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Effect of adaptive rootzone development in quantitative land evaluation studies

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For quantitative land evaluation studies often simulation models are used to express the differences between soil types in terms of water availability or crop productivity. In the Netherlands we developed a land evaluation system specifically for water authorities, provinces and drinking water companies. The system allows answering questions on how water management influences crop development due to too dry or too wet conditions in the unsaturated zone. This system is based on the linked simulation model SWAP (Soil-Water-Atmosphere-Plant) and WOFOST (WOrld FOod STudies). The impact of changes in climate or hydrology can then be studied in terms of effects on crop growth and farm income.

Although SWAP and WOFOST are process based models, the rootzone development is simulated in a straightforward way: the development of the root extension is specified by the user in advance and the root length density distribution is assumed static in time. Because the circumstances within the rootzone is influenced by meteorological, hydrological and soil characteristics it is impossible to design an optimal rootzone development in advance. For a more realistic approach we implemented an adaptive rootzone distribution which will react on the hydrological conditions within the rootzone. This means that newly formed roots will be assigned to regions where there is no or the least stress, and less or no new roots to regions where water stress was experienced. As a result the drought and oxygen stress will be less dependent on the initial root distribution as specified by the user. An example for a regional study will be provided to show the relevance of adaptive rootzone development for assessing land qualities in space and time.