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Supplement of

On the assimilation of environmental tracer observations for model-based decision support

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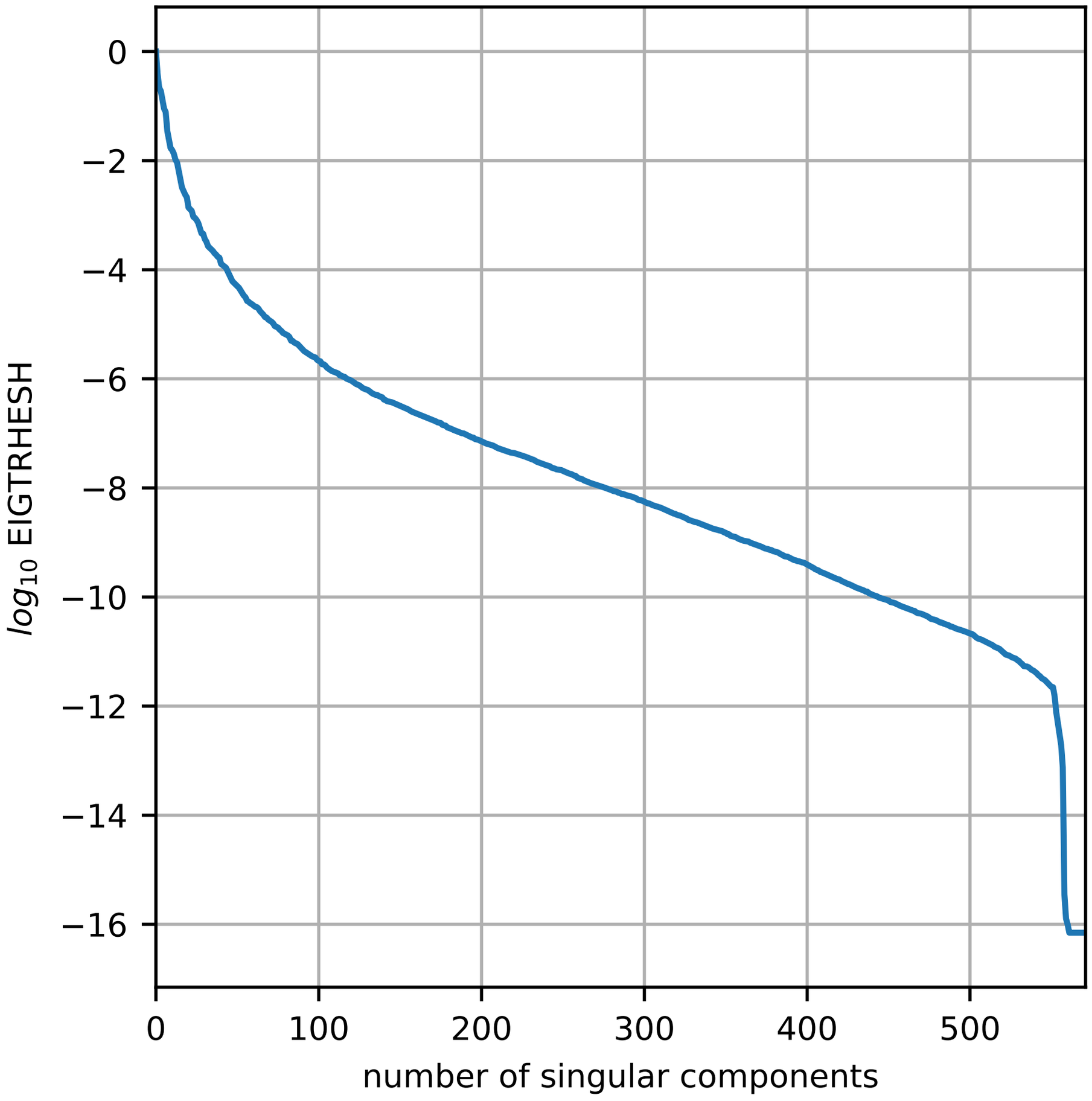
Heretaunga Plains model parameterization summary table

