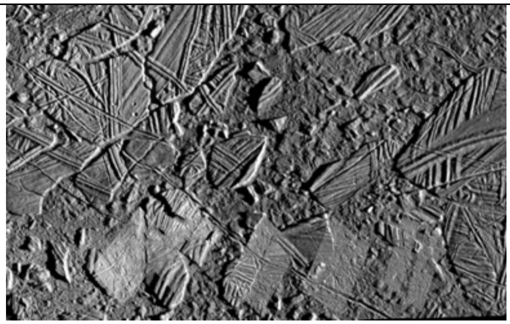
Spring 2007 GEOL 301 Geomorphology

Instructor: Dr. Cathy L. Connor

Denali 6195 m (Mt. McKinley 20,320') Granites emplaced 50 million years ago- Uplift mostly during the last 5 million years worldatlas.com	50,000 year old Meteor Barringer Crater, Arizona Micro-diamonds and Hi-Pressure iron minerals in the crater Geophysical Institute UAF	**OUter Icy? crust of Jupiter's Moon Europa unknown age Life in the watery mantle beneath? Geophysical Institute UAF**	**"Alluvial" Fractal patterns generated on SEAK uplifting landscapes Elise Tomlinson Artist and UAS Library Faculty with permission**

Class meetings: MWF 1:10-2:10, Lab Thursdays 8:20-11:20 HB 105
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Office Hours: MW 2:30-4:00 pm, Fr noon to 3 pm,

Required Text

1. Active Tectonics: earthquake, Uplift and Landscape Edward Keller and Nicholas Pinter. Prentice Hall, NJ ISBN 0-02-363261-5 PBK.

Other materials

2. You will use imagery from the Atlas of Stereoscopic Aerial Photographs and Remote Sensing Imagery of North America W. Kenneth Hamblin 3rd edition that I will supply for you in our weekly labs.
3. Geomorphology From Space: A Global Overview of Regional Landforms Edited by M. Short Sr. and Robert W. Blair Jr. NASA, JPL, DDL 1996 A CD_ROM your instructor will provide for you.
4. Various peer-reviewed journal papers, aerial photos, and satellite imagery supplied by your instructor

Why Take a Course in Geomorphology?

Human travelers from Tatshenshini Man, the 500 year old Alaska Native recovered from the Tatshenshini Glacier to Juneauites turning onto the UAS campus after passing Auke Lake, have utilized landforms as guides to get over passes to the next watershed, follow river valleys to commercial trading centers, cross deserts by using dune orientation or tundra snow sasstrugi to locate oases or hunting sites. Mariners have found their coastal port cities by recognizing prominant headlands and bays from the sea. Ancient Hawaiians have left their footprints in lava flows as they crossed newly cooling landscapes while fleeing adversaries. The "Hunt for Osama bin Laden" has at times utilized the knowledge of cave geomorphologists to identify his possible hideouts in Afganistan. Military campaigns have relied on landscape knowledge to surprise and overwhelm the enemy. The Jet Propulsion Lab rovers still ! operating on Mars, (Spirit and Opportunity), are remotely controlled from Pasadena, California by planetary geomorphologists, geologist, rocket scientists and engineers.

Seventy five percent of our Earth is covered with liquid water. Solar energy drives the active hydrosphere on our "planet ocean" that allows for continuous resurfacing and landscape development in response to climate change through time. The Earth's geothermal energy forces vertical and horizontal crustal changes renewing eroded landforms through tectonic uplift and creating depositional areas through subsidence. The timescales or process rates controlling landscape formation are inversely proportional to the size of the landform in question. Mountains are deformed over timescales of 1 to 30 million years. Glaciers and icesheets wax and wane over time periods of tens, to hundreds, to thousands, to tens of thousands of years. Fault scarps are created by earthquakes, submarine landslides, terrestrial avalanches and mudflows. They can generate deadly tsunamis and are created in seconds to minutes.

The Earth's geoid or equipotential gravity surface is equal to mean sea level and defines the ultimate base level for our planet's geomorphic processes. In this class we will also explore how landscapes have developed on other planetary bodies such as our moon, Mars, Venus, and Europa where internal planetary energy may be neglible and no liquid water exists on the surface.

