One-Week Introduction to Stochastic Groundwater Modeling

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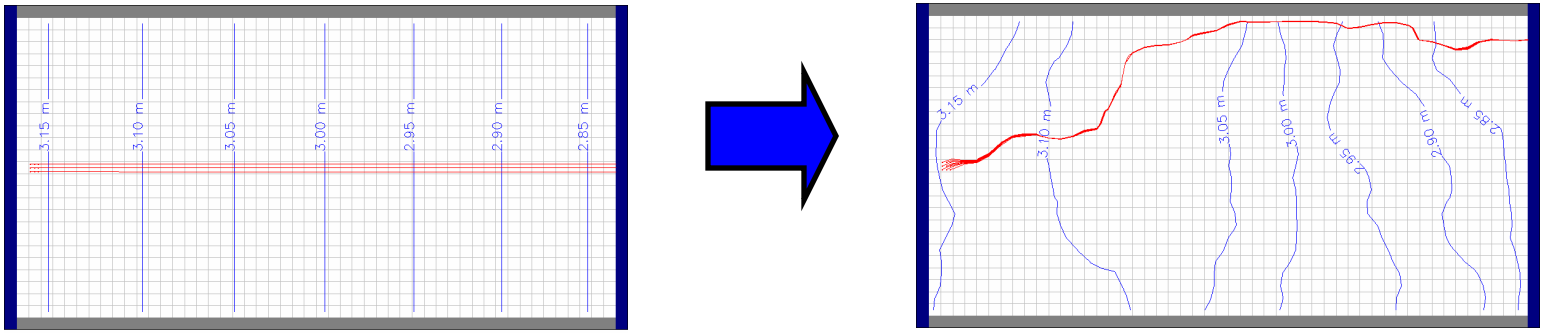
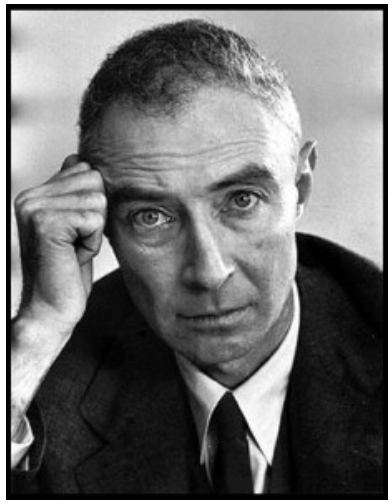
University of Colorado Denver



Annual Meeting
Geological Society of America
Denver, Colorado, October 27-30, 2013

Outline

- Motivation
- Spatial Correlation
- PMWIN
  - classroom model
  - homework exercise
- Monte Carlo
- Summary



stochastic hydrogeologist

groundwater consultant

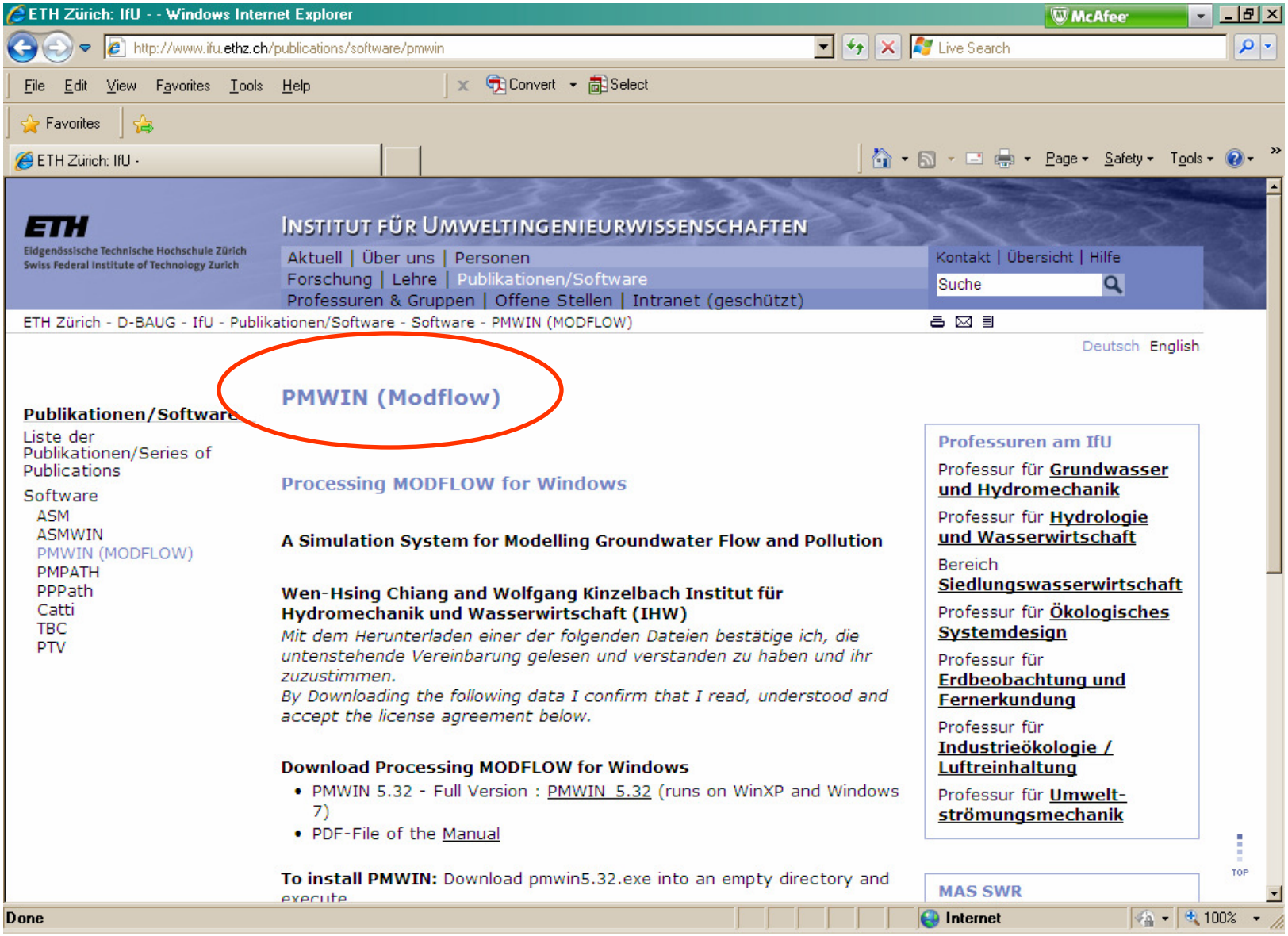
Oppenheimer http://rhapsodyinbooks.files.wordpress.com/2009/01/oppenheimer.jpg?w=230 10/22/20013
Truman http://h-bombbook.com/images/truman.jpg 10/22/2013

