



One Year of operating a wireless watershed in Lemon Creek, Juneau, Alaska

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Outline

- SEAMONSTER
- Lemon Creek Watershed
- Year 1 Observations

SEAMONSTER



SouthEast Alaska MOnitoring Network for Science Technology Education and Research

We seek inspiration from the Tlingit legend of Gunakadeit, a seamonster who brought fish and furs to an impoverished village. The modern parallel is harvesting and distributing geospatial information via a sensor web to a world struggling with climate change.



Tlingit carving
of Gunakadeit



A modern
seamonster
tentacle

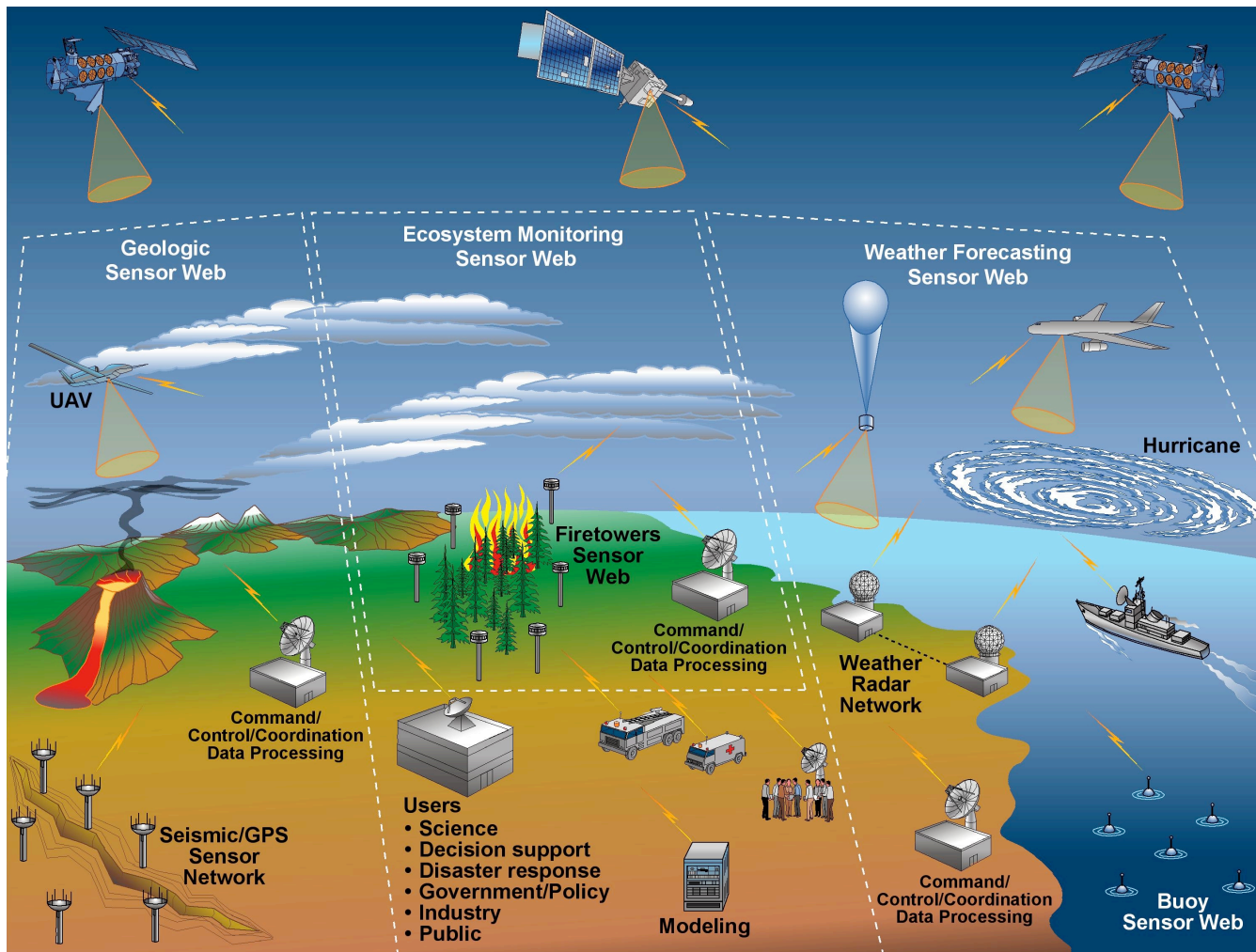


SEAMONSTER

- Scientifically Motivated Sensor Web Technology Development
- Infrastructure to Improve Water Resource Management in Southeast Alaska
- Insight Regarding Lemon Creek Watershed and Glacial Outburst Floods



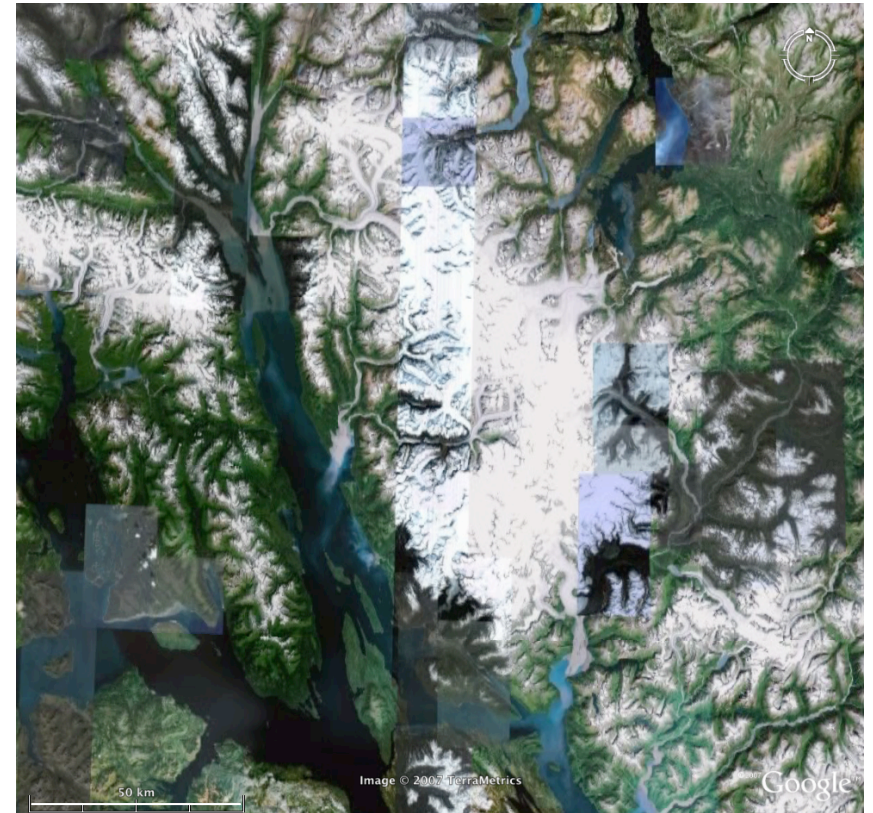
Sensor Web Concept





Scientific Motivation, 1

Long term monitoring
of the Juneau Icefield
to observe watershed
and ocean ecological
impacts of glacial
recession



50 km



Scientific Motivation, 2

Detection of transient glacial lake outburst floods and observation for watershed impacts