Humans are now a geomorphic force on this planet. We are directly causing an increase in the rate and extent of landscape resurfacing by our activities of land disturbance through agriculture, mining, road building, paving of urban areas, and logging. Our fossil fuel burning is changing the climate, diminishing surface ice and generating landscape and ecological responses as Earth's albedo changes in polar regions, plant communities change their geographic distribution, increased weathering and stream erosion redistributes topsoils, and sea level rises to drown low-lying coastal areas. The discipline of geomorphology will provide you with the tools to quantitatively understand these processes and the changes they create in order to live wisely with the realities of gravity on a dynamic planetary surface.

Coursework

Students of geomorphology will read all of the assignments, attend all classes, and contribute your critical thinking and analysis to weekly class discussions of assigned classical and recent research papers. Recognition of the linkages between landforms, the climate, and tectonic processes all over the planet with Alaskan examples will be part of our weekly adventure together. Thursday labs will alternate between interpretation of aerial photographs and maps to train your eyes to recognize landscape features, and fieldtrips to gather data about local landscapes and processes that we can use to "groundtruth" our virtual sources. We will utilize GIS software and satellite imagery as well as the knowledge of local experts who will pop in now and again to tell us about their work. Your analytical skills will be honed as you are challenged to quantify landscape change over long and short timescales. Each student will take on a modest Alaskan landscape problem for their "geomorph project" for the second part of the semester. A take-home midterm and final exam will assess your progress in geomorphic understanding.

Course Grading/Component Activities

Course Component	Points/each	Total points	% total grade
Weekly Labs	10 @ 50	500	55%
Class Seminar Lead	2 @ 50	100	11%
Mid-term	100	100	11%
Semester Scale research project and paper	150 (write up, data analysis, summary and conclusions)	150	17%
Class Presentation of Project	50	50	5%
TOTAL Points	Possible	900	100%

Grades will be assigned as follows:
A=100-90%, B=89-80%, C=79-70%, D=69-60%, F=<59%

UAS Competencies Incorporated into this Course

http://www.uas.alaska.edu/provost/assessment/competencies.htm

Upper Division, Baccalaureate in Science degree, caliber skills in the following areas will be taught and assessed in this course.

1. Communication: Students will lead 2 discussion groups and give a class presentation about their individual research projects.

2. Quantitative skills: Quantitative Geomorphology tools will be developed in weekly labs and through student geomorphology projects which will require weekly data collection and analysis.

3. Information Literacy: Students will locate pertinent information in scientific literature using GEOREF and other EGAN Library databases. Students will locate pertinent satellite imagery, aerial photographs, maps, and data on the World Wide Web.

4. Computer Usage: Students will use ARCGIS software, satellite imagery software (ERDAS IMAGINE), geology software (ROCKWARE),
and be able to work with numerical datasets in MS Office programs. We will also be using GEOWALL to view 3-D landscapes

5. Professional Behavior: Students will be expected to be responsible in their class and lab attendance. Each will complete and turn in
assignments punctually and treat their colleagues with respect. Students will demonstrate professional ethics in decision making and honesty in exam-taking.

6. Critical Thinking: A successful geomorphology student will develop skills to synthesize landscape information from class, text, scientific journals, and lab exercise questions. He/she will utilize information synthesis in his/her individual semester project to demonstrate skills in conceptualizing, interpreting, analyzing, and evaluating in the project's design, field work, analysis of data, write-up, and class presentation.

Class Schedule for Semester

Date	**Chapter/Topic**	**Lab**	**Synergistic Journal Papers**
Week 1			TBA
Wed. Jan 18	1-Introduction, Active tectonics Global tectonics EQ and related phenomena GOOGlE Earth Ex	Thurs Jan 19 Lab 1-Intro to Photogrammetry, Stereo Imagery	
Fri Jan 20	1-Active Fault Zones Seismic Risk Predicting Ground Motion		
Week 2 Mon Jan 23	2- Landforms Tectonic geomorphology Pleistocene and Holocene Chronology		

