your 🖼 **in an** **R** **!**

slides at https://github.com/mrustl/useR-2016

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your ~~goddess~~ in an R

↓

Environmental models

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Challenge

Environmental models

- (Usually) not implemented in **R**
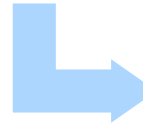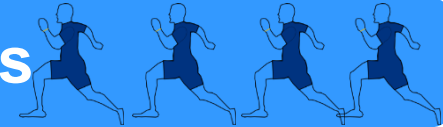
- Generic
  - → **Case-specific**
    - **Sensitivity analysis**
      - **Calibration**
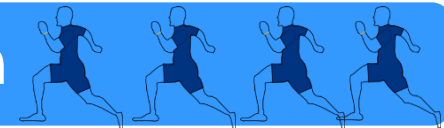
Challenge

Environmental models

- 💧 **(Usually) not implemented in** **R**

- 💧 **Generic**

 → **Case-specific** 🏃

  → **Sensitivity analysis** 🏃🏃🏃🏃
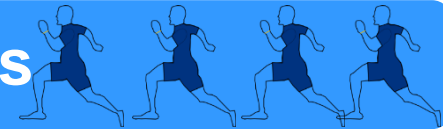
  → **Calibration** 🏃🏃🏃🏃
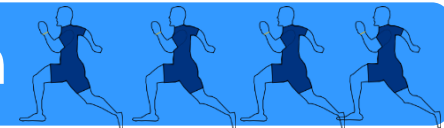
"*If you're going to do something* **three times or more**, *you should think about* **writing a small package**"(*Peng,2016*)

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Well drawdown model

USGS — science for a changing world
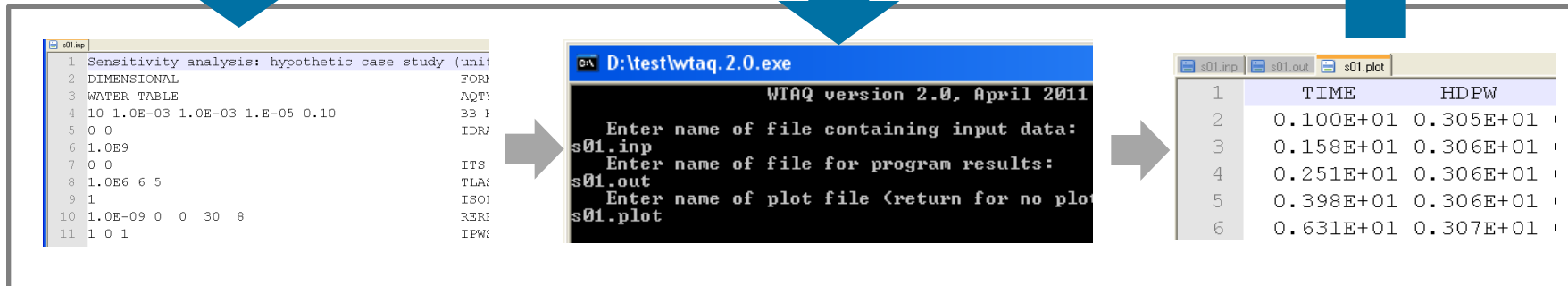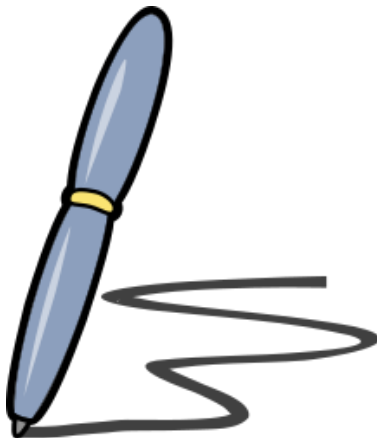
Groundwater Resources Program