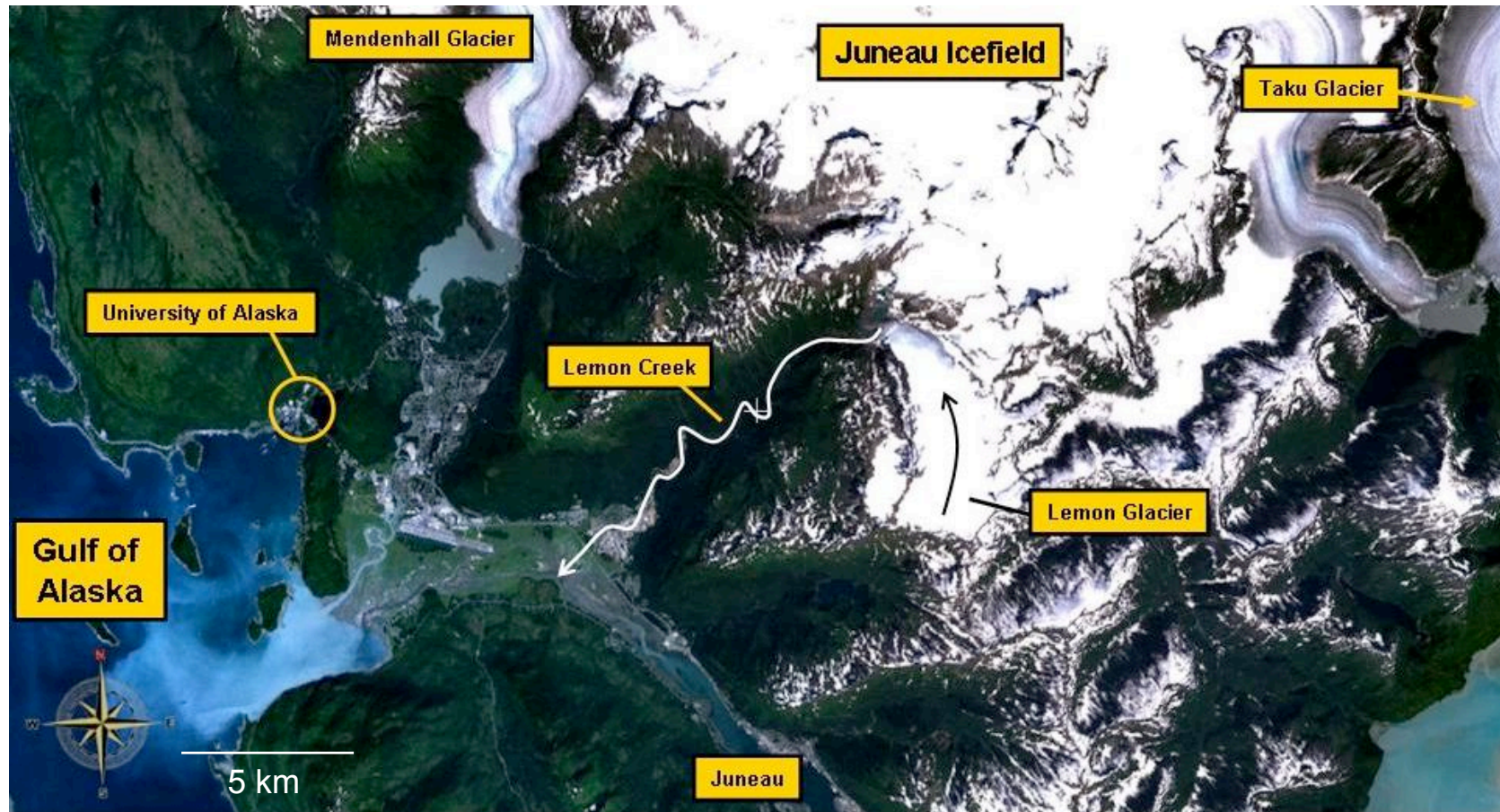
Lake pre-drainage



Lake post-drainage



Lemon Creek Watershed



The University of Alaska Southeast has (relatively) easy access to these areas. The initial watershed of interest is the Lemon Creek watershed (fed by Lemon Glacier) which can be entirely accessed via hiking. Lemon Glacier was monitored as part of IGY (1957-58) and is again being studied during IPY (2007-8).



