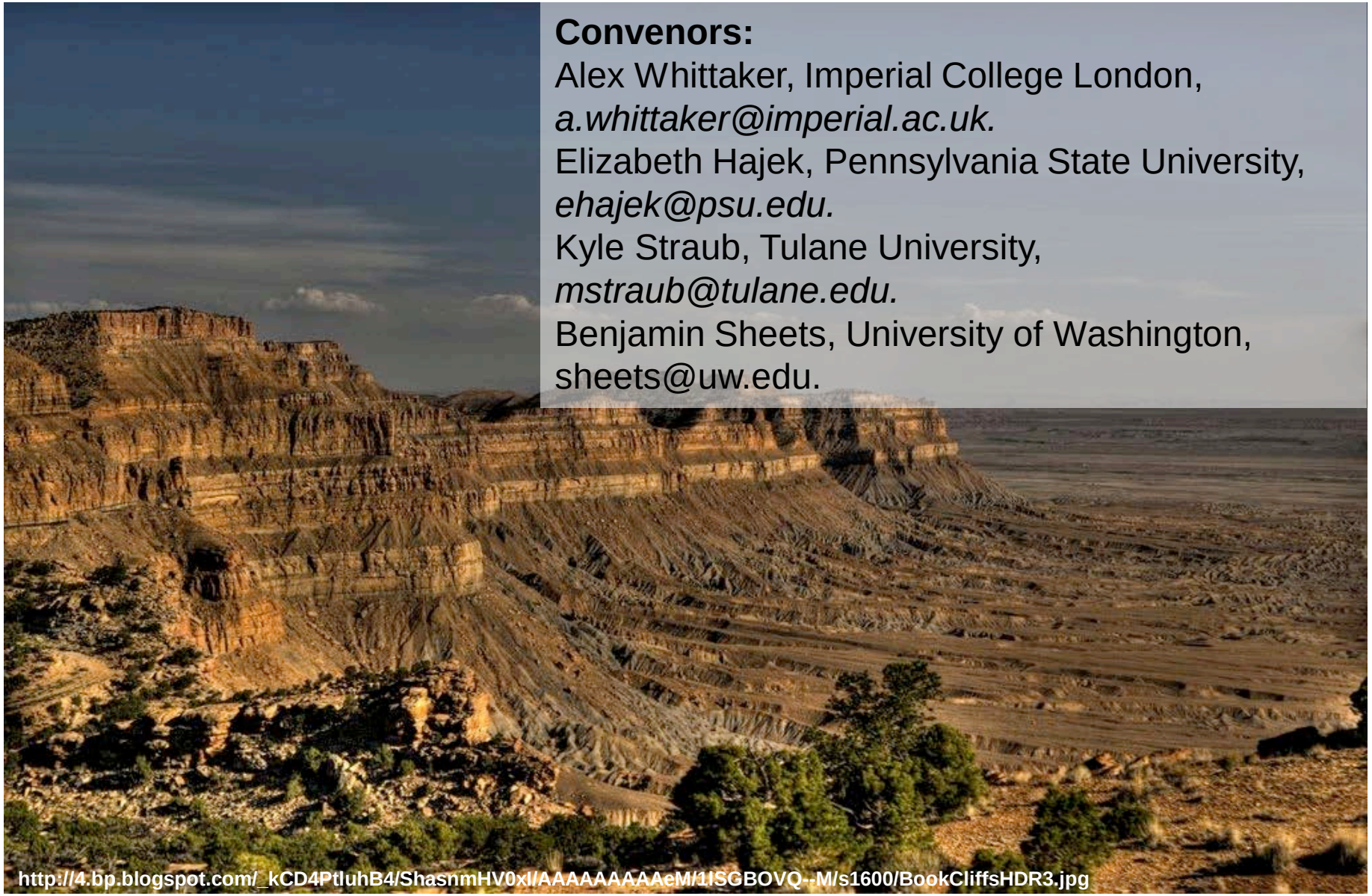
MYRES 2012 Proposal: Landscapes into Rock