Why Stochastic Modeling?

- Translate research to practice
- Demonstrate evaluation
  - top level of Bloom's Taxonomy
- Show humility
  - All models are wrong, but some are useful (Box 1979)

Spatial Correlation

inexpensive http://bethpartin.com/wp-content/uploads/2010/03/Globeville-houses-Feb-2010-600x400.jpg 10/22/2013
expensive http://www.armstrongre.com/upload/Hilltop%201.jpg 10/22/2013
neighborhoods http://collaborativelibrarianship.files.wordpress.com/2010/09/denver-neighborhoods.jpg 10/22/2013


ETH Zürich: IfU - - Windows Internet Explorer
http://www.ifu.ethz.ch/publications/software/pmwin
File Edit View Favorites Tools Help
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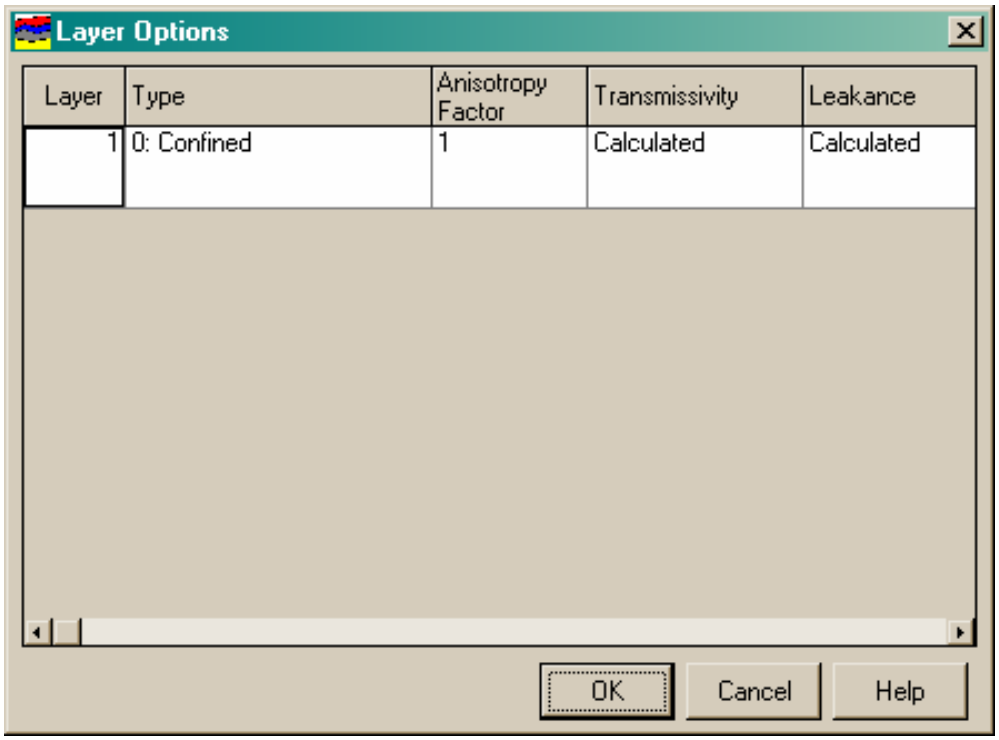
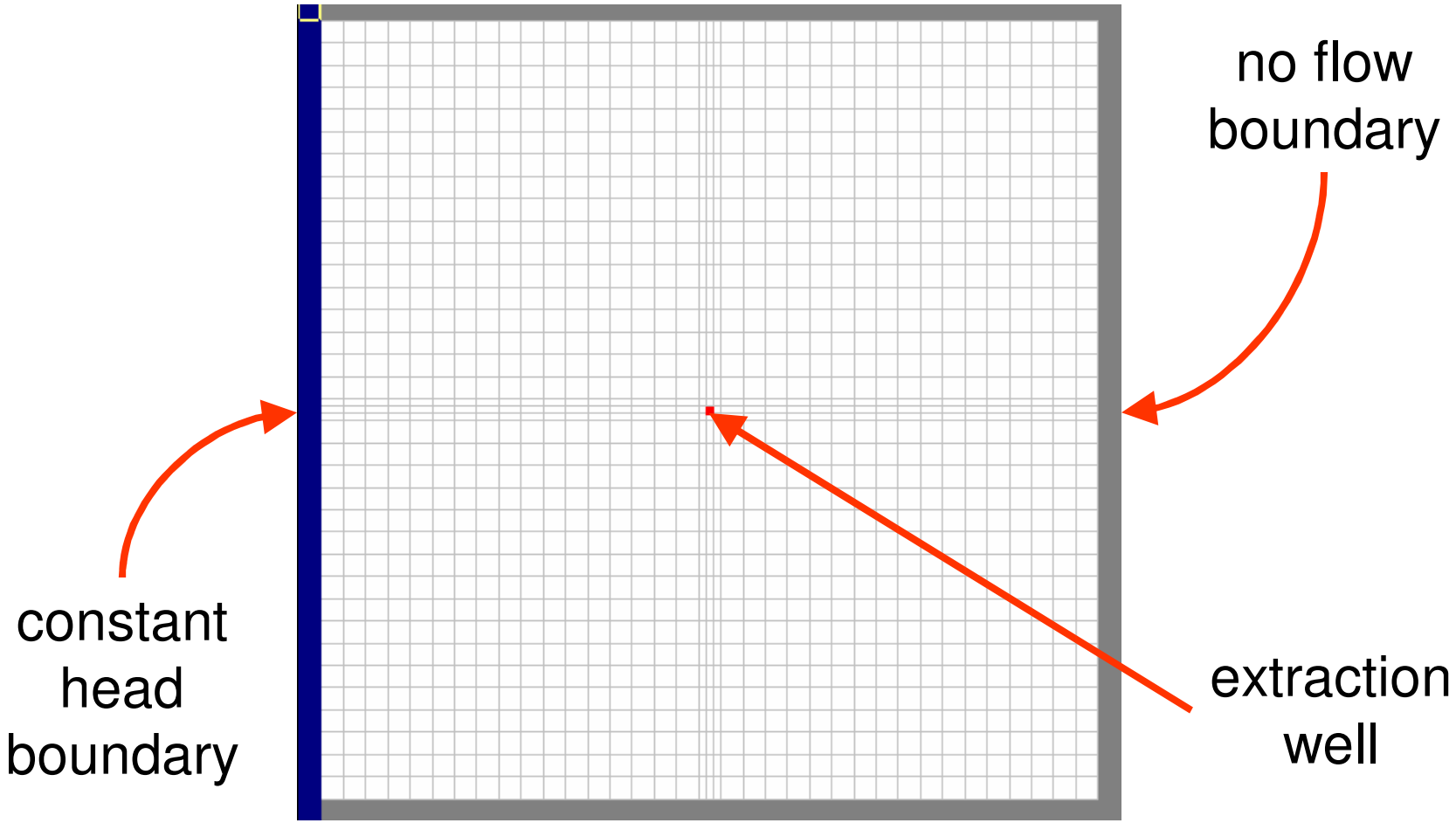
ETH Zürich: IfU -
ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich
INSTITUT FÜR UMWELTINGENIEURWISSENSCHAFTEN
Aktuell | Über uns | Personen
Forschung | Lehre | Publikationen/Software
Professuren & Gruppen | Offene Stellen | Intranet (geschützt)
Kontakt | Übersicht | Hilfe
Suche
ETH Zürich - D-BAUG - IfU - Publikationen/Software - Software - PMWIN (MODFLOW)
Deutsch English
