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Parameterizing the Root System Development of Summer Barley using Minirhizotron Data

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Increasing computer power favors the use of complex mesoscopic models to predict root water uptake. Those models explicitly consider the 3-D root architecture and root growth of a plant and may have variable hydraulic potentials in both soil and root. However, it remains difficult to calibrate and validate these models due to a lack of high-quality data. We examined the possibilities of the root architecture development model RootTyp to reconstruct the below-ground architecture of growing barley in an undisturbed lysimeter using minirhizotron data at four depths. We investigated the model sensitivity and the type of interaction between model parameters as well as the data uncertainty. We adjusted a simplified root architecture to the data. However, the result was not satisfying since the simple model could not reproduce the observed increasing root number with depth. The model was improved by making the branching and root elongation more horizon-dependent and by making reiteration of root tips possible. Reiteration is an alternative form of branching, where secondary roots can become as long and thick as primary roots. However, minirhizotron data do not contain enough information to restrain the parameters governing these processes. Therefore, different experimental techniques should be combined to achieve a better model result.