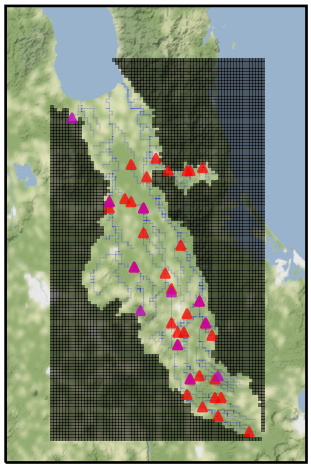
type	transform	count	initial value	upper bound	lower bound	standard deviation
coastal boundary conductance	log	14	0.576089 to 5	5	-3	1.33333
river-bed conductance	log	67	-0.767135 to 5.69897	5.69897	-3	1.44983
river-bed conductance	mixed	271	-3 to 3.28756	5.69897 to 500000	-3 to 0.001	1.44983 to 83333.3
drain conductance	log	1	-2.28602	2	-3	0.833333
horizontal hydraulic conductivity	log	235	-1.43573 to 4	2 to 4	-4 to 0.69897	0.333333 to 1.1165
horizontal-vertical anisotropy factor	log	187	0.897056 to 3	3	0	0.5
porosity	log	235	-1	-0.823909	-3	0.362682
(irrigation well) abstraction rate multiplier	none	1	98.9137	120	80	6.66667
recharge multiplier	none	1	99.4197	120	80	6.66667
seasonal river-bed conductance multiplier	none	7	100 to 547.22	2000	100	316.667
specific storage	log	185	-6.1167 to -5.90237	-3	-7	0.666667
specific yield	log	93	-3.93455 to -0.69897	-0.69897	-4	0.550172

Hauraki Plains model singular-value spectrum. Here, "EIGTHRESH" is the ratio of the lowest-to-highest eigenvalue. An EIGTHRESH value of 10^{-6} is often recommended. However, this assumes the case that a model can perfectly assimilate the information contained within the observations to the level implied by the observation weights. The total number of non-zero weighted observations used for history matching is 571. Note that this plot was generated using a Hauraki Plains model with a reduced-parameterization scheme (e.g., pilot points instead of grid-based parameters) such that a Jacobian matrix could be computed within reasonable computational resource constraints. We refer the reader to Knowling et al. (2019, *Adv Water Resour*, doi: 10.1016/j.advwatres.2019.04.010) for more information.

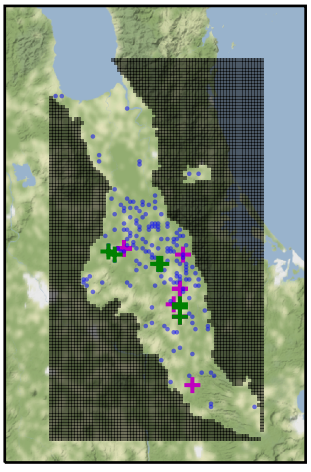

0
−2
−4
−6
−8
−10
−12
−14
−16
log_{10} EIGTRHESH
0
100
200
300
400
500
number of singular components

Hauraki Plains model observation locations by layer. Blue markers are groundwater levels, red triangles are surface-water fluxes, magenta triangles are surface-water nitrate concentrations, green crosses are nitrate concentrations and magenta crosses are groundwater tritium concentrations.

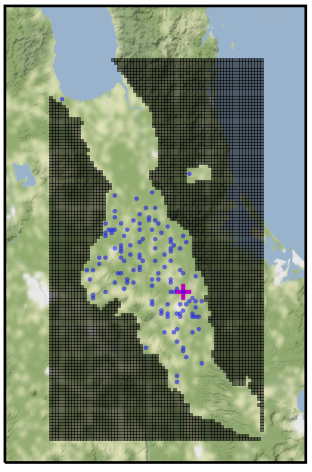
A)Layer 1 observations



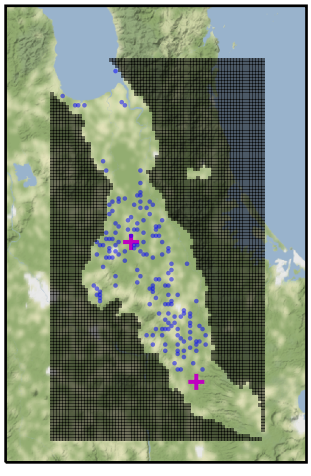
B)Layer 2 observations



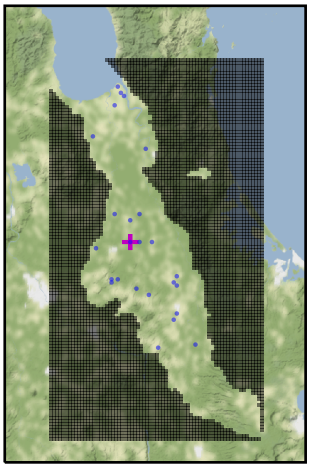
C)Layer 3 observations



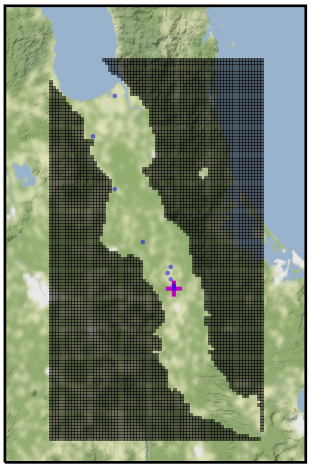
D)Layer 4 observations



E)Layer 5 observations



F)Layer 6 observations



G)Layer 7 observations