Publikationen/Software
Liste der Publikationen/Series of Publications
Software
ASM
ASMWIN
PMWIN (MODFLOW)
PMPATH
PPPath
Catti
TBC
PTV
PMWIN (Modflow)
Processing MODFLOW for Windows
A Simulation System for Modelling Groundwater Flow and Pollution
Wen-Hsing Chiang and Wolfgang Kinzelbach Institut für Hydromechanik und Wasserwirtschaft (IHW)
Mit dem Herunterladen einer der folgenden Dateien bestätige ich, die untenstehende Vereinbarung gelesen und verstanden zu haben und ihr zuzustimmen.
By Downloading the following data I confirm that I read, understood and accept the license agreement below.
Download Processing MODFLOW for Windows
PMWIN 5.32 - Full Version : PMWIN 5.32 (runs on WinXP and Windows 7)
PDF-File of the Manual
To install PMWIN: Download pmwin5.32.exe into an empty directory and execute
Professuren am IfU
Professur für Grundwasser und Hydromechanik
Professur für Hydrologie und Wasserwirtschaft
Bereich Siedlungswasserwirtschaft
Professur für Ökologisches Systemdesign
Professur für Erdbeobachtung und Fernerkundung
Professur für Industrieökologie / Luftreinhaltung
Professur für Umwelt-strömungsmechanik
MAS SWR
TOP
Done
Internet
100%

