EARTH SURFACE DYNAMICS

A proposal for a new AGU Focus Group

The Earth Surface Dynamics Working Group
Fall 2007

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Proposed Descriptor:

Earth and Planetary Surface Dynamics (EPSD) embraces geological and biotic processes and the internal dynamics that generate and erode landscapes, that generate basin stratigraphy, and that quantify the coupling of the surface to the atmosphere and to the crust.

Introduction

One of the largest and fastest growing communities within the American Geophysical Union is that which studies the Earth's surface[1]. This community does not presently have representation within the organizational structure of the AGU. This short document is a proposal to form a new focus group with a working title of Earth Surface Dynamics (ESD). We lay out below a rationale for the need for such a focus group, and we demonstrate importantly that it fills an intellectual void in the present scientific organization of the Union.

Scope of the subject: filling voids, connecting communities

The scope of ESD embraces processes that generate and degrade landscapes, the making of geological history via the dynamics of surface processes, and the various techniques and tools that go along with this. (The latter notably include very low-temperature geochronology and cosmogenic radionuclides, very high-resolution digital topography, and an increasing number of stable isotope systems.) The scope of ESD is very broad, and yet the community is unified by the object that it studies. The community is inextricably integrated, and indeed the revolution that has and is taking place in Earth surface studies is directly attributable to the true integration of many facets of Earth science. The scope of ESD fills a significant void within the current organizational structure of AGU. No single section or focus group represents this community or its intellectual scope: its members currently divide themselves among several sections and focus groups including hydrology, cryosphere, nonlinear geophysics, tectonophysics, geobiology, etc. And yet none of these units properly reflect the diverse nature of the subject. With the formation of a new focus group in Earth Surface Dynamics, we do not anticipate a wholescale withdrawal of members from the related sections and focus groups, but instead an overlapping membership, which will ultimately make the integration among groups stronger and scientifically healthier.

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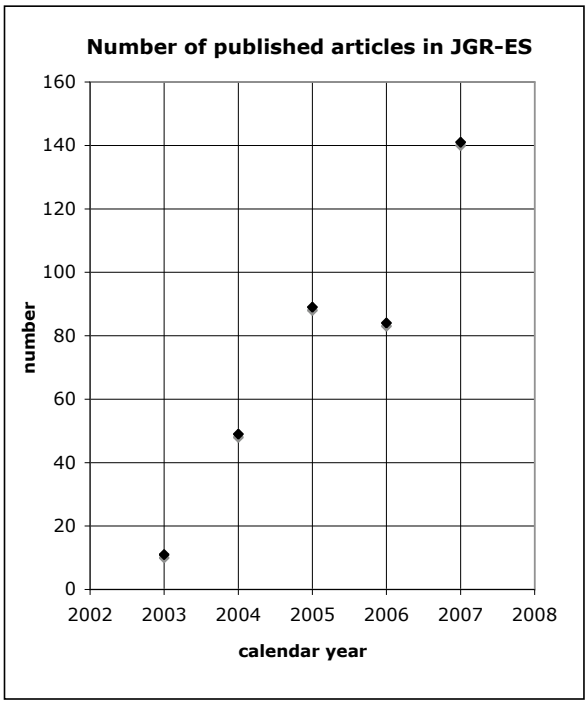
[1] We include here studies of other planet's surfaces, particularly Mars.

There are several metrics that in sum provide a rationale for the new focus group.

Publications in the discipline.

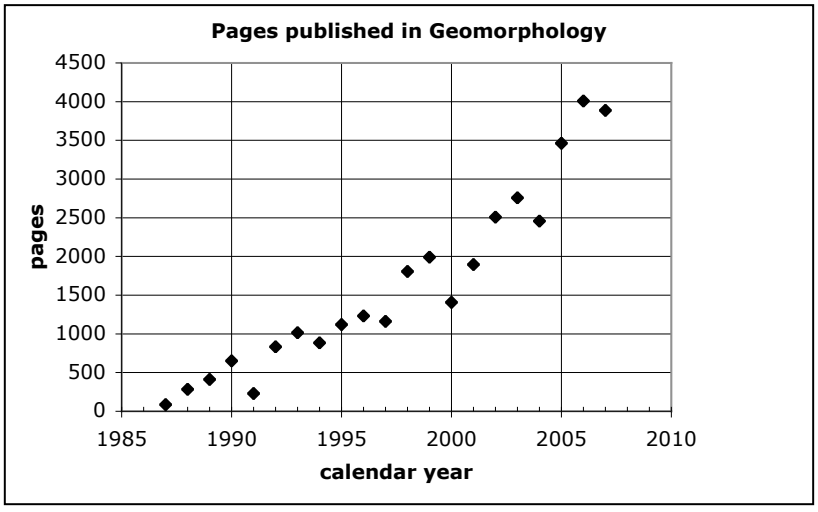
The AGU has recognized that the discipline has emerged as coherent and integrated subject by providing the community with the *J. Geophysical Research: Earth Surface*. *JGR-ES* started in October 2003 with 11 published articles journal pages and a handful of associate editors (Fig 1). In 2007 the number of articles so far published is 141 and the Editor (now Mike Church) needs 18 associate editors.