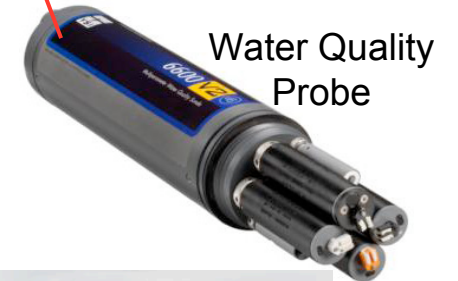
Instrumentation



Pressure Transducer



Met Station



Water Quality
Probe



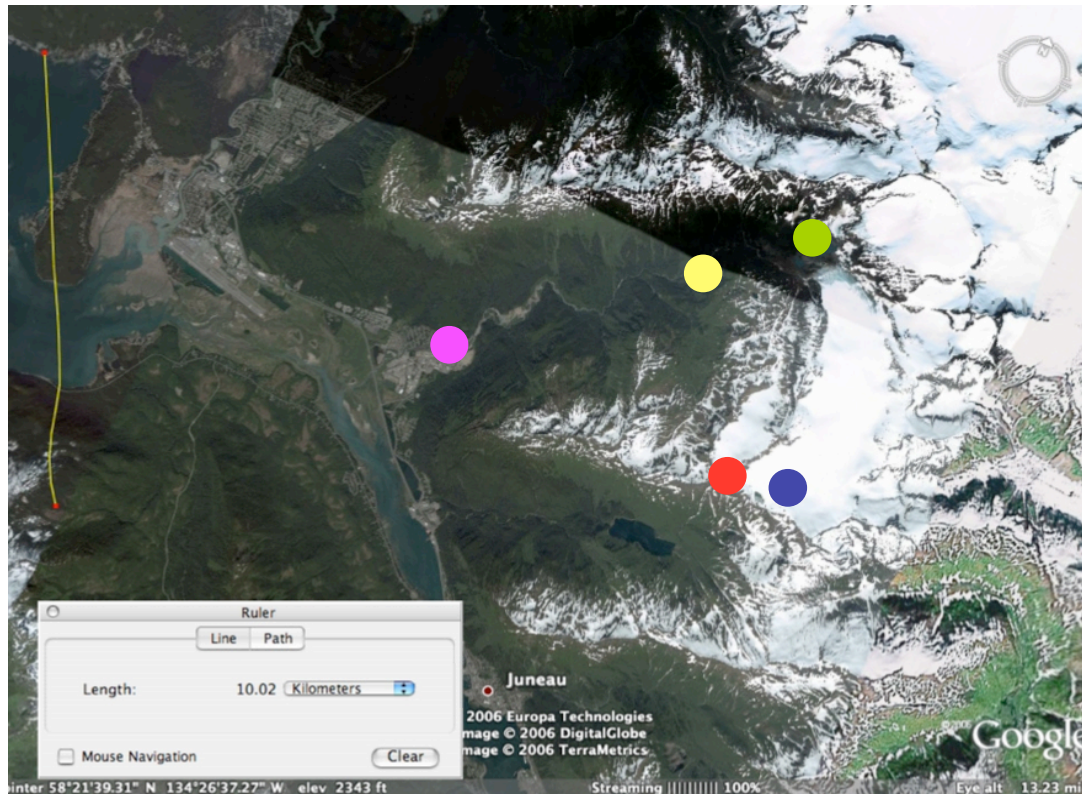
GPS and Seismic



User controllable camera



Lemon Creek Sensor Web



- Met Station, Web Cam, Comm Hub
- Lake Level, GPS, Geophone
- Met Station, Web Cam
- Water Qual, USGS Gauge
- Water Qual

Communication between the nodes enables the Sensor Web.
Ex: pressure transducer (●) detects lake drainage and passes the message **reconfiguring** other sensor behavior.



Why A Sensor Web?