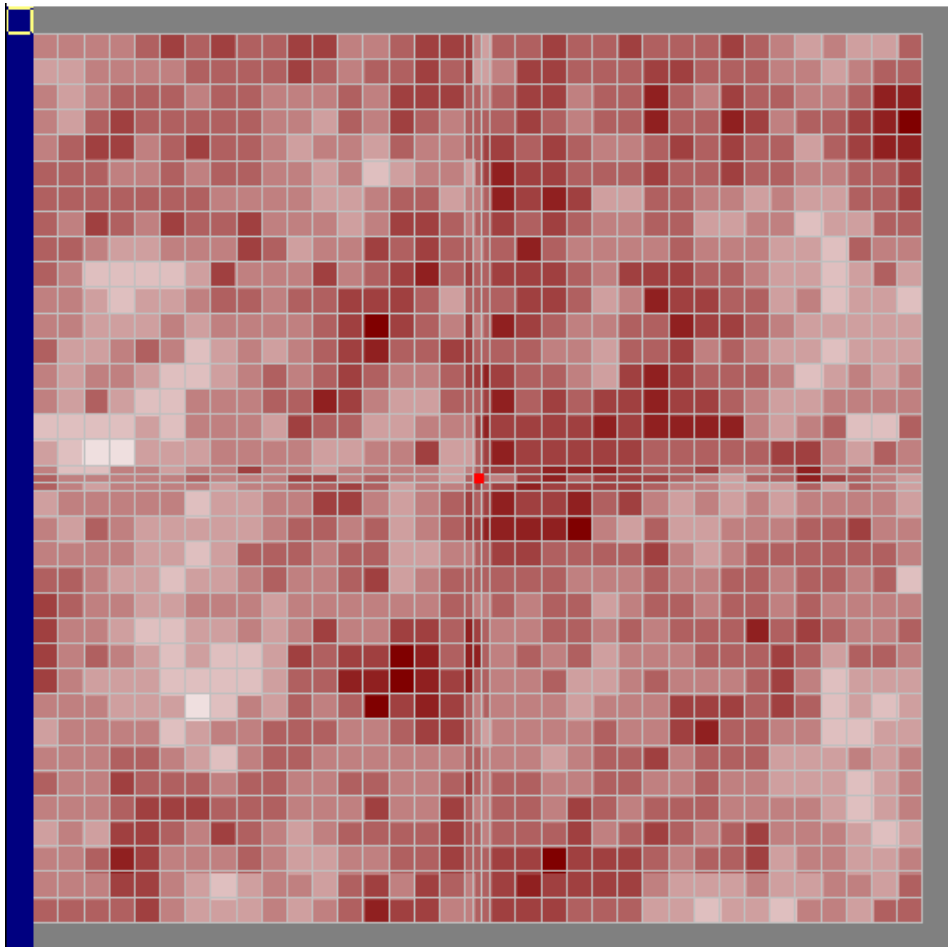
Classroom Model



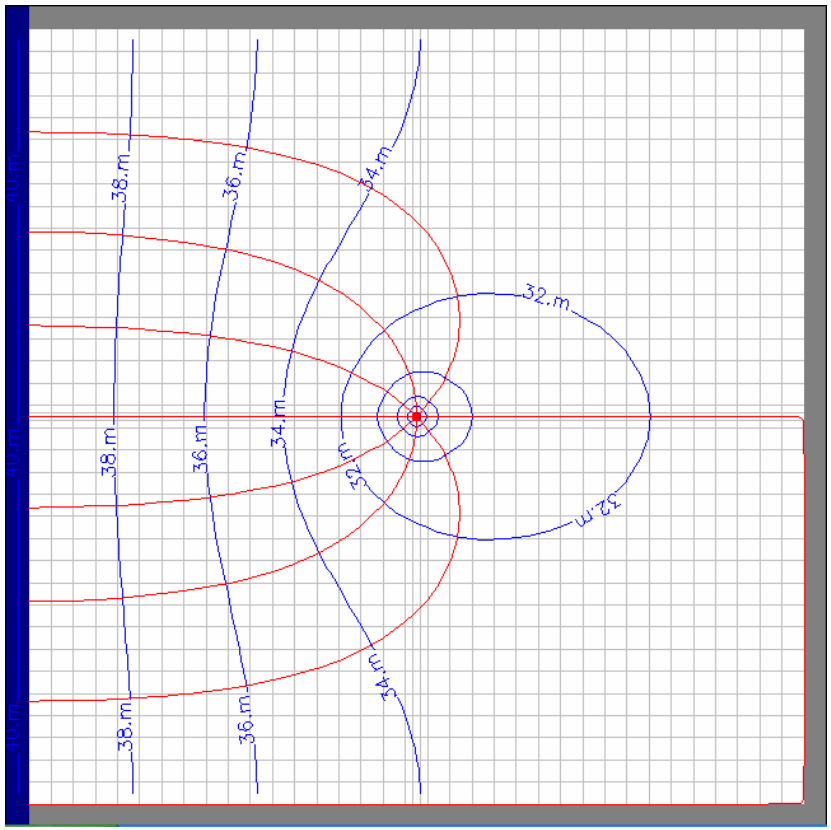
