Course Summary
Basic Questions That We Addressed

- Where does water go when it rains?
- How long does it reside in the catchment?
- What flowpath does the water take to the stream?
New problems that catchment hydrologists are tackling and where this knowledge is essential....
Visualization can be very useful.
New questions in catchment modeling

• What is physically based modeling?
• Hydrological simulations of river basins by **physically based** models without calibration parameters: reality or future or utopia?
• What are the prospects of transferring the lumped parameter approach from distributed basin elemental areas?
• **process oriented** and physically based hydrological models: differences in terminology or philosophy or scales or …?
• What are the **limits to predictability** of physically-based models? How may these limits be overcome?
• Is hydrograph comparison the best way to test physically-based models?
• What is the role of top down approaches in data analysis in the development, validation or improvement of physically-based models?
• At what **scales** should we apply closure of mass and energy balance in our models?
• Do we have a common understanding of the governing physical processes and their **scale dependency**?
• What is the role of “soft-data”? What is the role of experimentalist’s knowledge?
• Are there **scale invariant** process descriptions that can be included in models, are there ranges of scales at which scale variations are minimized?
One proviso before ending
Catchment runoff and representative elementary area

Parshall Flumes

Total Runoff

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Event Runoff

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REA: Something to keep in mind in your study areas
REA: something that you can determine

![Graph showing the relationship between watershed size (km^2) and flow (mm/day). The x-axis represents watershed size ranging from 0 to 30 km^2, and the y-axis represents flow ranging from 25.0 to 75.0 mm/day. The data points are scattered, showing a general trend of decrease in flow as watershed size increases.](image-url)
Our (point-scale) catchment instrumentation reinforces many bad concepts.
Explicit solution of water and tracer mass balance
Relative Flow

Depth of saturation

Event water mass

Total runoff and variability in channel

- High
- Low

$q$

time

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Introduction

Overview of the main runoff generation concepts

Runoff processes
- Plot scale
- Hillslope scale
- Catchment scale

Catchment modeling

For more information, a copy of this presentation or pdf of papers, please visit http://www.cof.orst.edu/cof/fe/watershd
For a more extended virtual course

20 2hr lectures that expand on what we covered today