Wed Jan 25	2-Geomorphic Concepts	Thurs Jan 26 Lab 2- Evergreen Cemetary Data Collection, Evaluation	Compare with Dillion and Butte Montana Cemetary Data
Fri Jan 27	2-Pleistocene and Holocene Chronology		
Week 3 Mon Jan 30	3-Geodesy Principles & Techniques		
Wed Feb 1	3-Applications of geodesy to Active tectonics	Thurs Feb 3 Lab 3- Landslides and Avalanches in SEAK	Gastineau Ave/MT. Juneau Examples
Fri Feb 3	3-San Andreas Case Study	Fri Feb 3 Juneau GI-UAF Mend Glacier VC Fireside Chats 6:30 and 8:00 pm	
Week 4 Mon Feb 6	4-Geomorphic Indices of Active tectonics Hypsometry Science for Alaska		
Wed Feb 8	4-Drainage Basin Asymmetry Stream length-gradient index	Thurs Feb 10-Lab 4-Watershed analysis	

Fri Feb 10	4-Valley floor width to height ratios		
Week 5 Mon Feb 13	5-Active Tectonics and Rivers Alluvial Landforms Science for Alaska 7:30 Centennial Hall		
Wed Feb 15	5-Bedrock channeled rivers	Thurs Feb 17-Lab 5-Riverbend Mendenhall Valley-Meander Cutoff in progress, Herbert Lake/River Change 1948-2005	
Fri Feb 17	5-Drainage Networks Models of tectonic Adjustment		
Week 6 Mon Feb 20	6- Tectonics and Coastlines Science for Alaska 7:30 Centennial Hall		
Wed Feb 22	6- Co-seismic deformation Coastal geomorphology and Sea level	Thursday Feb 23-Lab 6 Wave-Cut terrace and Karst Development and Caves of Southeast AK	
Fri	Dating Coastal Landforms		

Feb 24	Coastal tectonics and time scale		
Week 7 Mon Feb 27	7-Folding and earthquakes Fold and thrust belts Science for Alaska Arctic Sea Ice: 7:30 Centennial Hall		
Wed Mar 1	7-Slip folds and Flex Folding and Strike Slip	Thursday Mar 2-Lab 7 Faults, Folds and Alaska Mountain Ranges	
Fri Mar 3	7-Geomorph of Active folds		
Week 8 Mon Mar 6	In class mid-term exam Chapters 1-7		
Wed Mar 8	8-Paleoseismology and EQ prediction Fault Scarps	Thurs Mar 9 Lab 8 –Eurythmic section Lituya Bay-Mann	
Fri Mar 10	Fault Zone segmentation		
Week 9 Mar 13-17	Spring Break No Class or Labs		
Week 10 Mon Mar	9-Mountain Building The shape of your planet		

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Wed Mar 22	9- Driving Mechanisms for Orogeny	Thurs Mar 23 Lab 9 Denali pokes up into the sky Mt Logan, Mt St Elias, Mt Fairweather	
Fri Mar 24	9-Mountain Isostasy vs Chemical Weathering		
Week 11 Mon Mar 27	10 Glacial Processes Ice		
Wed Mar 29	10 Glacial Landforms	Thurs Mar 30 Lab10 Glacier Buzz Saw and the St. Elias Mountains	
Fri Mar 31	10-GB Uplift tectonics or ice unloading?	Glacier Bay/Gulf Coast	
Week 12 Mon Apr 4	11-Quaternary Climatic Changes and the Ice Ages	Climate Change and the Cryosphere in the 21^{st} century	
Wed Apr 6	11-Periglacial Processes and Landforms	Thurs Apr 7 Lab 11 Thermokarst, Tors and permafrost in Arctic Alaska	
Fri Apr 8	11-Permafrost		
Week 13 Mon Apr 10	12-Eolian Systems		

Wed Apr 12	12- Eolian Processes and Landforms	Thurs Apr 13- Nebraska, Sahara, Mars, Carcross, Kobuk	
Fri Apr 14	12- Beringian Dunes		
Week 14 Mon Apr 17	13-Planetary Geomorph Martian Landforms		
Wed Apr 19	13-Landforms of Venus	Thurs Apr 20-Martian GIS,,,Other world landscapes	
Fri Apr 20	13- Moons of outer planets		
Week 15 Mon Apr 24	14-Wrap up Distribution of Lecture Final Take-Home exam		
Wed Apr 26	14- Student Presentations	Thurs Apr 27-Work on final	
Fri Apr 28	14- Student Presentations		
Week 16 May 1-5	Final Exam Week No Class or lab Complete Take-Home Exams	Turn in research Papers and Lecture Final Exam	