The water forecast

Professor Dr Ir Nick van de Giesen from TU Delft, calls for the development of a detailed global overview of water availability, similar to that used to predict the weather...

We all watch the weather news and adjust our weekend plans accordingly. So why is there no 'water news'? Water plays a large number of essential roles in our society, including drinking, farming, cooling, hydropower and navigation. The present drought in Shandong Province threatens to upset global grain prices, but we lack a good insight into what the all-determining soil moisture status is. A global water report would provide planners and financial markets with essential information. Similarly, accurate flood predictions are crucial in saving lives. The recent floods in Australia were devastating, but the number of victims was minimal when compared to the number of victims of the unpredicted floods in Brazil. I do not expect water news to be featured in the media in the same way that we have weather news because most of the time water is only of specialised interest. There is, however, a clear need for a continuous global overview of water availability at relatively small scales of, for instance, one hectare to one kilometre squared. Such a global water report would serve governments, insurers, energy companies and commodity traders. The value would be difficult to estimate, but a price tag in the region of €20-50m per year would seem quite reasonable.

To build this system, we need models, observations and the computational means to combine the two. Hydrological literature is overflowing with models for many different processes at all possible scales. Although undoubtedly much more process-oriented research is needed, a relatively mature set of models is available to be operationalised at a global level. Given the activity level of the hydrological community with respect to model development, I do not see a great need for a special effort in this respect. The questions of observation and computation, on the other hand, will need special attention in the coming years.

For a global view, satellite data is crucial and hydrologists have used this to measure variables such as soil moisture and evaporation from vegetation. Until recently, most use of satellites within hydrology was rather opportunistic because all satellites were designed for other applications. For example, soil moisture status can be estimated with an instrument called a scatterometer, which was initially intended to estimate wind levels over the sea.

In November 2009, the first hydrological satellite, SMOS, was launched by the European Space Agency, and several others are planned. But satellites alone will not be able to give us the complete view. Ground-based methods are needed, especially for variables such as groundwater depth and river flow, which are difficult to ascertain from space. The sensor revolution that is making our cars, houses, and cities smart can also be used to revolutionise hydrology. An interesting example that aims at tying Africa into the global network is the Trans-African Hydro-Meteorological Observatory.[1]

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From a scientific point of view, perhaps the biggest task lies in tying together models and observations in an optimal way. No model will ever be perfect and data will always have noise associated with it. To ensure that the final results are the best possible, so-called data assimilation techniques are required. In meteorology, these techniques are very well developed, but in hydrology much work remains to be done. Data assimilation is very data and computation intensive. Our community will have to mobilise resources such as cloud computing, which has hardly been used so far in hydrology.

In around five years' time, we could have a daily detailed global overview of water availability. The investment needed would be modest and the returns would be high. As with weather forecasting, Europe could become a world leader in providing operational hydrological information.

[1] www.tahmo.org

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