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Predicting and mapping of soil salinity using machine learning algorithms in central arid regions of Iran

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In this study, we predicted and mapped soil salinity using machine learning (ML) and digital soil mapping (DSM) approaches. Support vector regression (SVR) and the hybrid of SVR with wavelet transformation (W-SVR) where applied to correlate soil salinity of the upper 200 cm of soil to a wide range of environmental covariates derived from a digital elevation model (DEM), remote sensing (RS) and climatic data. Results indicate that W-SVR performed better in predicting soil salinity at all depth intervals with scattered index ranging from 1.45 to 1.68 compared to the standalone SVR. This is particularly true at the lowest soil depth when W-SVR indicated ~1.5 times higher accuracy compared to the SVR. At this soil depth topographic features are the main covariates in the models. For topsoil salinity, land use represented by RS features controls the spatial distribution of the salinity widely. Independent from soil depth, climatic features are the most important predictors for soil salinity in all ML models. The predicted salinity maps show the highest salinity for soils in the eastern parts of central Iran. Furthermore, the importance of topographic features for all ML algorithms coincides with most landform characteristics in central Iran and confirms a close relation of soil salinity not only to land use practices like irrigation but also to soil-landscape relationships in this dry region.

Keywords: Soil salinity, machine learning, spatial variation, central Iran, support vector regression, wavelet transformation

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