Classroom Model



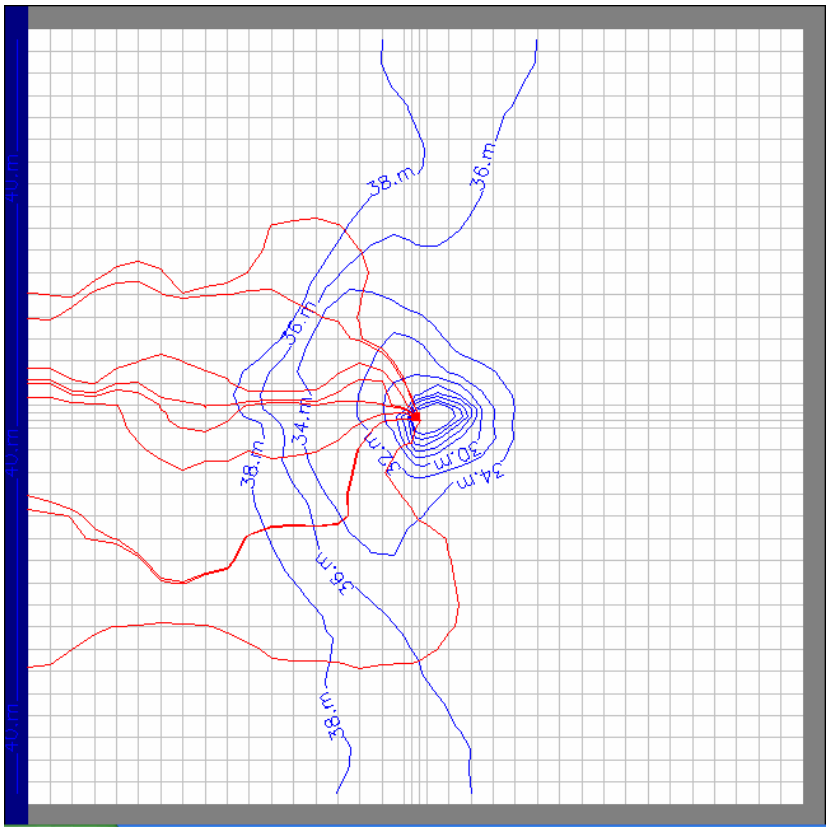
Spatially Correlated ln(K)