- Resource management
 - Power constrained (batteries and solar)
 - Also: storage, bandwidth, processing
- Conflicting sample requirements
 - Long term monitoring
 - Transient, rapidly evolving events

➤ **NEED SEMI-AUTONOMY**



Lemon Glacier Geometry

Total surface elevation change head-to-terminus: 400 meters

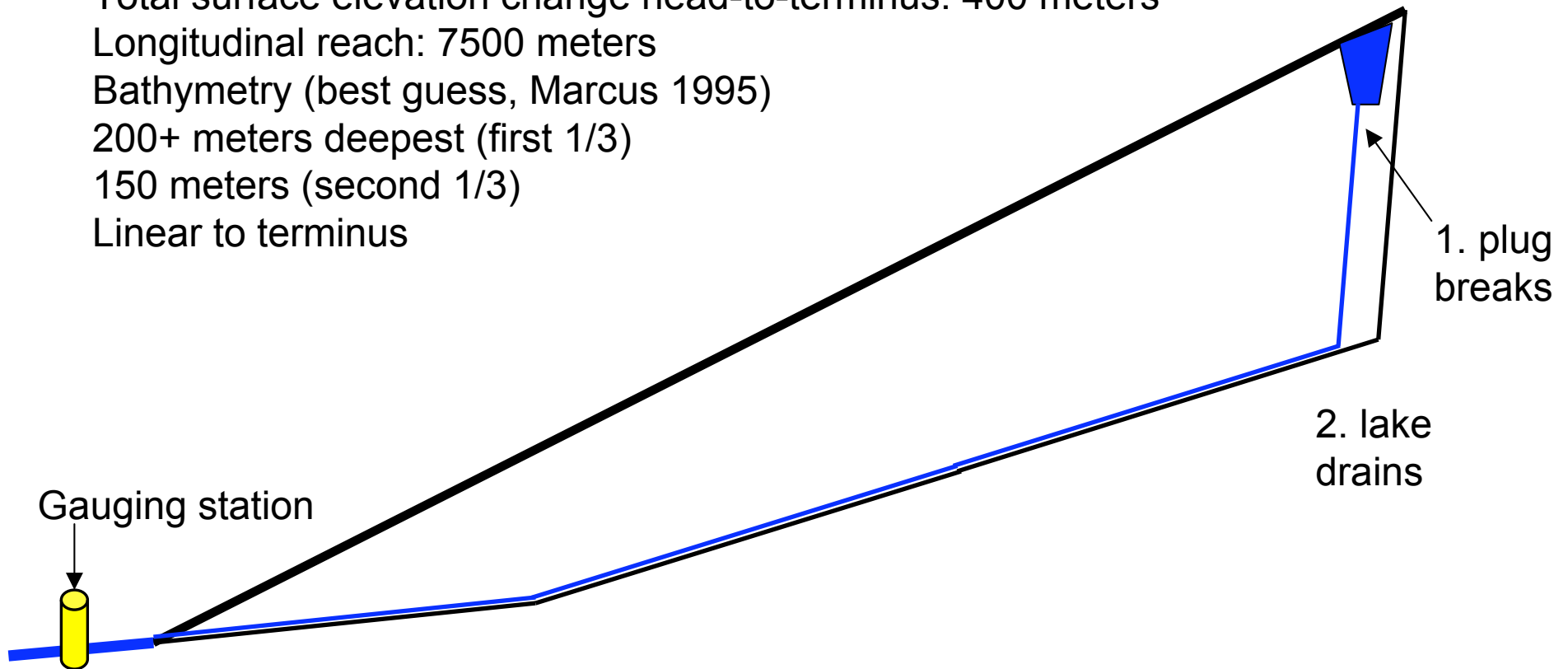
Longitudinal reach: 7500 meters

Bathymetry (best guess, Marcus 1995)

200+ meters deepest (first 1/3)

