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Welcome to **G-EMMA**, software written to facilitate end-member mixing analysis within a GLUE uncertainty assessment framework.



Using mixing model approaches to separate the different components of a hydrograph has a long and successful history in the hydrological community. However, the application of mixing models suffers from uncertainty in both the identification of the correct sources (end-members) and the unavoidable spatiotemporal variation in end-member concentrations. Before G-EMMA, no method accounted for both these sources of uncertainty.

G-EMMA is a novel method of uncertainty assessment in end-member mixing analysis, based on generalized likelihood uncertainty estimation, and has been successfully applied to a lowland polder catchment, part of the Haarlemmermeer. This catchment provided for a difficult test case, due to a large spatial variability in end-member concentrations, and a large number of different distinguishable water types. G-EMMA was better able to deal with the large number of and spatial variation in end-members than the traditional approach, suggesting possible application over a wider range of catchments than traditional EMMA.

The G-EMMA procedure and its application to a Dutch polder catchment have been published in a scientific paper ([Delsman et al., 2013](#)).

Published applications of G-EMMA:

- [Delsman, J.R., Oude Essink, G.H.P., Beven, K.J., Stuyfzand, P.J., 2013. Uncertainty estimation of end-member mixing using generalized likelihood uncertainty estimation \(GLUE\), applied in a lowland catchment. Water Resour. Res. 49, 4792–4806.](#)
- [Koutsouris, A.J., Lyon, S.W., 2018. Advancing understanding in data-limited conditions: estimating contributions to streamflow across Tanzania's rapidly developing Kilombero Valley. Hydrol. Sci. J. 63, 197–209.](#)

I wrote this software as part of my PhD research "Adaptation to drought and salinization in the groundwater - surface water system" ([visit website \(in Dutch\)](#)), within the [Knowledge for Climate, Climate Proof Fresh Water Supply](#) program. I hope it can be of use to other researchers,

Joost Delsman, April 2013

