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# Hydrological Science and Engineering: the Yin and Yang of Water Resources Management

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**Research and applied engineering are often seen as opponents. One is driven by curiosity, the other by necessity. One is satisfied with finding out that the world is coming to an end, the other is doggedly planning measures to stem the tide. One has all the time in the world to dig ever deeper, the other has to come to robust decisions on the basis of incomplete knowledge within strict deadlines. Despite all these contrasts the two need each other in a dialectic fashion as the Yin and Yang of Daoism to move water resources management to a higher level. Engineering without the salt of scientific development becomes stale and science without the proof of viability by practice stays l'art pour l'art.**

**As a rule new scientific results are slow to get into practice. This has several good reasons: Engineering is conservative in order to avoid risk of litigation. Science which leads "only" to improvement of quantitative accuracy, does not necessarily change the course of action, as for decisions the accuracy is often irrelevant. The predictive power of hydrological science is still poor and for many new techniques and ideas the scientists have not given the proof that their application brings advantages.**

**Using some examples I would like to illustrate how the fun of science and the satisfaction of being useful need not be contradictory and how sophisticated new scientific results and methods can find their way into management practice.**

**The first example is Zurich water works, where we are in the process of devising a real-time groundwater model, which is the basis for real time control of pumping**

**and infiltration wells of the Hardhof wellfield. In this enterprise the Water Supply of Zurich cooperates with ETH Zurich to improve daily practice by employing innovative techniques.**

**The second example is the water and salinity management in a basin in Xinjiang China, where a modeling effort based on traditional data and new data sources such as satellite remote sensing is used to define sustainable practices. The model is cast in the form of a simulation game. This game is applied in the training of water authority officials in order to raise their awareness for the consequences of decisions in a complex environment.**

**To bring science into practice, it is crucial to find partners in state bureaus of water affairs, engineering firms or utilities, who are open to new ideas. Once they succeed to have a comparative advantage over their peers through new techniques others will follow suit.**