Surface Processes Lab

In the
Department of Physics & Astronomy
at
Appalachian State University
SPL - Mission

“To provide an applied physics and engineering research facility for faculty and students to investigate fundamental governing phenomena of terrestrial surface processes.”

This enables:

- Science-based insights that contribute to the academic understanding of related phenomena.
- Engineering-based solutions to emerging issues related to environmental sustainability.
Who are we?
The Surface Processes Group (SPG)-Summer 2007

- Dr. Chris Thaxton
- Graduate students
  - Adam Jones (graduated)
  - Jason Davis
  - James Kelly
- Undergraduates
  - Carla Penders
  - Kevin Lindley
  - Robert Duke
  - Naomi Eckerd
SPL - Resources

• Computational geophysics

PHYSICS:
Classical mechanics
Fluid mechanics
Powders & grains
Statistical mechanics
Thermodynamics
Multiphase flows
Boundary layer theory
Fields and waves
Material properties
Reaction-diffusion
Optics
...

APPLICATIONS:
Granular flow in viscous media
Sediment transport in steady and oscillatory flows
Contaminant transport and diffusion
Stream discharge and thermal evolution
Pattern formation and evolution
Forest fire migration
Regional climate modeling
Surface morphology
...

METHODS:
Discrete Particle Model (DPM)
Monte Carlo path-sampling methods for field evolution
Finite element & finite differencing for PDE solutions
Cellular automata for systems simulation
Data and image processing
Regression techniques for data analysis
...
SPL - Resources

• Experimental facilities
  – Control systems
  – Communications / telemetry
  – Remote sensing and imaging
  – Laboratory automation
  – (Wave tank, Oscillating Water Tunnel, ...)

• Field work
  – Stream monitoring
  – Surveys and urban infrastructure
  – Weather stations
  – Networked databases
SPL - Examples

- Watershed-scale morphology model
- Stream monitoring & telemetry
- Contaminant and forest fire migration
- Hydrodynamic data collection, imaging, and modeling
- Ocean wave modeling for remote systems
- Environmental engineering design, testing, and modeling
- Flow theory & model development
- Automated grain sizing
- Grain-fluid interaction

Granular rheology measurements

Watershed-scale morphology model

Appalachian State University – Surface Processes Lab
SPL – Collaborations / Funding / Partnerships / Memberships

Naval Research Laboratory  
NASA Space Grant  
NC Extension Service  
NCSU – BAE & Soil Sciences  
Kraut Creek Committee  
Mountain Keepers Association  
National Committee for the New River  
Trout Unlimited  
US Geological Survey  
Blue Ridge RD&C  
IEEE  
American Geophysical Union  
American Physical Society  
ASU – University Research Council

Geological Society of America  
Water Resources Research Institute  
Environmental Protection Agency  
NCDENR  
NC Sea Grant  
Clean Water Management Trust Fund  
FEMA  
Virginia Polytechnic Institute & State University  
ASU – Water Resources Planning Committee  
US Army - ERDC

Calantoni, J. and C.S. Thaxton. 2007. Simple power law for transport ratio with bimodal distributions of coarse sediments under waves, In review, Submitted to the Journal of Geophysical Research - Oceans (American Geophysical Union); collaboration with the Naval Research Lab, Stennis Space Center, MS

Thaxton, C.S., W.P. Anderson, C.M. Babyak. 2007 - Non-peer reviewed. Baseline monitoring, analysis, and modeling of the Boone Creek watershed, Final Report for the University Research Council Competitive Grants program, Appalachian State University, Boone, NC


Thaxton, C.S., H. Mitasa, L. Mitas, R. McLaughlin. 2004. Simulations of distributed watershed evolution, deposition, and terrain evolution using a path sampling Monte Carlo method, paper number 042101, 2004 ASAE Annual Meeting, Ottawa, ON, Canada