MMA A Computer Code for Multi-Model Analysis

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A link to this example problem can be found at :

http://igwmc.mines.edu/freeware/mma/MMA_Demo_MFandMore2017.zip

The MMA computer program performs multi-model analysis and provides statistical information for any quantitative model that produces text output.

Reasons for Performing Multi-Model Analysis

Groundwater models are commonly calibrated with sparse observation data relative to the scale of the groundwater system being modeled

⇒More than one model may explain the observation data set

⇒A single conceptual model only accounts for parameter uncertainty of that one model while uncertainty associated with possible different model structures is ignored

Information Criteria (IC) Equations are used to evaluate the strength of evidence for each model

General form of the IC equations:

$$IC_{SCORE} = Goodness\ of\ fit + Penalties$$

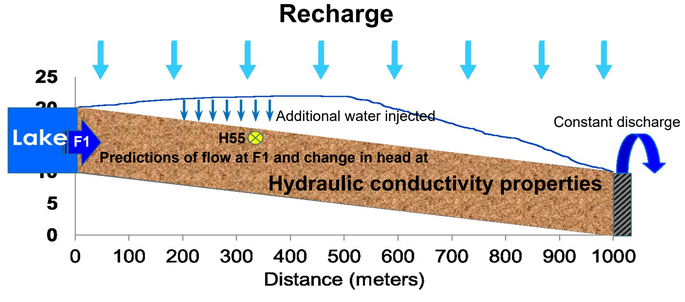
Model with the lowest *IC* score is assigned the highest *IC* probability

IC equations presented in this example include: Akaike (AIC); Akaike corrected (AICc); Bayesian (BIC); and Kashyap (KIC).

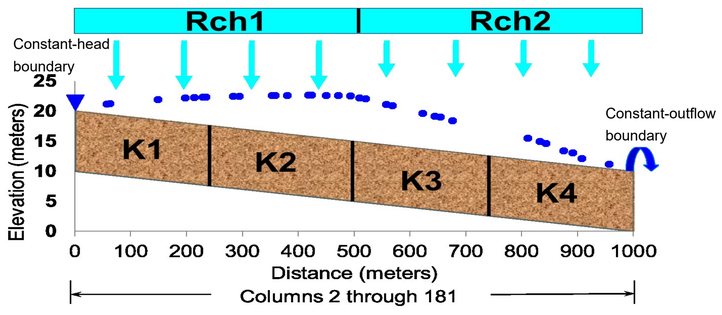
Example using UCODE_2014

1. Create different conceptual models of a groundwater system
2. Calibrate a set of models of the groundwater system using the same observation data set (UCODE_2014 in optimization mode)
3. Check for model deficiency and remove deficient models from model set
4. Generate predictions (UCODE_2014 in prediction mode)
5. Generate prediction statistic file (UCODE_2014 auxiliary program *Linear_Uncertainty)*
6. Direct MMA to model directories that include MMA files (MMA input file)
7. Run MMA and evaluate results

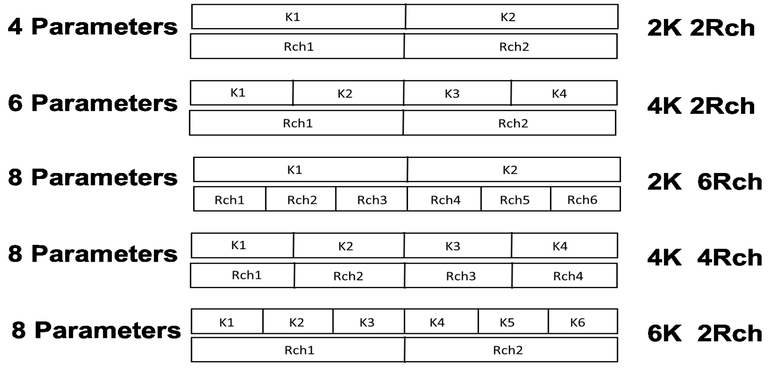
Hypothetical aquifer system



Example model of the aquifer system

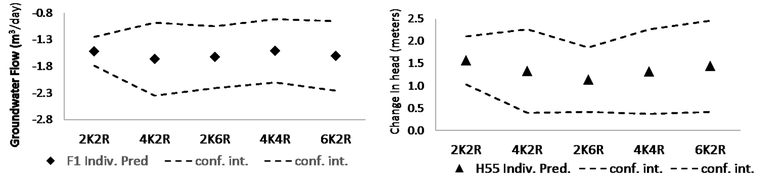


Possible Model Structures



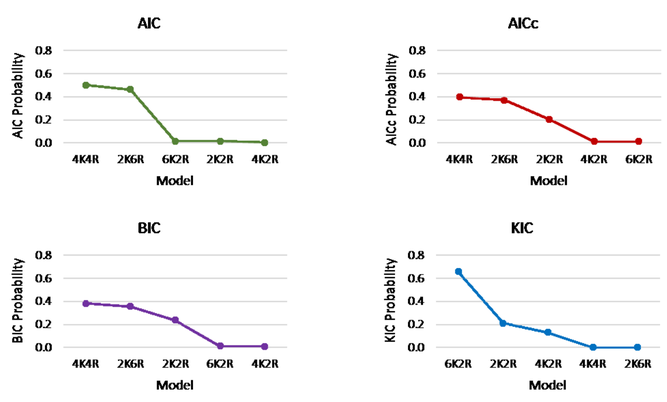
Flow and Head Predictions & Uncertainties

F1 and H55 Individual model predictions



Information Criteria Model Probabilities

(notice differing probability for different IC)



F1 and H55 Information Criteria Model-average Results

(notice similar model averaged results because deficient models were not included in the group of models)