Classroom Model

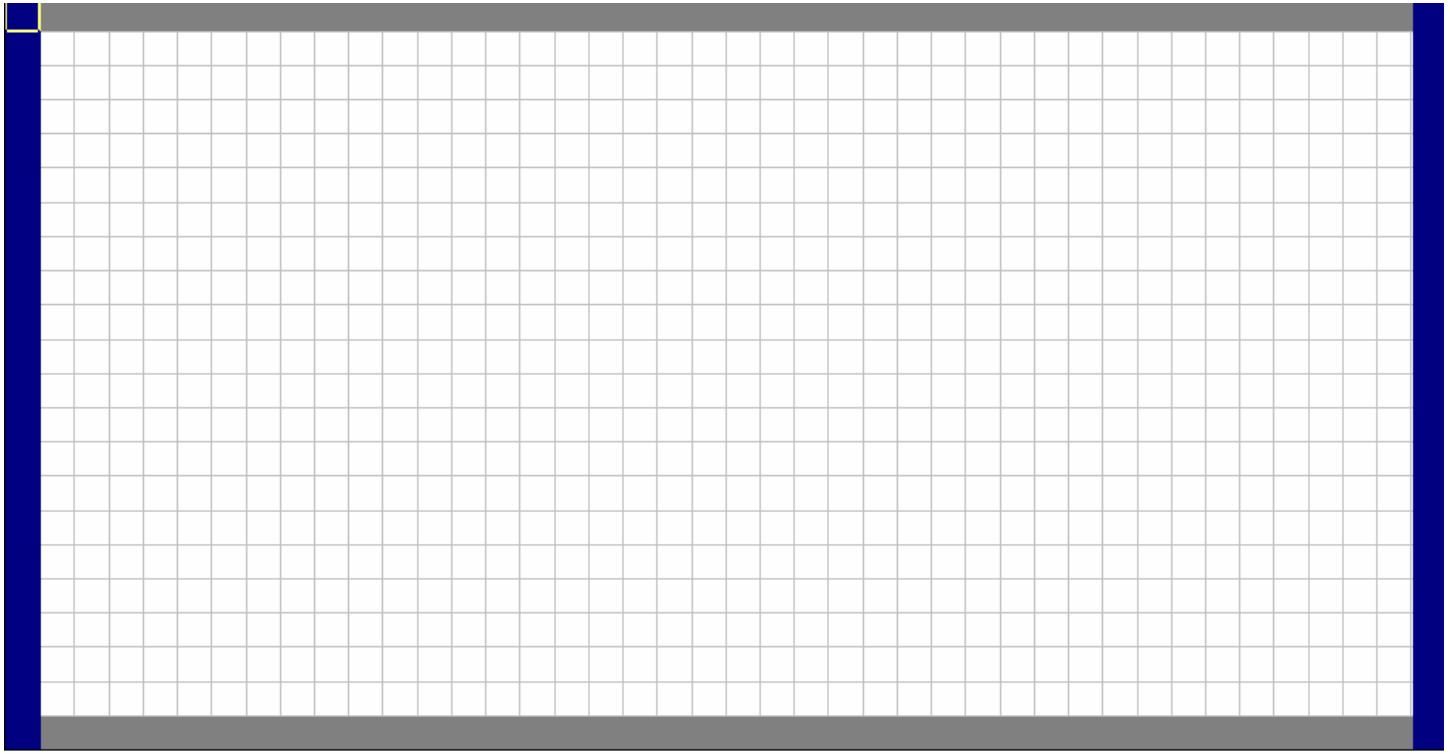


homogeneous

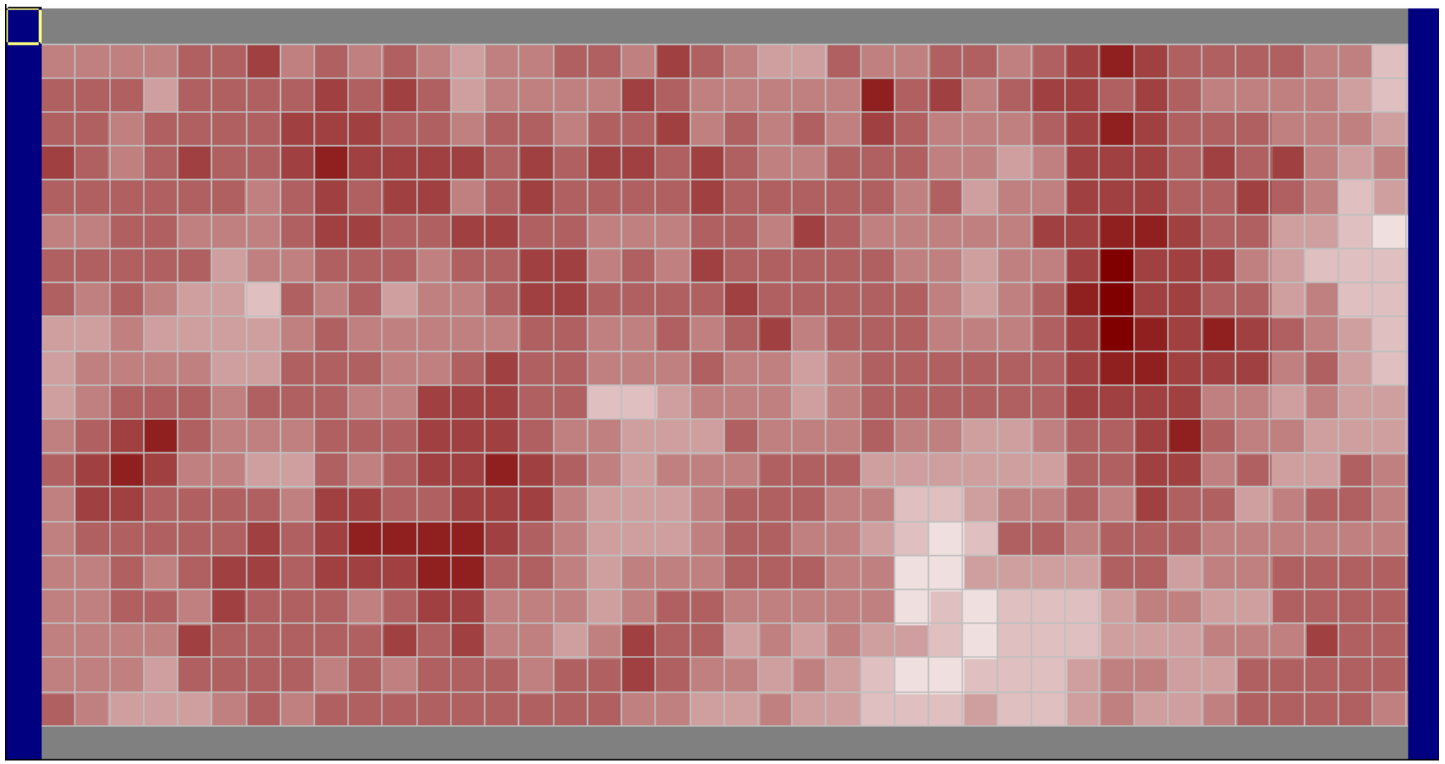


