We propose that the Kuparuk River and some surrounding nested drainages on the North Slope of Alaska be viewed as a Long Term Hydrologic Observatory (LTHO). The Kuparuk River originates in the northern foothills of the Brooks Range (Rocky Mountains) and flows northward out of the foothills onto the coastal plain before emptying into the Arctic Ocean.

In expanding this research program as a Long Term Hydrological Observatory, we intend to focus upon facets of arctic hydrology that interplay strongly with ecosystem dynamics, climate change, geophysics, near shore estuarine processes, energy dynamics and geomorphology. The climate is currently undergoing significant, broad scale change in the Arctic. The hydrological cycle is an integral component of the climate system, both moderating and driving changes in meteorology, coastal processes, and terrestrial and aquatic ecology (freshwater and marine). Warming of permafrost, a decrease in sea ice extent, thinning of the sea ice, later freeze-up and earlier break-up of lakes, reduction of snow cover extent in northern hemisphere and shorter season of snow on the ground are a few indications of warming in the Arctic and targets of important hydrological research.

The importance of the high latitudes in the global climate must be emphasized. It is apparent that climate driven changes are presently ongoing. This is impacting the hydrologic cycle, not only through the land/atmosphere interactions, but also the physical structure of the basin. The development of thermokarst, deeper active layer and an increase in shrubs (vegetative shift) are changes that will be reflected in the hydrologic response of these catchments. Quantifying the role of hydrology in a changing climate is critically important for U.S. and global science policy.

We should study the hydrology of an arctic region?

1. Most detailed hydrologic studies are carried out in tropical and temperate regions of the world where there is a net positive flux of radiative energy into earth’s system. But arctic regions of the world, with a net negative radiation flux, are equally as important in earth’s climate machine. Generally energy is transferred towards the poles by water fluxes in our oceans and the atmosphere. The hydrologic cycle in the Arctic plays a central role in moderating the climate dynamics of the more temperate regions.

2. Arctic regions of the world are predicted to have the greatest climate change with increased concentrations of greenhouse gases in our atmosphere. In fact, there is already evidence of climatic warming in many areas through the warming of permafrost, reduced spatial coverage of snow, reduced sea ice distribution and thickness and later freeze-up and earlier break-up of water bodies. Is this induced anthropogenic change or does it represent natural variability?

3. Like everywhere in the world, water is a valuable resource. To manage this resource properly, it is important that we have a sound understanding of the underlying hydrologic processes.

4. Although the watersheds discussed are quite pristine, future resource development and atmospheric transport of contaminants (locally and from Eurasia) into this region of the Arctic is a likely scenario.

5. We are starting to build a strong foundation in our individual disciplines in the Arctic but we have done little to understand the scientific bridges between linked systems (hydrology/atmospheric science; hydrologic and biogeochemical cycles; hydrologic and ecosystem interactions).

6. Due to the limited hydrologic data collection in the Arctic (sparse network, short record, poorly distributed stations), extreme events are poorly documented. There is past evidence of low probability hydrologic events. What does this mean? Will climatic warming increase the occurrence of such events (warmer atmosphere capable of transferring more moisture)?
Relevant publications

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