Geomorphology

Reading: Chps 1, 2, and 4

Uniformitarianism

- Basic physical and chemical processes that apply to the present apply to the past
  - "The present is the key to the past"
  - Care must be taken
    - Rates change!!
    - Processes that existed in the past may not exist today
- Understanding uniformitarianism is critical to the study of geomorphology

Geomorphic Processes

Vary in intensity across physiographic boundaries.

Why?
- Climate
- Vegetation
- Altitude

Geomorphic Equilibrium

Balance between driving forces and resisting forces.

Dependent on time.

Influence of time changes when viewed on different scales (Schumm & Lichty 1965)

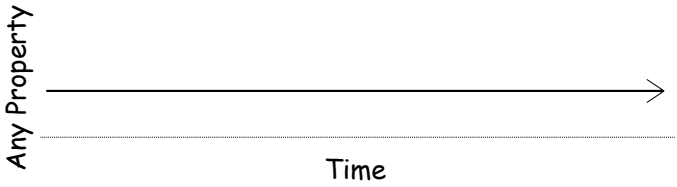
i.e. equilibrium states

Equilibrium States

- Static (1 day)
- Steady state (100 – 1,000 years)
- Dynamic (1,000,000 years)
- Metastable (1,000,000 years)
- Dynamic metastable (1,000,000 years)

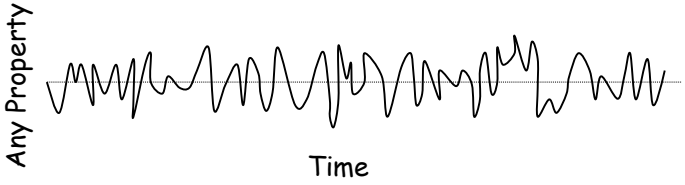
Equilibrium States

Static (no change)



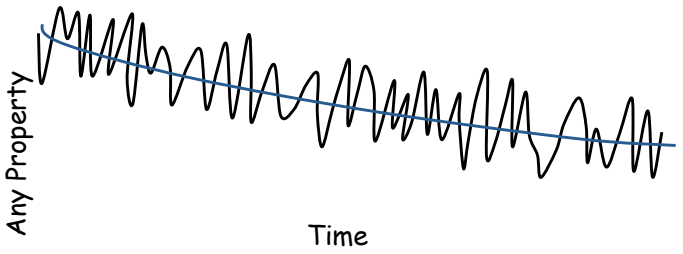
Equilibrium States

Steady State



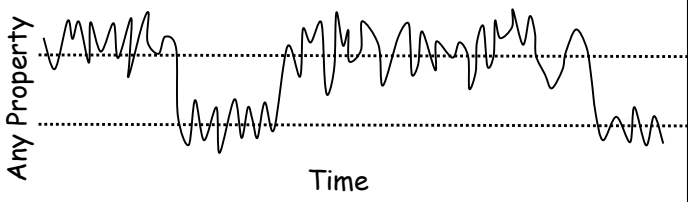
Equilibrium States

Dynamic



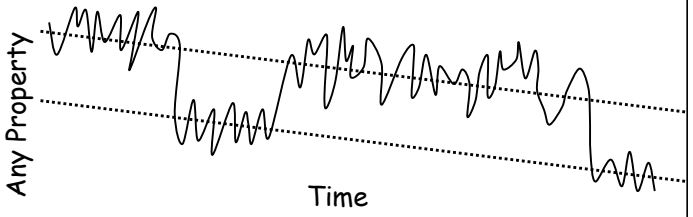
Equilibrium States

Metastable



Equilibrium States

Dynamic metastable



Geomorphic Systems

Understanding of surface processes involves applying common scientific concepts, such as ***uniformitarianism*** and ***equilibrium***.

Uniformitarianism, the present is the key to the past.

The basic physical and chemical processes that apply to the present apply equally to the past, and future.

Geomorphic Systems

What is a **system**?

A collection of related objects and the processes relating these objects.

Systems can be categorized, based on movement of matter and energy.

Types of Systems

Closed system

- No energy or matter leaks out of system & none comes in.
- Do NOT exist in the natural world (too complex).

Open system

- Energy or matter leaks out of, or is added to system.
- Any subaerial landscape on Earth's surface (Chorley 1962).

Natural Systems

Most geomorphic systems are **open.**

Steady state (type of open system) balance between input and out flow.

Steady state implies balance between Driving Forces and Resisting Forces.

Concept of **Grade**

Balance between sediment supply and sediment transport (of a stream).

Conceived by G.K. Gilbert.

Ex. A stream is graded if it transports as much load as it is capable of carrying, *without* eroding or depositing any of it.

Base Level

Lowest elevation to which a stream can Erode.

Local Base Level: Rock Outcrop, Lake Level, Master Stream, etc.

Ultimate Base Level: Sea Level

Geomorphic Thresholds

Threshold: Small energy or mass input that produces a sudden and dramatic response, resulting in a change in equilibrium conditions w/in a geomorphic system.

i.e. straw that breaks camel's back

Geomorphic Thresholds

- **Intrinsic**: depends on material
  - Ex. collapse of cave roof due to dissolution of carbonate strata.
- **Extrinsic**: depends on imposed process
  - Ex. meteor impact, climate change, anthropogenic influence.

Review -- geomorphology

- The systematic description of landforms
  - Processes that form them
  - Understand the function of landforms and their response to changes in energy
- Landforms: an individual feature (mountain, valley, etc)
- Landscape: the combined effect of numerous landforms

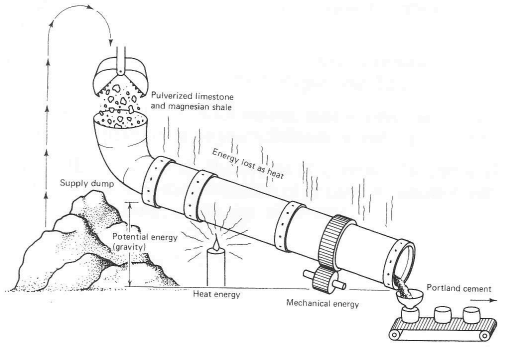
Landscape

- Landforms are part of a system that respond to external forcing
- The evolution of a landscape is the result of:
  - Process (erosion, deposition, etc)
  - Resisting framework (bedrock, structure)
  - Climate (water, vegetation, etc)
  - Tectonics
  - Time!

Geomorphic process - topography

- Major surface processes
  - Weathering
  - Mass wasting
  - Running water
  - Groundwater
  - Glaciers
  - Waves
  - Wind
  - Tectonism
  - Volcanism

Bullit Marquez / AP



Energy and Matter Flux in a Geomorphic System