The hydrogeological compiler.
A step towards Groundwater Integrated Modeling (GIM).

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I) Motivation: Complex problems in Earth Sciences ⇨ Use of numerical models

Large number of (powerful) codes available, but:
- ✓ sparse in general (academic framework). MODFLOW©, FEFLOW©
- ✓ aimed at solving a particular (set of) physical phenomenon (often, groundwater flow and contaminant transport only)
- ✓ most often, these codes do not integrate stochastic techniques

List of (already) embedded 'hosts' :
Geology modeling : COSNESIM, GSLIB, FLUVSIM
Gw flow and tranport : GROUNDWATER, TRANSIN
Postprocess : PARAVIEW / TECPLOT

⇔ **Groundwater Integrated Modeling (GIM).**

Features
- FULLY PARALLEL at three levels : inner coding, cluster level, grid computing
- OBJECT ORIENTED : easy to extend
- FORTRAN 95 / XML : standard programming

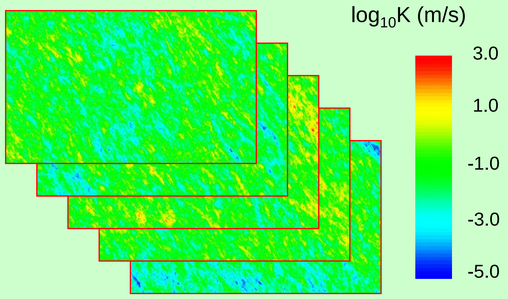
Strengths and weaknesses : those of the embedded "host" codes (black boxes)

II) Methodology / Application: Maximum abstraction from a set of wells . Stochastic K field (100 realizations), ground water flow simulation, collection of histogram of mass balances at pumping wells

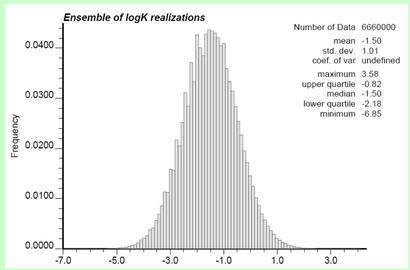
1) Read data common to "hosts" GIM
- Mesh (FE, FD, General)
- Measurements
- Variogram
- Regions
- Physical phenomena
- Etc
- ToDoList

2) Simulate K fields TRANSIN (1)

3) Plot K fields PARAVIEW (2)

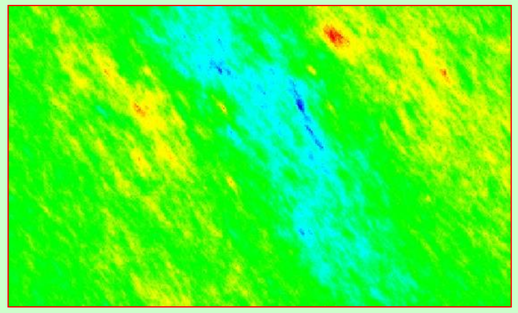


4) Histogram of K fields GSLIB (3)

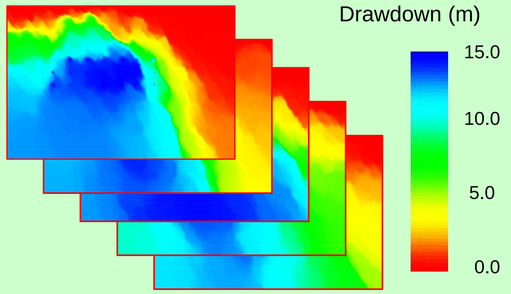


5) Simulate flows (100) GROUNDWATER (4)

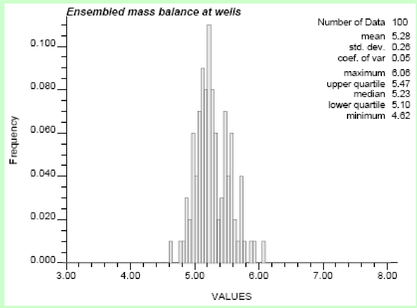
6) Calc./plot mean K field GIM / PARAVIEW(2)



7) Plot drawdown PARAVIEW (2)



8) Histogram of abstraction volume GSLIB (3)



CONCLUSIONS

- ✓ GIM is a versatile tool
- ✓ Easy to extend : just two black-box routines for I/O
- ✓ Ample room for future developments
- ✓ Not only in groundwater modeling. Potential uses in environmental engineering

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