



Measuring the World: How theory follows observation (Alexander von Humboldt Medal)

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I started my professional career as a hydrologist working for the government of Mozambique. I was responsible for overseeing the hydrological network, the operational hydrology and answering specific questions related to water resources availability and the occurrence of floods. In the late 1970s and early 1980s, the use of telecommunication and computers was still very limited. We had to work with handbooks, lecture notes and consultancy reports, but mostly with our brains. The key to answering a specific question was to go into the field and observe. We measured as much as we could to understand the processes that we observed. I didn't know it at the time, but this perfectly fits in the tradition of Von Humboldt.

During my time in Mozambique I surveyed during and after extreme floods, such as the 1984 flood caused by the tropical cyclone Demoina. I surveyed the geometry, hydraulics and salt intrusion of 4 major Mozambican estuaries. And I measured the quality and the quantity of the flows draining onto these estuaries. Having only limited access to the literature, it was a survey without much theoretical guidance. This maybe slowed us down a bit, and sometimes led to inefficient approaches, but scientifically it was a gold mine. Not being biased by established theories is a great advantage. One does not follow onto the well-trodden, but sometimes erroneous, paths of others.

After working for 6 years in Mozambique I joined an international consultant, for whom I worked for 6 years in many different countries in Asia, Africa and South America. Although the access to literature and other people's experience was better, I continued the practice of observing before believing. These 12 years of doing hydrology in practice formed the basis for the development of my own theories on hydrological processes, salt intrusion in estuaries, tidal hydraulics and even atmospheric moisture recycling. So when I started on my PhD at the age of 38, I made a completely different start from what has become normal nowadays. It was the first time I really had the opportunity to study the literature and to confront my own theory with the work of others. How different is this from how we guide our PhD students today.

In my Von Humboldt lecture I shall give examples of how field observation was crucial in developing new insights and new theories. I shall present highlights of my theories on: salt intrusion and tidal dynamics in estuaries; atmospheric moisture recycling; landscape based hydrological modeling; and the sizing of root zone storage capacity. I shall emphasise the use of analytical approaches and of the need to develop hypotheses and conceptual models based on field experience, observations and perceptions of how nature works.