

HERIOT WATT UNIVERSITY

Hidden Value in Tracer Experiments for ADE Model Calibration

Steve Wallis

Heriot-Watt University, Edinburgh

s.g.wallis@hw.ac.uk

Dye Tracing Workshop, April 2008 1

HERIOT WATT UNIVERSITY

Use of ADE to predict response to a pollution incident

Require:

- Model to implement Advection-Dispersion Eqn.
 - analytical, numerical, routing
- Information on the spill
 - mass, duration/intensity, non-conservative?
- Values of U & D

Dye Tracing Workshop, April 2008 2

HERIOT WATT UNIVERSITY

Use of ADE to predict response to a pollution incident

Value of U & D

Two

Quality of derived coefficients

Dye Tracing Workshop, April 2008 3

HERIOT WATT UNIVERSITY

Calibration using dye tracing experiments

Two scenarios:

- Many experiments Rare
 - dubious data can be discarded
- Few experiments Usual
 - need to extract maximum value from all

Dye Tracing Workshop, April 2008 4

HERIOT WATT UNIVERSITY

Calibration using dye tracing experiments

Dye Tracing Workshop, April 2008 5

HERIOT WATT UNIVERSITY

Calibration using dye tracing experiments

Methods for estimating U and D:

- Moments
 - historical usage; known difficulties
- ADE model optimisation
 - currently preferred
 - numerical solution; routing procedure

Dye Tracing Workshop, April 2008 6

HERIOT WATT UNIVERSITY

Calibration using routing procedure

- Predict d/s profile given u/s profile and estimates of U and D
- Find U and D values that give "best fit" between predicted and observed d/s profiles
- Manual or automated; subjective or objective

Dye Tracing Workshop, April 2008 7

HERIOT WATT UNIVERSITY

Illustrative Case Study

- Murray Burn, Riccarton
- Compare predictions between three cases
 - 1 – ideal (4 reliable experiments)
 - 2 – poor (2 reliable experiments)
 - 3 – hv (2 reliable & 2 unreliable experiments)

Dye Tracing Workshop, April 2008 8

HERIOT WATT UNIVERSITY

Illustrative Case Study

Case 1 - ideal

Dye Tracing Workshop, April 2008 9

HERIOT WATT UNIVERSITY

Illustrative Case Study

Case 2 - poor

Dye Tracing Workshop, April 2008 10

HERIOT WATT UNIVERSITY

Illustrative Case Study

Case 3 - hv

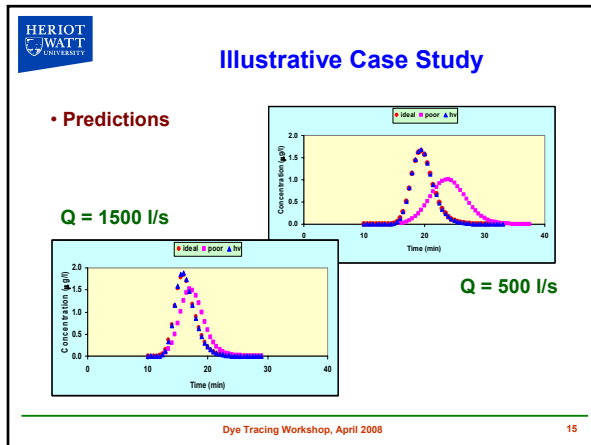
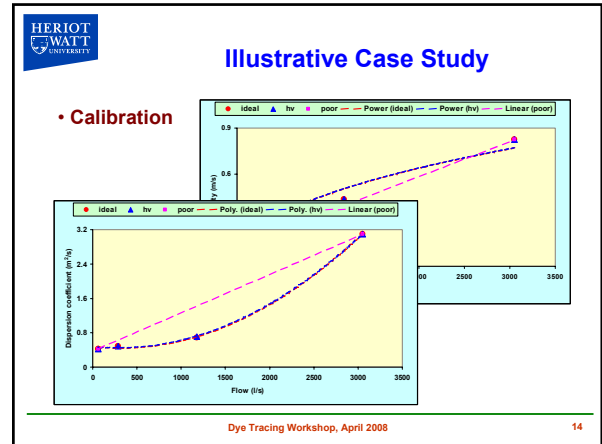
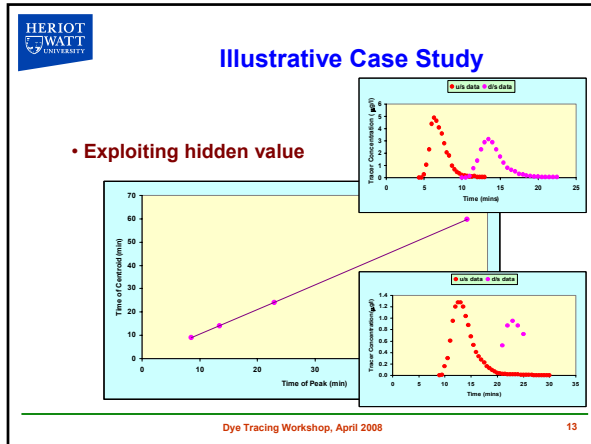
Dye Tracing Workshop, April 2008 11

HERIOT WATT UNIVERSITY

Illustrative Case Study

- Data analysis:
 - Cases 1 & 2: velocity (centroids - moments) dispersion coefficient (rout. proc.)
 - Case 3:
 - reliable experiments (as Cases 1 & 2)
 - unreliable experiments (as Cases 1 & 2 except centroids exploit hidden value)

Dye Tracing Workshop, April 2008 12



HERIOT-WATT UNIVERSITY

Conclusions

- Don't reject dubious data until you're certain it has no hidden value
- Further development of these ideas should lead to improved knowledge on the relative importance of quantity and quality re tracer data

Dye Tracing Workshop, April 2008 16