WTAQ Version 2—A Computer Program for Analysis of Aquifer Tests in Confined and Water-Table Aquifers with Alternative Representations of Drainage from the Unsaturated Zone
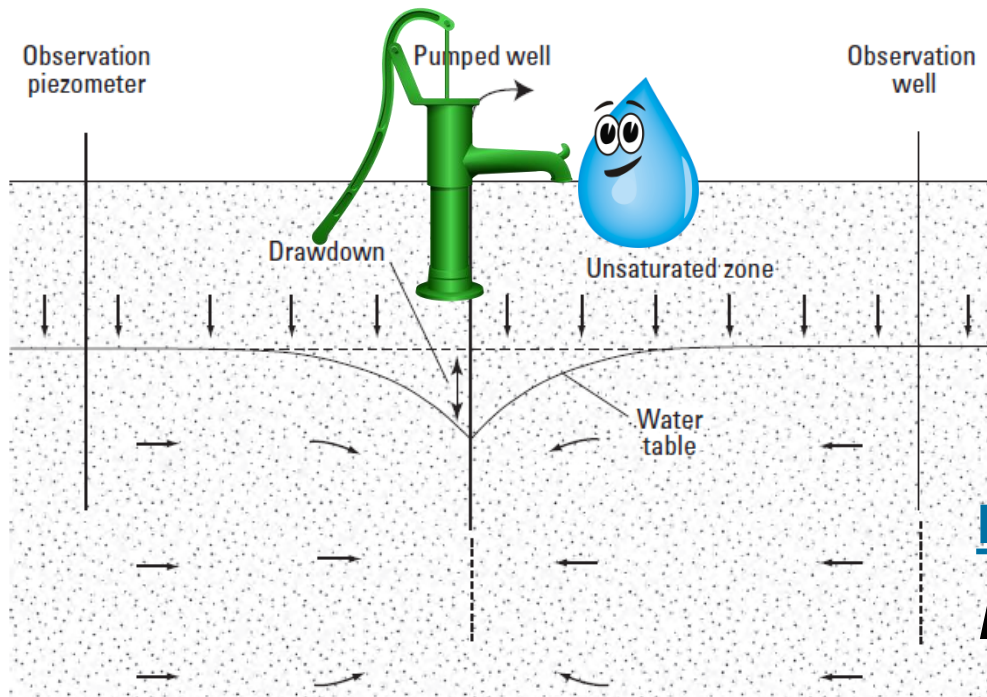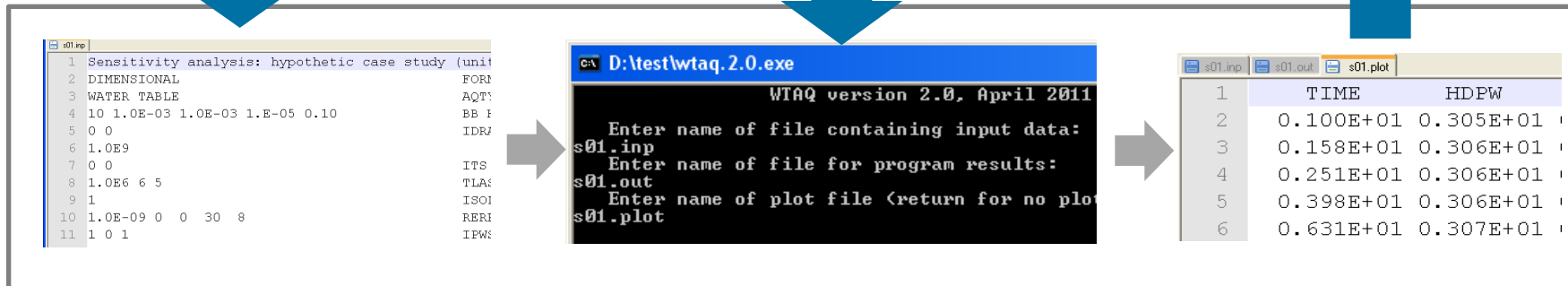

Freely available at:

http://water.usgs.gov/ogw/wtaq

Workflow

Our approach

configure()

input$

writeInputFile()

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Our approach

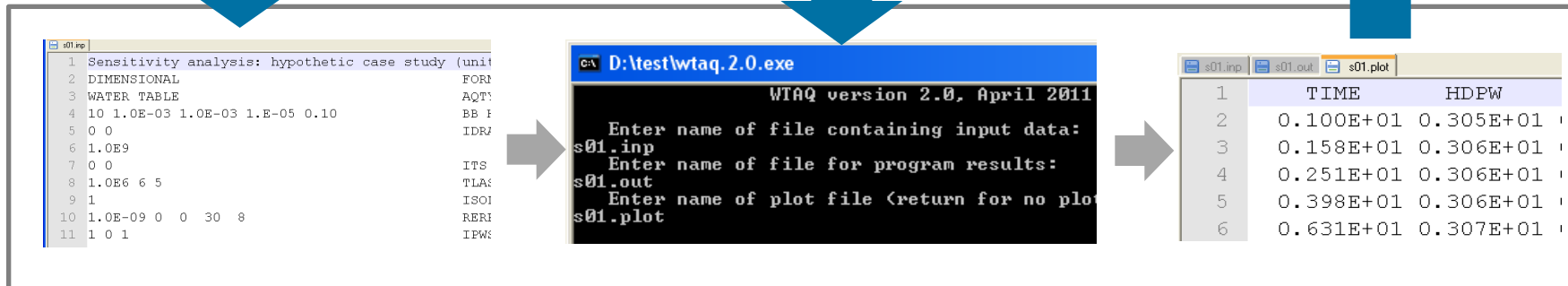## configure()

input$
- general
- aquifer
- drainage
- times
- solution
- pumpwell
- obswells

writeInputFile()