A notable rise in pages-published is also seen in Elsevier's *Geomorphology* in the late 90s (Fig. 2), but there is no apparent impact of the inception of JGR-ES. The latter is consistent with a rapidly growing discipline to the extent that there continues to be a high demand for publications in the discipline.

Figure 1: Number of articles published in the JGR Earth Surface section, 2003 - 2007. Note that the figure for 2007 does not include December figures.

Figure 2: Published pages in Elsevier's *Geomorphology*. Note the increase in the late 1990s, and that the inception of JGR-ES in 2003 did not have any impact on the number of pages published by this journal. (Data courtesy of R. Marston, Editor of Geomorphology.)



Funding of the discipline

The National Science Foundation Earth Sciences Division (EAR) was reorganized in 2004 to include a Surface Earth Processes section, and two new programs were developed to serve the significantly increasing demand for surface studies: *Low-temperature Geochemistry and Geobiology,* and *Geomorphology and Land-Use Dynamics.* A new interdisciplinary core-science program was initiated by the NSF in late 2007, *Coupled Natural and Human Systems* (CNH). The scope of CNH significantly overlaps with issues being tackled by the Earth Surface Dynamics community, as does the established program *Geography and Regional Science* (within the Social and Behavioral Dynamics division of the NSF), which in part funds surface process studies at the human time-scale.

EAR initiated three relatively large surface-process projects within the past decade and particularly recently. The first of these is the National Center for Earth-surface Dynamics (NCED), a Science and Technology Center that integrates sedimentologists, stratigraphers, hydraulic engineers, geomorphologists, ecologists, and non-linear geophysicsts - all geared toward quantifying the evolution of landscapes from headwaters to deltas (-$20m). In 2007, the NSF funded the Community Surface Dynamics Modeling System (CSDMS) ($4.25m), and this year, three Critical Zone Observatories (-$12m). The CSDMS is bringing together codes and algorithms that drive landscape evolution models, in order to generate a standard and modularized version of a source-to-sink model.

Demand for faculty and researchers in the discipline.

A less well developed metric that demonstrates the increasing relevance of ESD within Earth Sciences are the number of faculty positions that have been available over the past decade. The number of faculty positions in the discipline has risen sharply, as departments have realized the importance of the subject. However, these data have been assembled only in part, because it is a difficult metric to properly develop. (It would require, for example, knowing the number of ESD-type positions relative to other categories of positions, which is not a small task.)

Presentations and special sessions at the AGU.

The number of presentations and special sessions at AGU meetings that self-identify as under the rubric of Earth surface dynamics has grown significantly over the last couple of decades. We do not yet have hard data to support this, as the current status of the search engine at the AGU is unable to extract the data, but this can be done if deemed necessary.

Parallel developments in Europe

There is a thriving Earth surface group in Europe (http://rock.esc.cam.ac.uk/eusurfaceprocesses), and the European Geophysical Union have included *geomorphology* as an organizational unit within the Union.

Nature publications started a new journal, *Nature Geosciences* in January, 2008, and the inaugural cover of the journal came from a earth surface-process article in that issue.

The role of topography has also been linked to the presence of life, an inquiry that led to the role of life itself to the wholescale evolution of our planet and to the development of plate tectonics.

Above (left): the inaugural issue of *Nature Geoscience* featuring an earth surface-process article as the front cover, and (right) the cover of *Nature* Jan 26, 2005, coupling topography to life.

In short: the study of Earth surface-processes links a number of otherwise disparate fields, ranging from mantle convection and mountain building to the evolution of life and climate change. The techniques and data are pressing the limits of technology, from ultra-high resolution digital elevation models to the analysis of cosmogenic radionuclides and to ultra-low temperature isotope systems. These techniques and data alike are pushing the theoretical treatment of Earth surface-processes into new domains, including the use of non-linear complexity, fractional calculus, control systems, as well as fundamental geological analyses.

The time for a new AGU Focus Group in Earth and Planetary Surface Dynamics is surely now.

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