

“Aseismic Slip, Non-Volcanic Tremor, and Earthquakes” Workshop Program
February 25-28, 2008 at the
Dunsmuir Lodge, Sidney, British Columbia

Objective: To improve coordination among those involved in conducting research related to aseismic slip, non-volcanic tremor, and earthquakes (episodic and otherwise) and communicating results to the public. Research activities involve documenting (*e.g.* making relevant measurements, disseminating and analyzing them) the related phenomena of non-volcanic tremor, aseismic slip, and earthquakes, interpreting them in terms of the underlying causative physical processes, and conveying results to other researchers and the public. Consideration also will be given to the implications for earthquake hazard assessment and how to capitalize on the education and outreach opportunities these phenomena present.

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Monday Evening, (5:00 – 9:30 pm)

Poster Setup, Room 260 (5:00-9:30)

Reception hosted by UNAVCO, Peninsula Lounge (6:00-7:00)

Dinner (7:00-8:30 start)

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Tuesday Morning Plenary (9:00-12:00)

3 invited 30-minute talks, a coffee break, 2 15-minute contributed talks, 30 minute discussion

“The phenomenology; the observations of aseismic slip, non-volcanic tremor, related (temporally and spatially) earthquakes.”

Invited Speakers:

Honn Kao, Pacific Geosciences Center, Geological Survey of Canada

David Shelly, University of California, Berkeley

Shinichi Miyazaki, Earthquake Research Institute, Japan

In addition to presenting overviews of what the basic observations are, talks focus on some specific questions and topics, with examples listed below.

What occurs when and where? What are the spatial and temporal relationships between earthquakes (large and small), tremor, and slow slip?

How regular are the intervals of slow slip and tremor, temporally and spatially? How does the regularity (or lack of) vary among regions where it occurs?

Dynamically triggered tremor. Is dynamically triggered tremor the same phenomenon as tremor observed with ETS? Does slow slip accompany it? What is its relationship to triggered earthquakes? How widespread is it?

How ubiquitous are these phenomena? Can we identify common or distinguishing characteristics of regions where they are and aren't observed? Is it missing in places where we might expect it (e.g. above creeping faults, geothermal areas)?

The potpourri of slip events. A wide range of seismic and aseismic signals have now been identified and from them modes of fault slip inferred. How well do we really know the latter? For example, how dependent are inferences on how tremor 'events' are defined? To what extent might measurements bias our inferences (e.g. might GPS data be temporally or spatially aliased) or might source and path effects be confused (e.g. when interpreting spectral shapes)?

Where is tremor being generated? Many models proposed to explain tremor rely on them originating on the plate interface where slow slip is (inferred to be) occurring. Thus it is critical to ask how we might reduce the large uncertainties in tremor source location estimates, particularly their depths, and to insure that the estimates obtained represent the full complement of tremor sources and are not biased. For example, the most widely used class of tremor location algorithms requires waveforms or their envelopes that are coherent at numerous stations. To what extent does this selectively extract the subset of the tremor population that are deepest and on a single plane, and what fraction of the total population is not located when such algorithms are employed?

Tuesday Lunch & Posters (12:15-2:00)

Tuesday Afternoon Working Group Background Presentations (2:00-3:00)

These include invited talks by people who also lead the later respective working group session on the topic. The later working group sessions (2) are concurrent, but these talks are not.

E&O Needs & Opportunities Working Group Convenor Presentation – 30 minutes

Convenor: Robert Lillie, Oregon State University

Where and what are the greatest needs? What works and doesn't work? Opportunities for educating the public and invigorating the science.

Data and Instrumentation Working Group Convenor Presentation – 30 minutes

Convenor: Evelyn Roeloffs, USGS, Vancouver, WA

What exists and what do we need?

Tuesday Afternoon Working Groups (3:30-5:00)

These are concurrent, with participants (except the Convenor) switching after 45 minutes.

E&O Needs & Opportunities Working Groups

Convenor: Robert Lillie, Oregon State University

Working group to generate ideas for E&O within Earthscope, USGS, GSC, State Geological Surveys and other programs.

Data and Instrumentation Working Group

Convenor: Evelyn Roeloffs, USGS, Vancouver, WA

Working group to generate lists of the types of instrumentation we would like to add over the next 10 years.