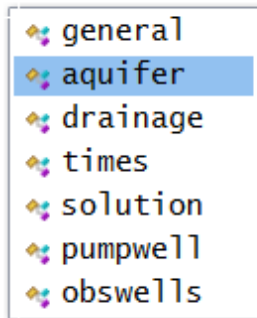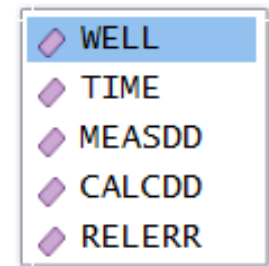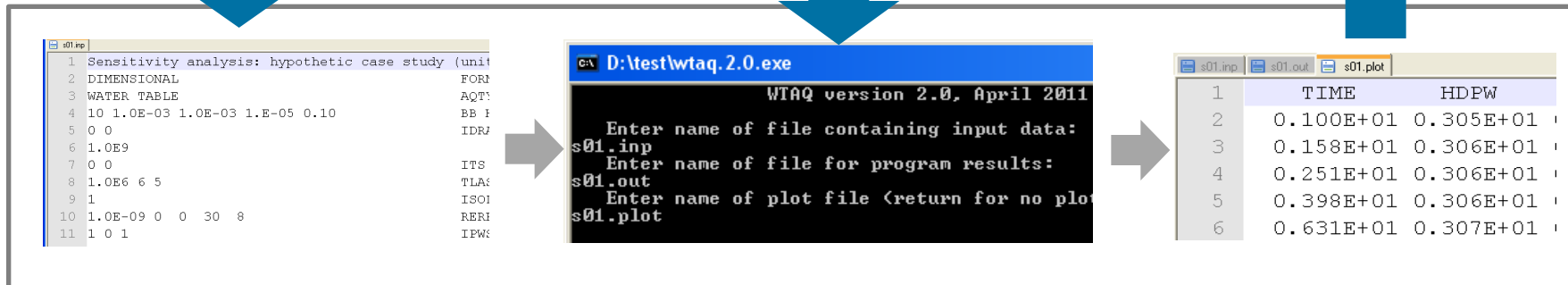## runModelEngine()

```
s01.inp
 1  Sensitivity analysis: hypothetic case study  (uni...    FORM
 2  DIMENSIONAL                                             FORM
 3  WATER TABLE                                             AQTY
 4  10 1.0E-03 1.0E-03 1.E-05 0.10                          BB
 5  0 0                                                     IDRA
 6  1.0E9
 7  0 0                                                     ITS
 8  1.0E6 6 5                                               TLAS
 9  1                                                       ISO
10  1.0E-09 0  0  30  8                                     RER
11  1 0 1                                                   IPWS
```

```
D:\test\wtaq.2.0.exe
                        WTAQ version 2.0, April 2011
    Enter name of file containing input data:
s01.inp
    Enter name of file for program results:
s01.out
    Enter name of plot file (return for no plot
s01.plot
```

TIME	HDPW
0.100E+01	0.305E+01
0.158E+01	0.306E+01
0.251E+01	0.306E+01
0.398E+01	0.306E+01
0.631E+01	0.307E+01

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Our approach

configure()

input$

- general
- aquifer
- drainage
- times
- solution
- pumpwell
- obswells

output$

- WELL
- TIME
- MEASDD
- CALCDD
- RELERR

writeInputFile()   **runModelEngine()**   **readOutputFile()**

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R functions:

- **read** / **write** / **modify** input file
- **run** model
- **read** output file

+ Model engine

Automated workflow

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Summary

"Wrapped" models:

WTAQ-2 (USGS)

https://github.com/KWB-R/kwb.wtaq

Tutorial: *https://kwb-r.github.io/kwb.wtaq*

EPANET (USEPA)

VS2DI (USGS)

Method:

"Wrap your model!" (*Sonnenberg et al., 2014*)

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Any ?

slides at https://github.com/mrustl/useR-2016
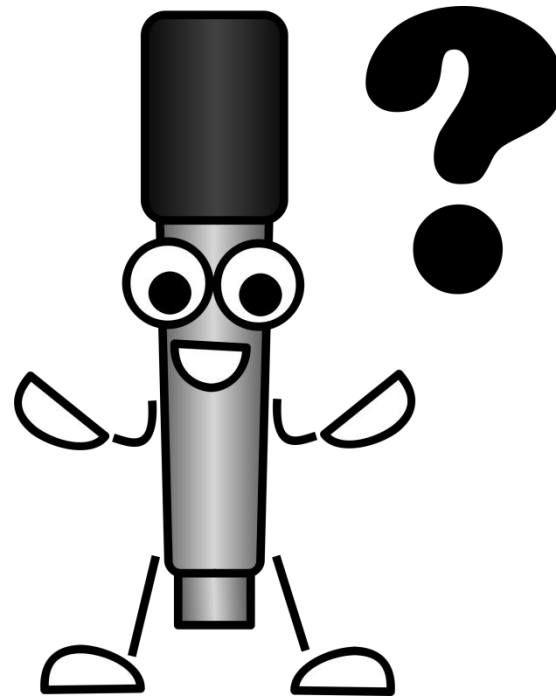
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