

Icelandic tricks of the trade - Modelling large geothermal reservoirs

by:

Grímur Björnsson and Arnar Hjartarson

*TOUGH Symposium 2006
Lawrence Berkeley National Laboratory
Berkeley, California, May 15–17, 2006*



Main issues

- Use iTOUGH2, both for inverse and forward modeling
- Leave a trail
- Use standard UNIX commands – easy to change from one platform to the other
- Use dates when applicable

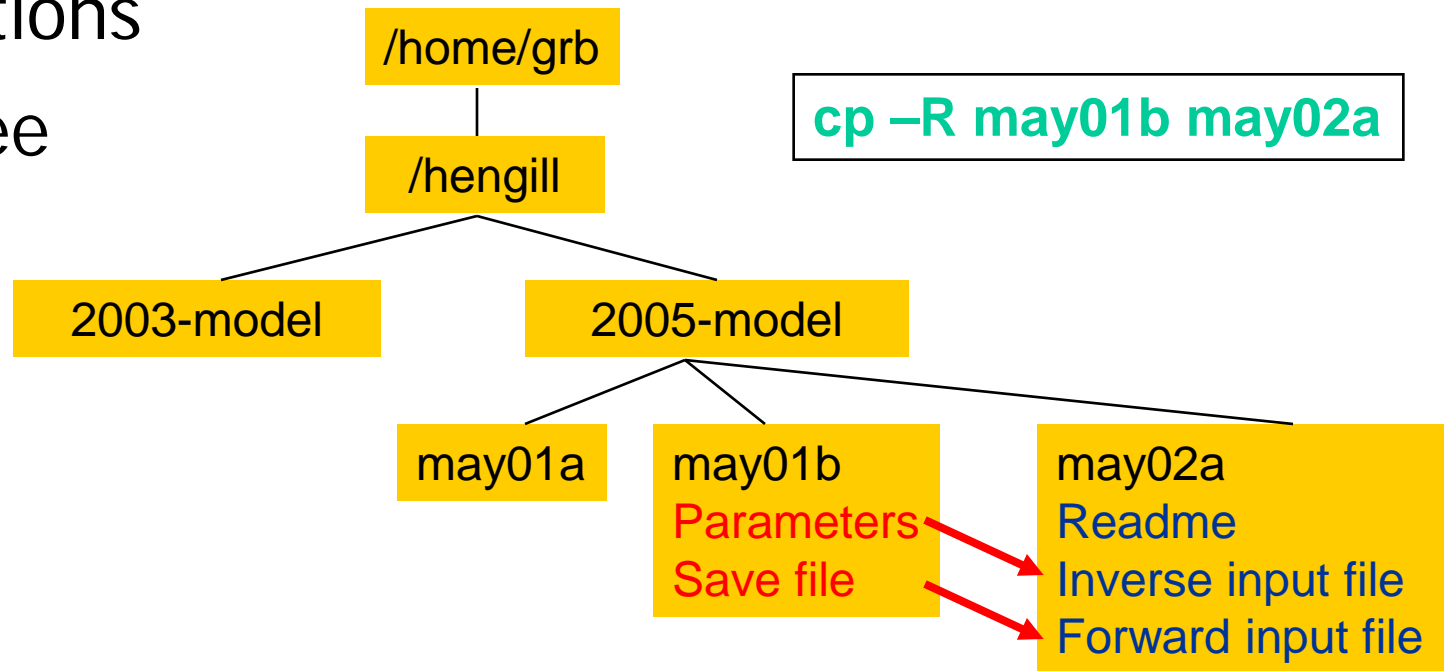
The iTOUGH2 environment

- Much easier to manage large models and datasets
- Output files convenient for plotting
- Objectivity function available in both forward and inverse models
- Work on the model, not the computer



Leave a trail

- Model important for reservoir management
- Used to minimize risk of new development
- Make sure that the “right” model is basis for predictions
- File tree



Use standard Unix commands

- grep, paste, sed, awk, head, tail
- Standard input/output concept
- Write scripts
- Use full path for filenames
- Don't forget to specify master files and folders in reports

/home/grb

/hengill

2005-model

graphics

may02a
Readme
Inverse input file
Forward input file
Forward output file
Inverse "tecplot" file

Example: Well enthalpy with time

```
$ cd /home/grb/hengill/graphics
$ outfile=/home/grb/hengill/2005-model/may02a/forward_ouput_file
$ grep "OUPUT DATA AFTER" $outfile | cut -c40-50 > j1
$ grep "WELL10" $outfile | awk '{if (NF==12) print $5}' > j2
$ paste j1 j2 | awk '{print 1975+$1/3.14E+7,$2/1000}' | xy_plot
:
: debug commands until right
:
$ history -5 > draw.well.10
$ rm j1 j2
```

iTOUGH2 understands DATES

- Extremely useful when working with long time histories
- Based on sec2date and date2sec fortran codes written in Iceland

```
> OBSERVATION
>> TIME: 1 DATES
      1975_01_01
>> TEMPERATURE
>>> ELEMENT: AAA_6
>>>> ANNOTATION: w5t_a
>>>> DATA DATES
      01-jun-2000 200
      2000-07-01_10:30 205
>>>> DEVIATION: 10
```

```
# this script plots temperature history of well 5 in layer a
#
outfile=/home/grb/hengill/2005-model/may02a/inverse_tekplot_file
grep "w5ta" $outfile | awk '{print $1,$2}' | sec2date -d 1975 > j1
grep "w5ta" $outfile | awk '{print $1,$3}' | sec2date -d 1975 >> j1
grep "w5ta" $outfile | awk '{print $1,$4}' | sec2date -d 1975 >> j1
```