

## Some perspectives on modeling vadose zone flow and transport processes

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Mathematical models have become indispensable tools for studying vadose zone flow and transport processes. In this presentation, we review the history of development, the main processes involved, and selected applications of HYDRUS and related models and software packages developed collaboratively by groups all over the world. This collaboration during the past three decades has resulted in the development of a large number of numerical [e.g., SWMS\_2D, HYDRUS-1D, HYDRUS-2D, HYDRUS (2D/3D), and HP1] as well as analytical (e.g., CXTFIT and STANMOD) computer tools for analyzing water flow and solute transport processes in soils and groundwater. The research also produced additional programs and databases (e.g., RETC, Rosetta, and UNSODA) for quantifying the unsaturated soil hydraulic properties. As evident from recent developments in coupling HYDRUS with other software packages (e.g., PHREEQC, UNSATCHEM, CW2D, and MODFLOW), we believe that regular communication between soil physicists and scientists in related earth and environmental disciplines is essential for further advances in modeling vadose zone flow and transport processes, and their application to increasingly urgent environmental problems.