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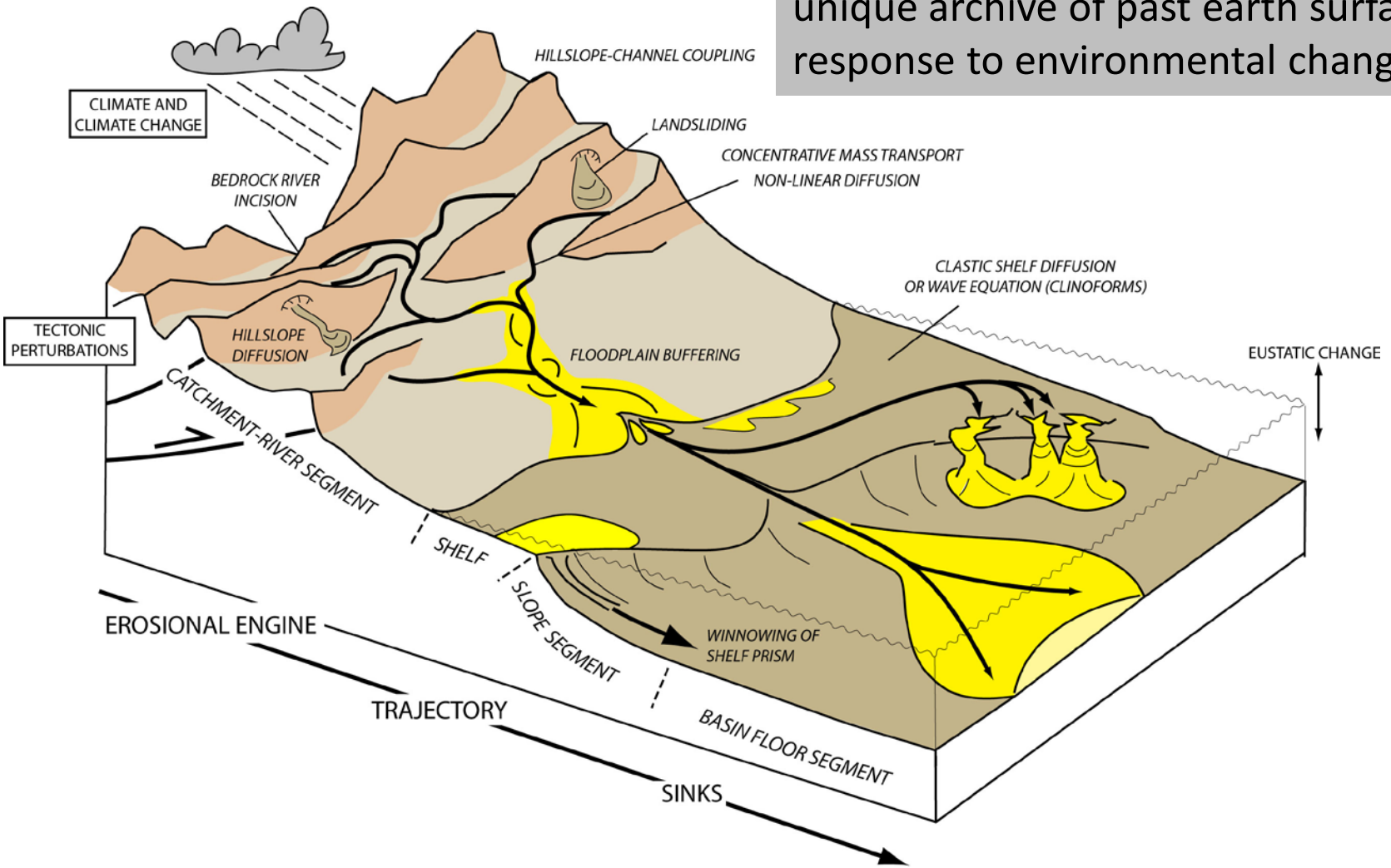
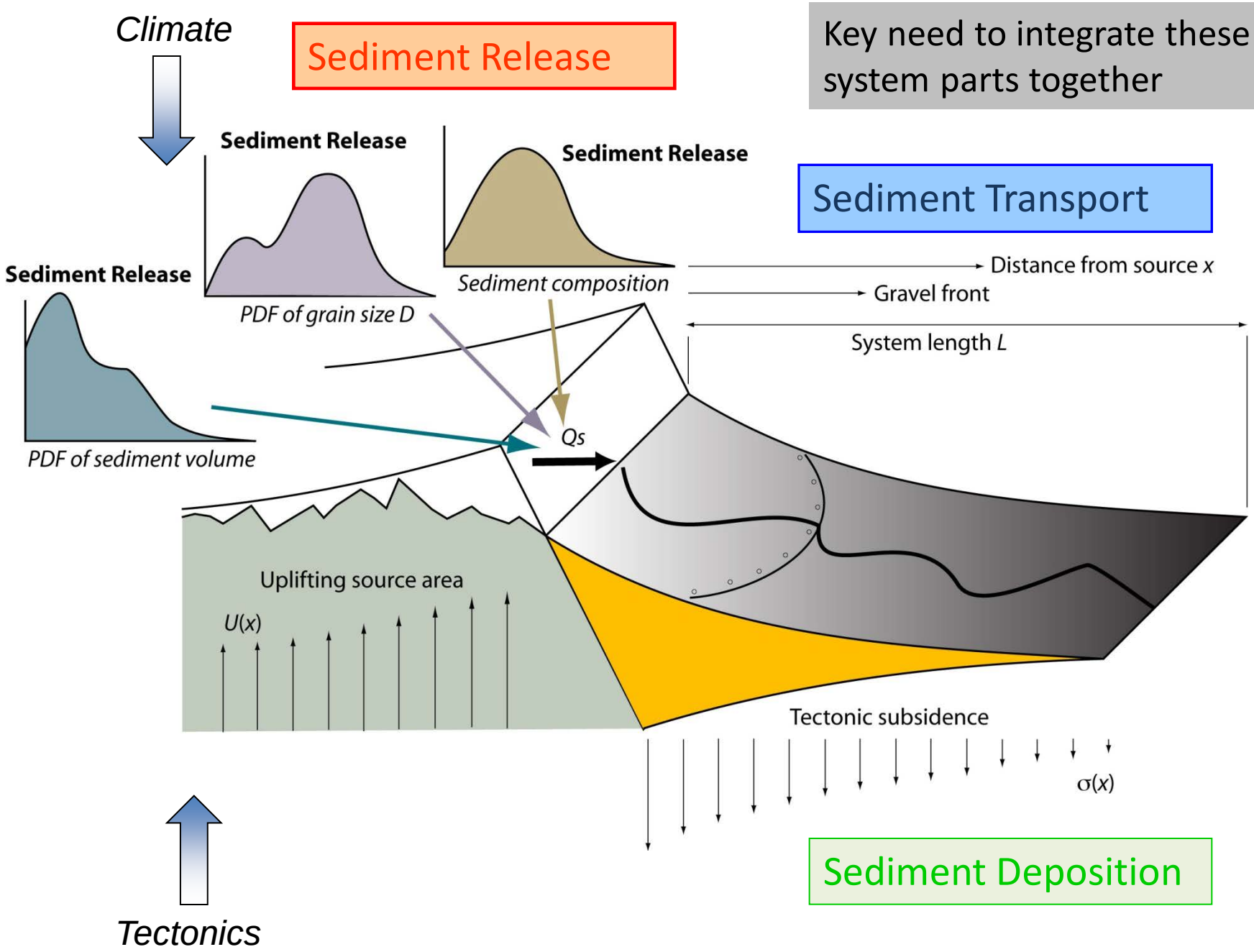
http://4.bp.blogspot.com/_kCD4PtIuhB4/ShasnmHV0xI/AAAAAAAAAeM/1ISGBOVQ--M/s1600/BookCliffsHDR3.jpg