Tuesday Dinner (6-7:30)

Tuesday Evening Working Group Reports (7:30-8:00)

15 minutes presentation from each working group Convenor (E&O Needs and Opportunities, Data and Instrumentation)

Tuesday Evening Working Group, Posters (8:00 – 9:30)

These two activities are concurrent.

Chapman Conference Working Group

Convenor: Joan Gomberg, USGS, Seattle, WA

Working group to identify Chapman conference Convenors, development of text for soliciting a Program Committee, identification and plans to solicit funding.

Posters

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Wednesday Morning Plenary (9:00-12:00)

This includes: 3 invited 30-minute talks, a coffee break, 2 15-minute contributed talks, concluding with a 30 minute discussion of outstanding issues raised

“The underlying physical processes; observational constraints, theoretical models.”

Invited Speakers:

Roy Hyndman, Pacific Geosciences Center, Geological Survey of Canada

Paul Segall, Stanford University, CA

Simon Peacock, University of British Columbia, Canada

In addition to presenting an overview of the classes of models currently proposed, talks may focus on some specific modeling questions and topics, with examples listed below.

What frictional models may explain slow slip and/or tremor? A variety of frictional models have now been proposed, each requiring specific loading conditions, constitutive properties, degrees and types of heterogeneity, etc. How can these models be verified observationally, what new modeling capabilities might we need (e.g. more compute power), what are their shortcomings?

What can we learn from models and observations that aren't based on seismic or geodetic data? Many models/explanations of tremor and slow slip appeal to the presence of fluids, either in static or changing conditions, but without rigorous consideration of how and where fluids are likely to exist. What do models and observations of fluid generation and flow in subduction zones (e.g. from studies of volcanism), and elsewhere in the crust and uppermost mantle, tell us about the feasibility of fluid-reliant mechanisms of slow slip and tremor generation? Others have proposed that long-lived fore-arc basins provide control on ETS processes. How might the morphology and petrology be important?

Is the mode of slip of any particular fault or fault patch a static feature? That is, based on

observations and predictions of theoretical models, do they slip aseismically sometimes and seismically other times?

Wednesday Lunch (12:15-1:30)

Wednesday Afternoon Plenary (1:30-2:30)

2 invited 30-minute talks

“Implications for earthquake hazards; what do users need/want to know and what do we need to do to deliver this?”

Invited Speakers:

John Vidale, University of Washington, WA

Jim Goltz, Cal Tech, CA

Talks address these questions, among others.

What does slow slip and tremor tell us about the seismic potential of major fault zones? What is the spatial correlation with locked faults/segments; how locked is locked and how do we know?

When is it useful to make public announcements and even predictions of ETS episodes? How should this be done most effectively?

Wednesday Afternoon Working Group Panel (2:30-3:00)

Panel on the User/Public Needs, particularly those concerned with earthquake hazards.

Panelists:

Michael Reichle, California Geological Survey

Vickie McConnell, Oregon Dept. of Geology and Mineral Industries

George Crawford, Washington State Military Dept

Maclaire Bolton, British Columbia Provincial Emergency Program

Representatives from Emergency Management Agencies and State Geological Surveys discuss what information related to slow slip and tremor might motivate them to take action, what those actions might include, how they would like information delivered, etc.

Wednesday PGC Field Trip 3:30-6 pm

Wednesday banquet 6:30-8:00 pm

Posters (8:00-9:00)

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Thursday Morning Working Groups (8:00-9:30)

These sessions are concurrent, with participants (except the Convenor) switching after 45 minutes.

User/Public Needs Working Group

Convenor: Selected Panel member

Working group to generate action item list of approaches to meeting public needs discussed in the panel.

Research Coordination Working Group

Convenor: Ken Creager, University of Washington, WA

Strategies for improving logistical coordination and information exchange among research projects and groups (e.g. website or email calendar of experiments, circulated updated reference list, blogs, etc.), particularly among those in different disciplines.

Thursday Morning Working Group Reports (9:30-10:00)

15 minutes presentation from previous 3 working groups' Convenors (Chapman conference, User/Public Needs, Research Coordination)

Thursday Morning Panel on Future Directions (10:30-12:00)

Workshop summary and 'what next' presented by organizers

Thursday Lunch (12:00-1:00)

Thursday afternoon (1:30-4)

Working group to prepare outline of Workshop Summary (published as a USGS Open-file Report or other publication) and EOS article.