Hydrol. Earth Syst. Sci. Discuss.,
doi:10.5194/hess-2016-539-AC4, 2017

Hydrology and Earth System Sciences
Open Access
Discussions

Interactive comment on "Examining the impacts of estimated precipitation isotope (δ^{18}O) inputs on distributed tracer-aided hydrological modelling" *by* Carly J. Delavau et al.

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Received and published: 14 January 2017

Abstract. Tracer-aided hydrological models are becoming increasingly popular tools as they assist with process understanding and source separation; aiding model calibration and diagnosis of model uncertainty (Tetzlaff et al. 2015; Klaus McDonnell, 2013). Data availability in high-latitude regions, however, proves to be a major challenge associated with this type of application (Tetzlaff et al., 2015). Models require a time series of isotopes in precipitation (δ^{18}O$_{ppt}$) to drive model simulations, and throughout much of the world, and particularly in sparsely populated high-latitude regions, these data are not widely available. Here we investigate the impact that choice of precipitation isotope product (δ^{18}O$_{ppt}$) has on simulated of streamflow, ïĄď18O in streamflow, and model

parameterization in a high-latitude, data sparse, seasonal basin (Fort Simpson, NWT, Canada). We assess three precipitation isotope products of different spatial and temporal resolution (i.e., semi-annual static, seasonal KPN43, and daily REMOiso), and apply them to force the isoWATFLOOD tracer-aided hydrologic model. Although total simulated streamflow was not significantly impacted by choice of δ^{18}O$_{ppt}$ input, simulated isotopes in streamflow (δ^{18}O$_{sf}$) and the internal apportionment of water (driven by model parameterization) were impacted. The highest resolution forcing (REMOiso, daily) performed differently than the two lower resolution products (i.e., KPN43 and static), but could not be verified as correct using monthly δ^{18}O$_{ppt}$ observations. The resolution of a precipitation isotope product impacts model parameterization and seasonal hydrograph separations, where models are most sensitive to large snowmelt and rainfall events when event compositions differ significantly from δ^{18}O$_{sf}$. Spatial variability in precipitation isotopes was seen and impacts model parameterization, which only distributed tracer-aided hydrological models can represent and respond to. We achieve an understanding of tracer-aided modelling and its applications in high-latitude regions with limited δ^{18}O$_{ppt}$ observations, and the value these models have in defining model uncertainty. In this study, application of a tracer-aided model was able to identify simulations with improved internal process representation, reinforcing that tracer-aided modelling approaches assist with resolving hydrograph component contributions and work towards diagnosing equifinality.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-539, 2016.