Hydrol. Earth Syst. Sci. Discuss., 9, C972–C974, 2012
www.hydrol-earth-syst-sci-discuss.net/9/C972/2012/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Filling the white space on maps of European runoff trends: estimates from a multi-model ensemble" *by* K. Stahl et al.

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Received and published: 18 April 2012

We agree that the application invites to further explore the intriguing question of why model ensembles may work better than individual models. Potential explanations include the averaging of model errors (e.g. Gao and Dirmeyer, 2006; Guo et al., 2007) and while we think that too much elaboration or additional analysis will distract from the main result, the trends across Europe, we suggest that we add some more discussion on the issue and the difficulties of model ranking (see also response to Referee 1).

Response to minor comments:

We thank the referee for pointing out the need to improve the presentation of Eq. 1. We will address this in the revised manuscript.

Page 2014, line 5: High flows depend strongly on precipitation. This close relation is captured by large-scale models (e.g. Prudhomme et al., 2011; Gudmundsson et al., 2012) and implies that trends in high flows are more similar to trends in precipitation (identical driver to all models). Low flows on the other hand, depend on a range of model-specific processes including storage and release processes that are model specific. We will review whether we have addressed this difference enough in the manuscript and will make revisions accordingly.

May and June: there is likely no simple answer that relates to all of Europe and any explanation at this point might be speculative. It is however the season where the overall N-S winter-trend pattern within Europe starts to change and large areas have only weak trends. Hence a low correlation when trend patterns are weak might be expected. In terms of hydrological processes, May/June may still be affected by snow melt in high latitudes and high elevations, the modelling of which is known to vary among models. In other areas processes change from rainfall-runoff domination to a large role of Evapotranspiration, which can also be expected to create more differences among models. We will review whether we have adressed these aspects enough in the discussion section and suggest to make revisions accordingly.

Figure 1 We do not exactly understand the suggestion. As we are dealing with many grid cells, we cannot provide time series plots with the classical ensemble shading. We suggest however to explore alternative presentation possibilities and/or improve the readablity of Figure 1.

We will add some additional information on the catchments (e.g. summary statistics of area, elevation).

References:

Gao, X. and Dirmeyer, P. A. (2006) A Multimodel Analysis, Validation, and Transferability Study of Global Soil Wetness Products, J. Hydrometeor, 7: 1218–1236.

Guo, Z., Dirmeyer, P., Gao, X., and Zhao, M. (2007) Improving the quality of simulated soil moisture with a multi-model ensemble approach, Quarterly Journal of the Royal Meteorological Society, 133: 731–747.

Gudmundsson, L. et al. (2012) Comparing Large-Scale Hydrological Model Simulations to Observed Runoff Percentiles in Europe, J Hydrometeor. 13(2): 604-620. DOI: 10.1175/JHM-D-11-083.1.

Prudhomme, C. et al. (2011) How well do large-scale models reproduce regional hydrological extremes in Europe? J. Hydrometeor., 12(6): 1181–1204.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 2005, 2012.