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12 November, 2010

Norwegian Institute for Air Research
Attention: Dr. Cathrine Lund Myhre
Department of Atmospheric and Climate Research
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Partnership in the project THAW: “Trends and Hazards in Arctic Warming: Climate change and greenhouse gas emissions from Arctic permafrost regions”

Dear Dr. Myhre,

On behalf of the U.S. Geological Survey’s Gas Hydrates Project, thank you for the invitation to participate as a partner in the project THAW being proposed in Europe under the coordination of the Norwegian Institute for Air Research. I lead the research on climate and gas hydrates within the USGS Gas Hydrates Project. I (Dr. Carolyn Ruppel), along with Dr. John Pohlman, Mr. Thomas Lorenson, Mr. Patrick Hart, and new postdoctoral researcher Dr. Laura Brothers, are looking forward to collaborating with THAW project members as your group advances research on this important topic. We believe that the combination of our U.S.-based efforts with those in Europe provides the potential for an unprecedented pan-Arctic perspective on climate change issues of importance to the planet.

As you are probably aware, the USGS Gas Hydrates Project has existed for two decades, building on at least a decade of research prior to that. We are one of the leading international groups working on energy, climate, and geohazards associated with methane hydrates and have more than 12 full-time employee equivalents (spread among ~17 individuals) based primarily within the USGS Coastal and Marine Program (mostly in Woods Hole, with 1 full time equivalent in Menlo Park) and the Energy Program. Several of us now devote most of our time to issues related to climate and permafrost-associated gas hydrates, with a particular focus on the Arctic. In addition, the Gas Hydrates Project includes the world’s leading expert on permafrost and gas hydrates (Dr. Timothy Collett, in the Energy Program in Denver), and those of us working on Arctic climate issues benefit constantly from his advice, knowledge, and access to individuals and data bases as we pursue research in the U.S. Arctic and with external partners. Within the Coastal and Marine Program at the USGS, we have a wide range of geological, geophysical, geochemical, oceanographic, and seafloor mapping equipment, an outstanding group of technicians and operational personnel, and a team of processors and GIS specialists available at no additional cost to the Gas Hydrates Project. At minimum, our group brings to THAW a desire to freely exchange our findings about the state of permafrost and gas hydrates on the US Beaufort Inner Shelf and information about our specialized equipment development efforts. In the future, depending on our own budgetary and personnel situation within the USGS, we may be able to provide specific scientific, technical, or operational expertise to THAW if requested by your researchers. Were the occasion to arise, we may also be in a position to include THAW researchers on our own US field projects, although at present we are limited by the very small (4- to 5-berth) vessels required to conduct permafrost-related research in shallow-water areas of the US Beaufort Sea.

Since laying out a 5 year plan for USGS climate-hydrates research in 2008, our accomplishments include:

- Cruise Activity: Completed a 2010 reconnaissance cruise to map top of permafrost in Harrison Bay, US Beaufort Inner Shelf and acquired 185 km of new geophysical data, the first new high-resolution data collected anywhere on the Beaufort Shelf by the US government in 3 decades. The data include Chirp (shallow) and sparker (over 110 m of penetration) seismics, sonobuoy data, seafloor maps, and water column imagery. This cruise is being reported in soundwaves.usgs.gov, to be released ~15 November. Another cruise will occur in Summer 2011.
- New mapping of subsea permafrost and full-time postdoctoral researcher: Re-analyzed legacy seismic data for Harrison Bay to determine the depth to the top of permafrost refractor and the seaward extent of permafrost. A new postdoctoral scholar resident in Woods Hole and sponsored by the prestigious National Research Council/U.S. Department of Energy program is currently analyzing *all* of digital legacy data from the late 1970s to produce the first-ever regional map of permafrost beneath the entire U.S. Beaufort Shelf.
- Closely related USGS proposal activity on subsea permafrost and on GHG emissions: Submitted a NSF Polar Programs proposal for coincident controlled source EM and seismic mapping of permafrost beneath the US Beaufort Inner Shelf with Scripps Institute of Oceanography. If successful, this cruise would occur in 2012. Another pending NSF proposal with partners at MIT includes the development of landers that would be directly relevant for quantifying methane fluxes across the sediment-water interface in the Arctic.
- Coring in areas of subsea permafrost: Opened discussions with external partners about possible coring in Harrison Bay, potentially as soon as spring 2011. The goal of this coring would include geochronologic measurements to reconstruct sea level rise, which is completely unknown in this part of the Arctic; pore water geochemistry and gas measurements; quantification of organic carbon contents; and sedimentologic descriptions.
- Fingerprinting technique to track gas hydrate degradation: Continued development of a noble gas fingerprinting method, needed by the larger community to determine whether gas mixtures collected at the seafloor or on the tundra are in part derived from degrading methane hydrates.
- ONSHORE: Permafrost/gas hydrate degradation in Alaskan coastal areas: Currently completing a pilot project on onshore methane emissions in areas of rapidly degrading permafrost. The recent focus has been Lake Teshekpuk, the largest lake on the Alaskan North Slope and one destined to be swallowed by the sea within ~500 years. This lake is underlain by a large thaw bulb that should perturb the gas hydrate as well, and we have found and are studying methane seeps in this lake in close collaboration with Benjamin Jones, a geographer at USGS Anchorage. Jones is an expert on thawing permafrost in Alaska and a well-published researcher on this topic.
- Database development: With support from the Energy Program (Collett), compiling gas data for all deep test wells in Alaska.
- Instrument development: Taking delivery this month on a fast-response Picarro CRDS, which will be equipped with a methane stripping line for mapping of seawater methane concentrations in real-time. Have taken delivery on a high-end, field-portable GC that can measure H₂ in addition to the main GHG. Have continued to increase the portability, usability, and degree of automation of our geophysical imaging methods for use in small boats in the US Arctic.

Thank you again for the invitation to collaborate as a partner, not a contractor, in THAW. I look forward to further interaction with your THAW collaborators on the critical climate change issues we are all pursuing for the pan-Arctic.

Best Regards,

Carolyn D Ruppel

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Research Geophysicist