Earth surface process system

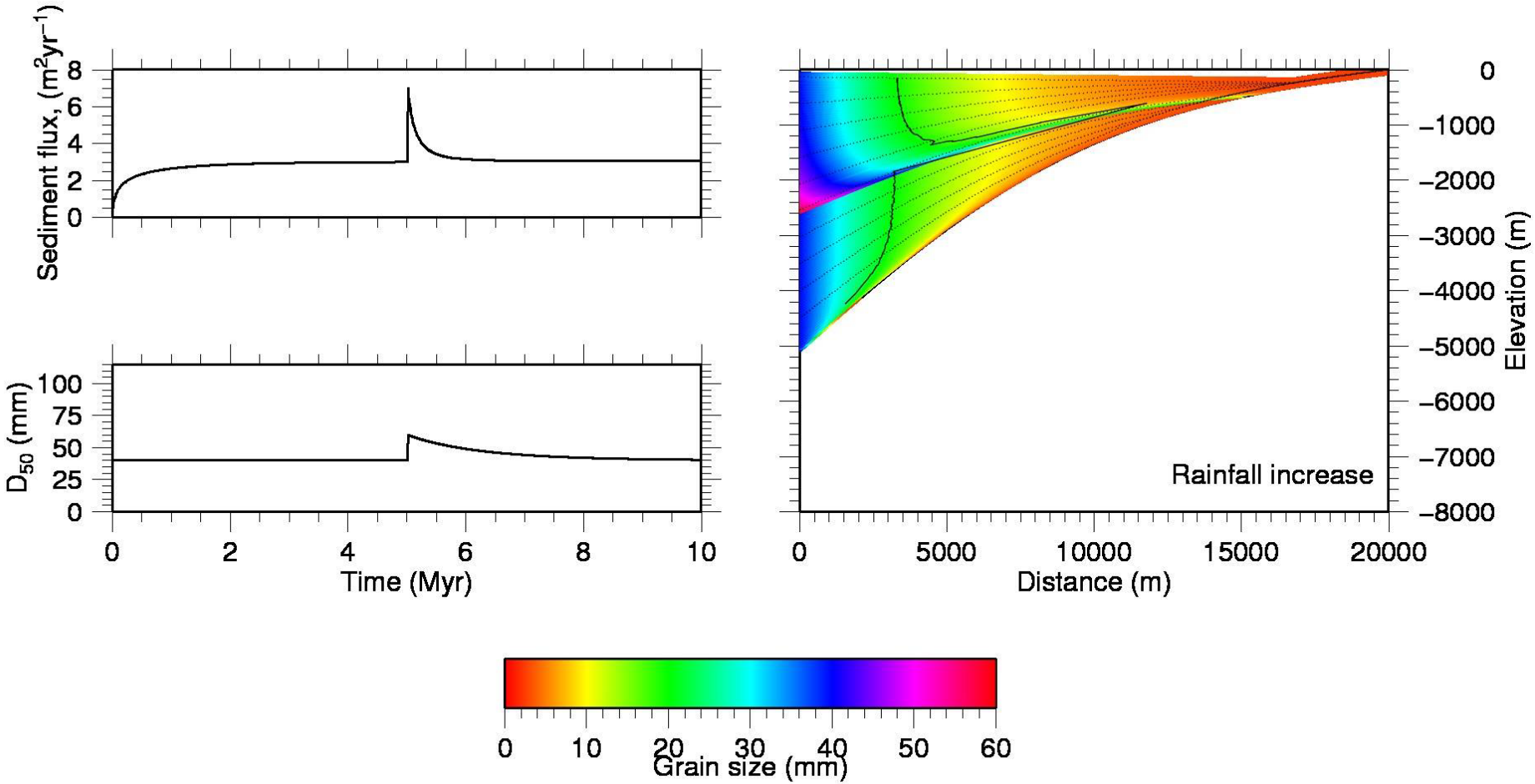
Landscape and stratigraphy is a unique archive of past earth surface response to environmental change




Climate
Sediment Release
Key need to integrate these system parts together
Sediment Release
Sediment Release
Sediment Release
Sediment Transport
PDF of grain size D
Sediment composition
Distance from source x
Gravel front
System length L
PDF of sediment volume
Qs
Uplifting source area
U(x)
Tectonic subsidence
σ(x)
Sediment Deposition
Tectonics

Example: stratigraphy and climate change

We are now developing some of the tools necessary to achieve this aim



Armitage et al., 2011, Nature Geoscience

Quantitative reconstruction of landscape dynamics across time scales:

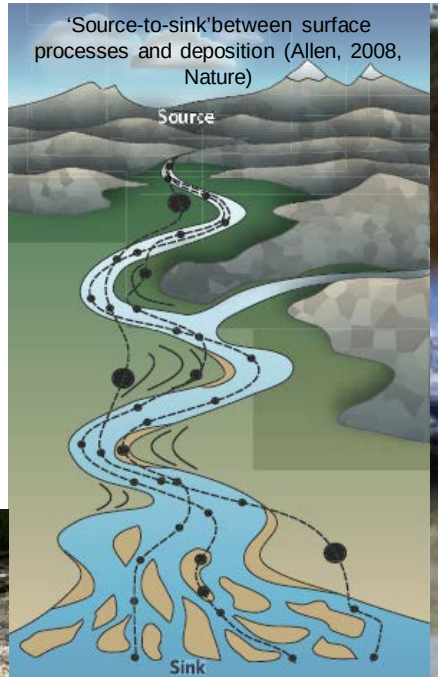
"This major research initiative is focused on developing quantitative reconstructions of Earth surface evolution from instants to eons based on information fromlandscapes and the sedimentary record"

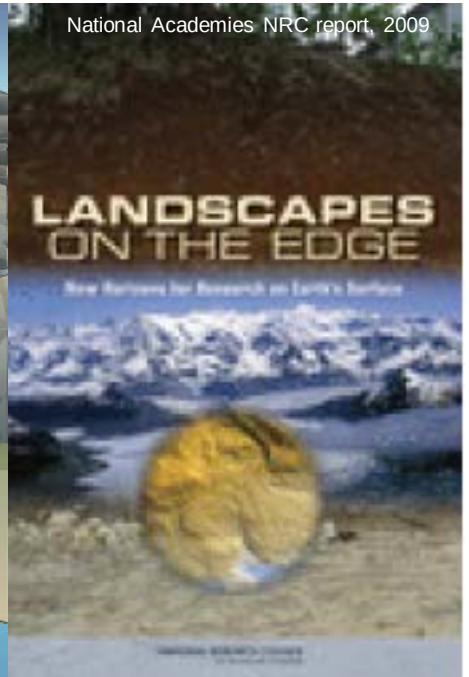
Research Relevance

- Landscape dynamics over long timescales must be understood in order to:
  - Model and predict landscape response to climate and tectonic change
  - Understand hazards associated with infrequent but catastrophic events
  - Identify ancient climate and tectonic signals in the stratigraphic record
  - Improve subsurface prediction for developing hydrocarbon resources

Recent publications and meetings have emphasized the importance of this topic, but the interdisciplinary approaches necessary to progress have yet to be defined

William Smith Conference, GSL, London, 2010





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Key Challenges

- There is currently a gap between geomorphic studies of surface processes and stratigraphic studies of sedimentary dynamics
  - Geomorphic studies are difficult to up-scale to millenia and beyond
  - Stratigraphic studies are limited by a lack of age control and poorly-constrained preservational bias

Early-career geomorphologists and stratigraphers are poised to make significant progress but need to develop a common language and collectively identify key research targets and priorities

Ecoene paleochannel dynamics (river avulsion) preserved in the stratigraphic record (Ebro Basin, Spain; NRC *Landscapes on the Edge*, 2009)

Workshop Organisation

- Four-day meeting in Salt Lake City, Utah
  - Three key topics:
    - Erosional regime,
    - Sediment transfer system,
    - Stratigraphic record

These topics will be linked together by 5 cross-cutting themes:

- How to compare data across timescales or upscale?
- What tools and data are needed to improve process understanding and prediction?
- How is material routed and transferred through the earth surface system?
- What methods are best for geomorphic and stratigraphic prediction?
- How do geomorphic and stratigraphic systems respond to climate and tectonic change?

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Proposed workshop:

- Field trip to promote discussion and integration – Book cliffs

- Three main goals:
  - Facilitate communication between young researchers from a range of disciplines
  - Identify key challenges and opportunities
  - White paper detailing important next steps

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Potential support and partners

- Financial and logistical support possible from
  - NSF (Sedimentary Geology and Paleobiology, Geomorphology and Land-use Dynamics, GeoPRISMS)
  - National Center for Earth-Surface Dynamics
  - Society for Sedimentary Geology
  - Community Surface Dynamics Modeling System
  - Energy companies (possibilities include ExxonMobil, Shell, Statoil, ConocoPhillips, Chevron)

- Post-meeting community building and knowledge transfer will be arranged in collaboration with an existing agency.