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Improving hydrological modelling/predictions for the Rhine River in the context of the IMPREX project

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Within the H2020 IMPREX project (www.imprex.eu) we follow a stepwise approach to move from a proprietary hydrological legacy code to an open source distributed hydrological modelling framework (Schellekens, 2016) which allows for testing of hydrological modelling choices, numerical solution, etc (Clark et al.,2015; Kraft et al 2011) and taking advantage of as much available observations and spatial data sources as possible to improve forecast accuracy and skill. A method to extend gridded precipitation climatology data sets was already developed and tested (van Osnabrugge et al.,2017).
While many publications investigate the effect of resolution on hydrological modelling by focusing on model calibration and parameter sensitivity (e.g. Melsen et al., 2016), we test some of these previous results by converting a semi-lumped hydrological model(∼1000-2000 km2) to a distributed model (1.2x1.2 km2) for a large catchment with different hydrological regimes over long periods (1961-2006 & 1997-2015) using streamflow gauges, independent snow water equivalent estimates (Jörg-Hess et al., 2014) and GRACE estimates. The effect of using lumped or distributed forcing is also investigated for the period 1997-2015. Finally, the effect on hydrological prediction is quantified by comparing reforecasts from both lumped and distributed model using a 20 year ECMWF reforecast from model Cycle 43r1 (Buizza et al. 2017). Results show differences in streamflow in snow dominated areas due to different vertical discretization, sometimes leading to erroneous simulation for the lumped model.

References:
Buizza, Roberto, Jean-Raymond Bidlot, Martin Janousek, Sarah Keeley, Kristian Mogensen, and David Richardson. 2017. “New IFS Cycle Brings Sea-Ice Coupling and Higher Ocean Resolution.” ECMWF Newsletter, no. 150: 14–17. https://www.ecmwf.int/sites/default/files/elibrary/2017/16987-newsletter-no-150-winter-201617.pdf.
Clark, M. P., Nijssen, B., Lundquist, J. D., Kavetski, D., Rupp, D. E., Woods, R. A., Freer, J. E., Gutmann, E. D., Wood, A. W., Brekke, L. D., Arnold, J. R., Gochis, D. J. and Rasmussen, R. M.: A unified approach for process-based hydrologic modeling: 1. Modeling concept: A unified approach for process-based hydrologic modeling, Water Resour. Res., 51(4), 2498–2514, doi:10.1002/2015WR017198, 2015a.
Jörg-Hess, S., Fundel F., Jonas T., and M. Zappa. Homogenisation of a gridded snow water equivalent climatology for Alpine terrain: methodology and applications, The Cryosphere, 8, 471-485, 2014, do: 10.5194/tc-8-471-2014
Kraft, P., Vaché, K. B., Frede, H.G. and Breuer, L.: CMF: A Hydrological Programming Language Extension For Integrated Catchment Models, Environ. Model. Softw., 26(6), 828–830, doi:10.1016/j.envsoft.2010.12.009, 2011.
Melsen, L. Teuling, A., Torfs, P., Zappa, M., Mizukami, N., Clark, M., Uijlenhoet, R.,, Representation of spatial and temporal variability in large-domain hydrological models: case study for a mesoscale pre-Alpine basin. HESS 20(6)-2207-2226, doi: 10.5194/hess-20-2207-2016.
Schellekens, J. (2016). OpenStreams Wflow documentation. Retrieved from http://wflow.readthedocs.io.
van Osnabrugge, B., Weerts, A. H., & Uijlenhoet, R. (2017). genRE: A method to extend gridded precipitation climatology data sets in near real-time for hydrological forecasting purposes. Water Resources Research, 53. https://doi.org/10.1002/2017WR021201