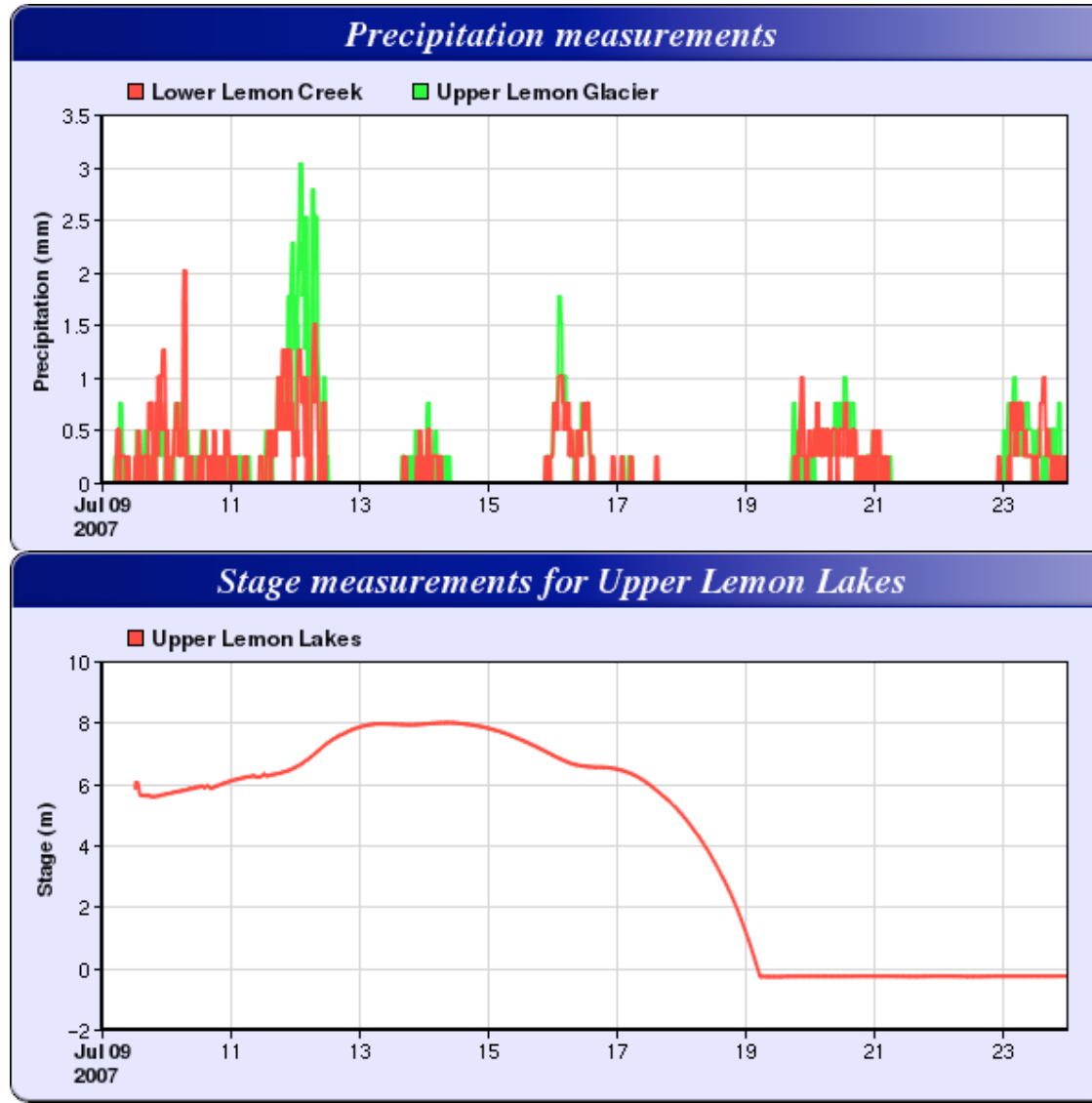
150 meters (second 1/3)

