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Effects of watershed delineation resolution on water quality model outputs

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The first step in applying a spatially distributed water quality model, such as SWAT or WARMF, is to delineate the watershed under study at a certain spatial resolution. Model output can vary significantly for different delineations, which can represent an important source of model uncertainty. To explore the effect of delineation on model uncertainty, we applied these two models in the Newport Bay watershed (California) at three delineation levels using the same Digital Elevation Model: 4-subbasin, 16-subbasin and 46-subbasin. The results indicate that stream flow is not very sensitive to delineation scheme, while simulated sediment, nutrients and pesticides concentrations depend more strongly on delineation resolution. The dependence is a function of two important classes of factors: (1) parameterization at different spatial scales; and (2) mathematical interpretation of the underlying physical processes. However, it is not clear that model output always matches observed data much better at higher resolution. The implication is that an appropriate delineation scheme should be identified to balance uncertainty and computation efficiency, and this depends on the intended use of the model.