heterogeneous

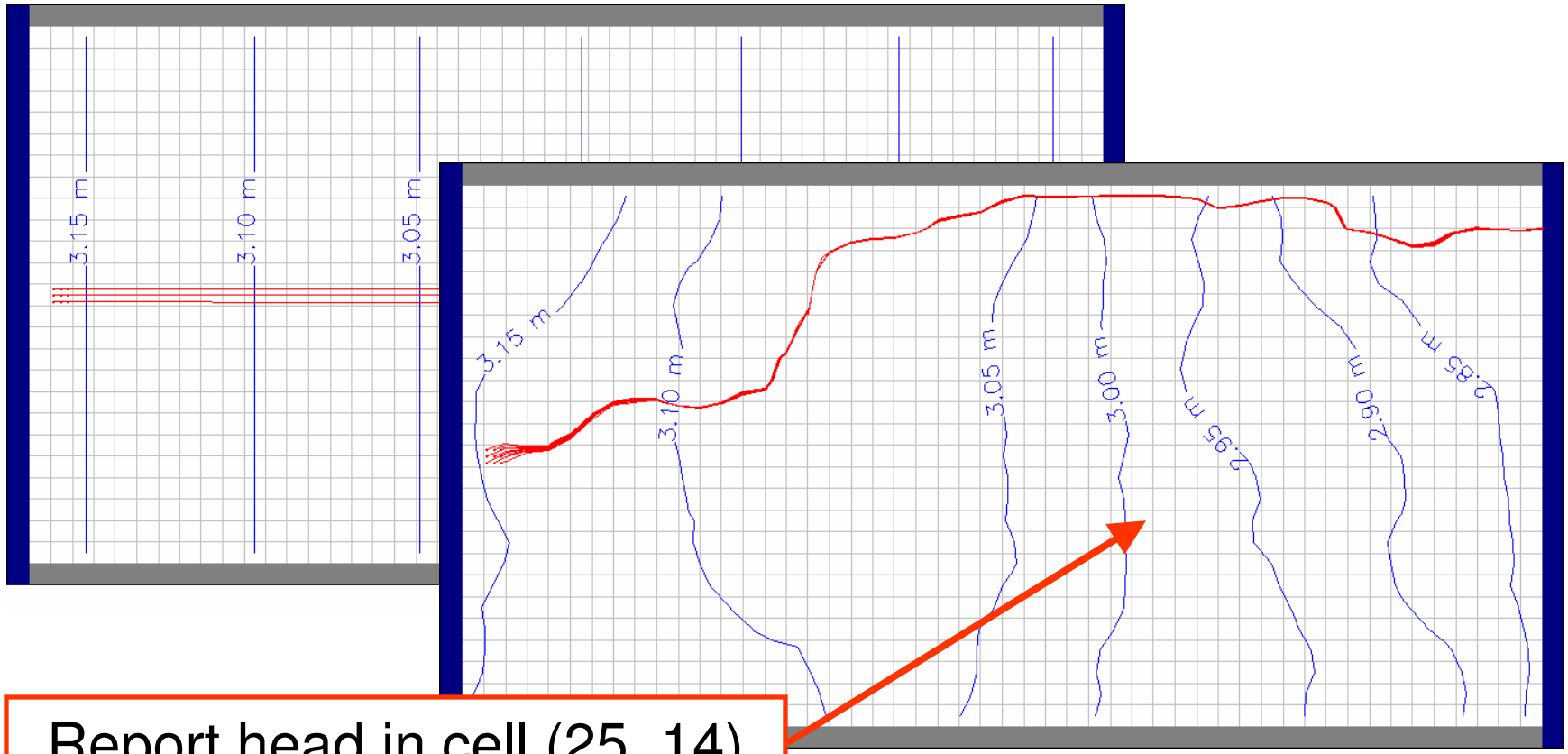
Homework Exercise



Spatially Correlated ln(K)

