant topic.

The paper makes very good points, such as the importance of addressing uncertainty  
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in curricula on hydrology and water science, and also the point made earlier by Metzger and Zare (1999) that interdisciplinary education should complement and be based on disciplinary strength; the critical point on “centres of excellence” (p. 10578, line 11), which resonates a similar argument given more than 10 years ago by Wright et al. (2001), and the point about the need to avoid “some type of scientific colonialism, where the outside organizations remain the dominant force” (p. 10577, line 19-21).

We also agree that the question the paper ends with is important: “one of the critical questions to be asked is how international organisations, such as UNESCO and IAHS, can contribute to resolving some of the constraints and encouraging the development of hydrology teaching and research in developing regions such as sub-Saharan Africa?” (p. 10581, lines 22-25). In fact, we are in a position to suggest an answer: UNESCO’s role can be to support networks of academic departments concerned with water issues (be these related to hydrology, water science, water engineering, water management or water policy), inspired by the WaterNet experience (see below and Jonker et al., same issue), and scaled out by CapNet. So in our view the question posed by the author has already been answered, at least to some significant extent.

2. The paper lacks empirical evidence

What we find a pity is that the paper lacks empirical evidence for several statements made (the author recognises this by stating that “many of the opinions are difficult to support with hard facts” on p.10580 line 4-5). This makes the paper read more like an opinion article than a scientific paper. Some of the opinions may thus be incorrect. We give seven examples.

1) “A more detailed examination of the backgrounds, educational qualifications and proposed research topics provided more evidence to support the contention that most of the training offered in the region is on water resources management, rather than water resources science.” (p. 10572, lines 14-17). We entirely rely on the author with respect to the evidence. Why not tabulate the findings such that the reader can verify

the claim.

2) "A large proportion of these funding opportunities do not support the development of faculty staff members within the region's university institutions and only provide limited funds for the development of research infrastructure." (p.10574, lines 6-8). How large is the proportion? How limited is the funding for the development of research infrastructure? Given the numerous long-term capacity development projects that universities in Southern Africa have with Norwegian, Swedish, German, Belgian, British, American, Canadian, Australian, Dutch and other counterparts and funding agencies, we doubt whether this statement is correct.

3) "... locally developed and applied research products are rarely used and there is a short-circuit in the processes associated with translating research into practice, evaluating the benefits and generating further research to continually improve both scientific understanding and practical applications." (p. 10576, lines 7-10). We are not sure whether this statement is entirely true. Several institutional arrangements, platforms and organisations attempt to link research to policy and to professional applications; e.g. within South Africa the Water Research Commission and WISA, and in many Southern African countries the country water partnerships. At SADC level there are strong feedbacks between the Water Resources Technical Committee, the meetings of ministers responsible for water and the annual dialogues: GWP-SA coordinates the annual SADC Multi-stakeholder Water Dialogue for the water sector and FANRPAN the annual Regional Policy Dialogue on Food & Natural Resources. Finally there are the annual WaterNet/GWP symposia.

4) "While problems of transferring science into practice are certainly not unique to the developing countries of the world, the gap is arguably wider in developing countries due to communication problems between those involved in research, practice, management and policy development."(p. 10576, lines 12-16). We are not sure whether such a general and rather stereotypical statement can be defended. In many developing countries we have seen local academics having close links with sector ministries,

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much closer than in many developed countries.

5) "There is little doubt that networks of potential collaborators in research, training or practice are not very well developed in sub-Saharan Africa."(p.10578, lines 5-7). We are not sure whether such a broad-brush statement can be defended. In Southern Africa we have observed that several water-related communities exist, such as those concerning aquatic ecology, hydrology, water resource management and water governance. These groups really are epistemic communities that not only share common professional values and concepts and also have developed social bonds. This in our view demonstrates that disciplinary expertise creates common grounds that can transcend national, language, gender, age, ethnic and other barriers. WaterNet is a clear example of such a network which intersects with, and has partially fostered, the professional communities mentioned.

6) "While there are a number of different collaborating groups (collaborating with each other and with organisations outside the region), they are frequently not very extensive, tend to be rather exclusive and often compete for funding opportunities with each other." (p.10578, lines 7-9). This is a rather vague statement which should be substantiated. Again, WaterNet is an example to the contrary: it is regional, it is active and vibrant, and it is inclusive and open. Within WaterNet resources are shared, and though most papers presented at its annual symposia are focused on IWRM in a wider context, it has had sessions on hydrology (with a focus on science) already for 12 years. The 64 hydrological papers published in the ten WaterNet special issues of Physics and Chemistry of the Earth (2002-2011) are evidence of this.

