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Strategies for Hydrology Teaching for a Changing World

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Hydrology as a science has undergone dramatic changes in the past 80 years. However, as evidenced by the text books that are being used and conversations with many educators, it appears that hydrologic education has not kept pace. The legacy of the past growth of hydrology is reflected in the materials and methods used in hydrology teaching as practiced now. Current teaching methods tend to present a mix of empirical approaches (e.g., data analysis, multiple regressions), systems approaches (e.g., unit hydrograph methods, bucket models), and process theories (e.g., infiltration, runoff generation, evaporation, channel flow), often in the form of recipes or skill sets. However, they represent an old paradigm where hydrology was seen as dealing with the movement of water through and over a static earth, aimed at solving one or a combination of separate boundary value problems. However at least since the 1990s there is a new research paradigm operating, which treats hydrology as a distinct geoscience, which does not just deal with the movement of water, but with an interacting holistic earth system that includes not just hydrological but also biogeochemical, ecological and human subsystems. Global change increasingly dictates that this geoscience paradigm be further extended to include highly non-stationary, evolutionary behaviors strongly governed by human-nature interactions. Shouldn't this be recognized in our teaching, and if so how can we achieve it? In this talk I will outline broad strategies we can adopt that could pave the way for a paradigm shift also in the way we teach hydrology. Beyond the essential skills that we have always taught, some of the new skill sets we need to impart are, amongst many others: learning to read the landscape, learning from patterns in the data, including patterns in the landscape and in the atmosphere (e.g., channel morphology, vegetation patterns, climatic patterns), comparative studies as opposed to place-based studies, learning from case studies of nature's experiments with respect to climate change and land cover changes, predictions using space for time substitution, models of interacting processes as opposed to models of individual processes, and models of human-nature interactions and feedbacks. Instead of, or in addition to, pooling together collections of hydrologic recipes or tool sets, as we do now, there is a need for consensus building on a clear vision or philosophy of hydrology teaching that is cognizant of where hydrology presently is and where it is headed. This will enable experimentation of different methods of teaching to different audiences (e.g., engineers, earth scientists, even social scientists) while remaining within an agreed vision. In this way we can be satisfied that teaching methods will improve so that future practitioners carry forward a coherent philosophy of the science and possess the necessary skill sets.