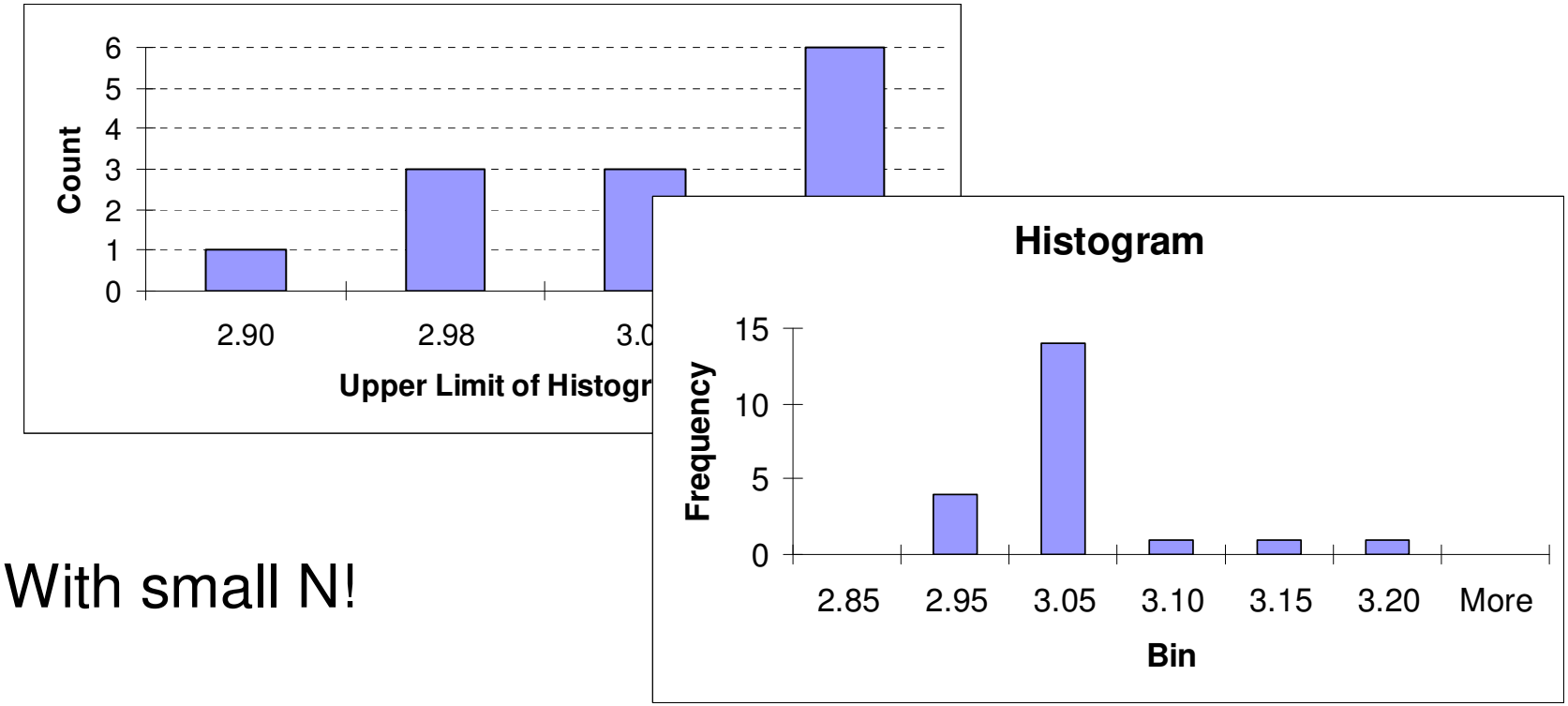


Homework Exercise



Report head in cell (25, 14)

Monte Carlo Simulation



With small N!

Summary

1. Stochastic modeling—worthwhile!
2. Real estate analogy for spatial correlation
3. PMWIN for teaching Modflow
4. Monte Carlo through “crowdsourcing”
5. Give it a shot—fast, fun, and free

Thank You!

FOR MORE DETAILS
- learning objectives
- step-by-step instructions
- Likert assessment results

Mays (2010)
Journal of Geoscience Education
http://dx.doi.org/10.5408/1.3534852