7) It remains unclear whether the pool of qualified scientists and engineers is "small (and shrinking)" (p.10569, line 20-21), or whether "there has been significant progress in recent years, specifically at the post-graduate (mainly PhD) level" (p. 10577, line 4-5). So what is it?

3. Some important phenomena are mentioned but are not analysed

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The paper flags some important phenomena but these are not analysed, which would arguably be a prerequisite for arriving at plausible solutions.

1) The reason that in South Africa there are “relatively few young recruits to teaching and research groups within Universities” (page 10571, line 11-3) is attributed to a lack of training in science-based methods. But why is there such a lack? And, how can this be overcome? An entirely different but no less pertinent question is: to what extent does South Africa recruit young water engineers and postgrads from “north of the Limpopo”? And what does this imply for the water sector those countries?

2) “Within most of the region there appears to be a plentiful source of student interest. However, within South Africa, where there are frequently more resources, it is difficult to attract students to post-graduate degree programmes and even more difficult to retain them as future research or teaching faculty members. Part of the reason for this is the lower remuneration offered in academic institutions compared to the business (consulting) and government sectors.” (p. 10575, lines 19-23). This is not a satisfactory explanation, since also in other countries “of the region” (SSA, or SADC?) academic salaries tend to be lower than salaries in other sectors. We would like to have a better analysis of this interesting situation, and its consequences.

3) “the UNESCO Southern Africa FRIEND (Flow Regimes from International Experimental Network Data) programme that generated valuable regional research results during a 10 yr period up to 2003 (UNESCO, 1997, 2004), (...) has been largely inactive since then” (p. 10578, lines 23-27). In the context of the present paper it is important to analyse why it became inactive, and why a programme such as WaterNet could simultaneously grow and develop.

4. Some statements are problematic

There is a geographical bias in this paper. Notwithstanding the title, this paper is mostly concerned with the reality in Southern Africa. Within that region the role of South Africa is acknowledged as being special (the economy of South Africa is several times all

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other southern African economies taken together) but this is not fully explored.

The claim that universities such as of Botswana and Malawi “represent existing resources that are not being used to their fullest advantage for the benefit of training hydrologists and water resource engineers and scientists” (p. 10573, lines 10-13) is a very strong statement which colleagues at these two universities may disagree with. The University of Botswana offers an MSc programme in Hydrogeology already for quite some time.

The author focuses on the South African system of Master programmes, which are either coursework-based or thesis-based, and he appears convinced about the superiority of the latter. However, he seems unaware of the situation in many other places in Africa, including in the WaterNet programmes offered by the University of Dar es Salaam (UDSM) and the University of Zimbabwe, where coursework forms an important part of the master programme, but where also a significant component consists of thesis research. So, in our view it cannot be maintained that the WaterNet Master programme in IWRM “may not fulfil the need for more science-based training.” (page 10571, lines 24-27). Note that the paper itself gives two examples to the contrary: Dr V. Kongo did his PhD study in a WaterNet-affiliated interdisciplinary research programme (SSI), and one of the author’s own PhD graduates, Dr T. Sawunyama (co-author of a paper he quotes in this article) followed the WaterNet MSc programme in IWRM. We could mention numerous other examples.

The paper suggests an “improved science agenda” (p. 10580, line 23), but it remains unclear what exactly the improvements will entail, except for a stronger emphasis on science; at what level (national regional, at continent level), and who should take responsibility for this: national governments, regional organisations such as ECOWAS, SADC and EAC) or at continental scale (AU), or academic bodies such as national academy of sciences and the African Academy of Sciences at continental level.

The solution proffered by the author, namely improved networking through an umbrella

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network, is a good one, and the good news is that it already exists: WaterNet. One could argue that within WaterNet there should be more attention to science, but then this should be based on a more solid analysis of WaterNet's track records. And the scientific track record of WaterNet is strong; as an example may serve a bibliometric analysis using the Scopus database ([www.scopus.com](http://www.scopus.com)) (see Jonker et al., same issue). It shows that of all papers with "hydrology" and "Africa" in the title, abstract and/or key words, 14.7% were published in the first nine WaterNet special issues of Physics and Chemistry of the Earth. In the absence of WaterNet and its annual symposium, some of these papers would not have been published in an international peer-reviewed journal and not be accessible to the African and global scientific community. These papers are also frequently cited, albeit less than the global sample. WaterNet papers on "water management" (15.4% of the global sample), however, are more frequently cited. This may indeed support some of the concerns expressed by the author. Interestingly, WaterNet papers on "water resources" (15.8% of the global sample) seem to stand in between both, as they are comparable to the global sample in terms of citations.

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