Linear to terminus



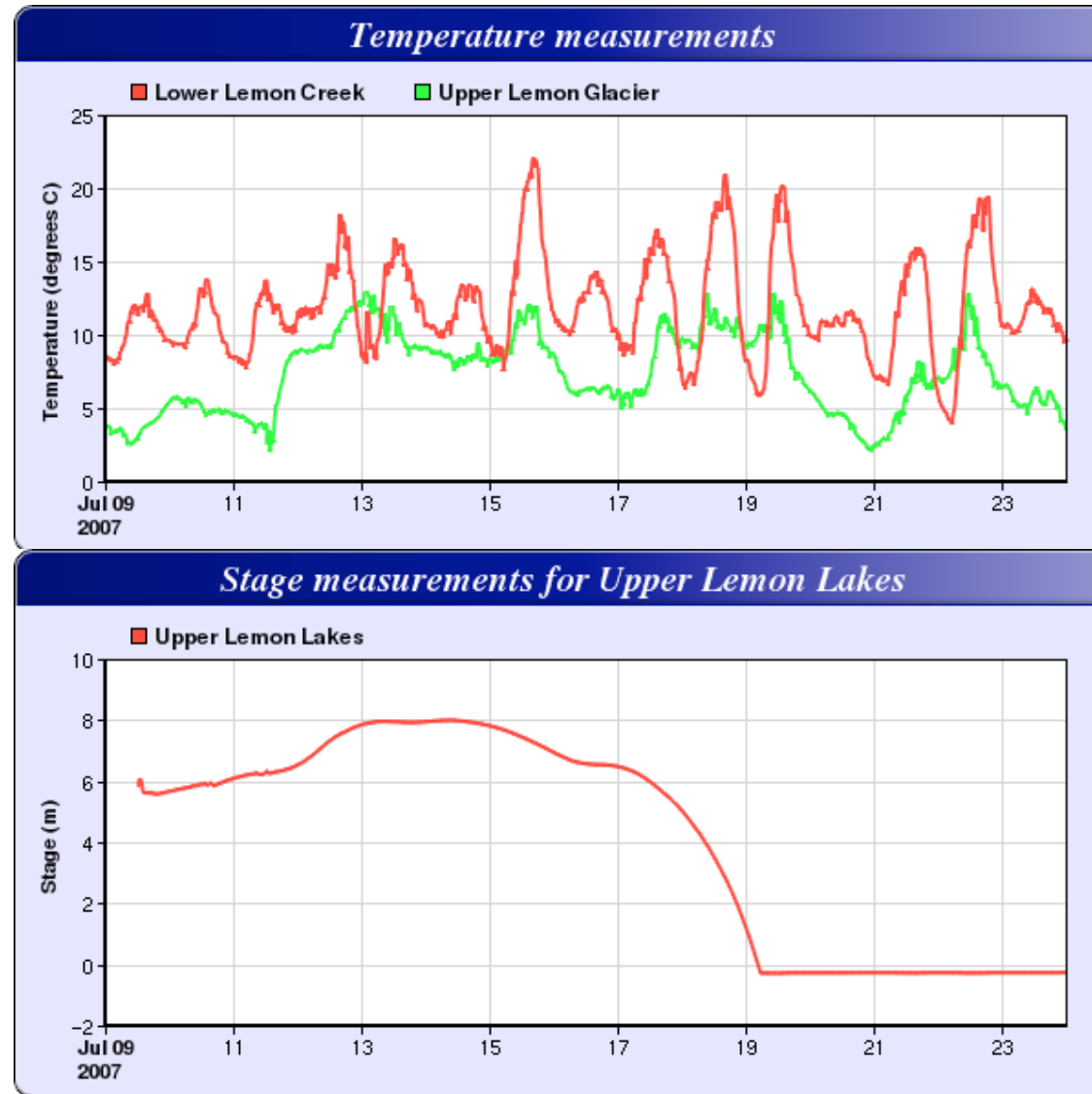


2007 Results: Precip, Lake

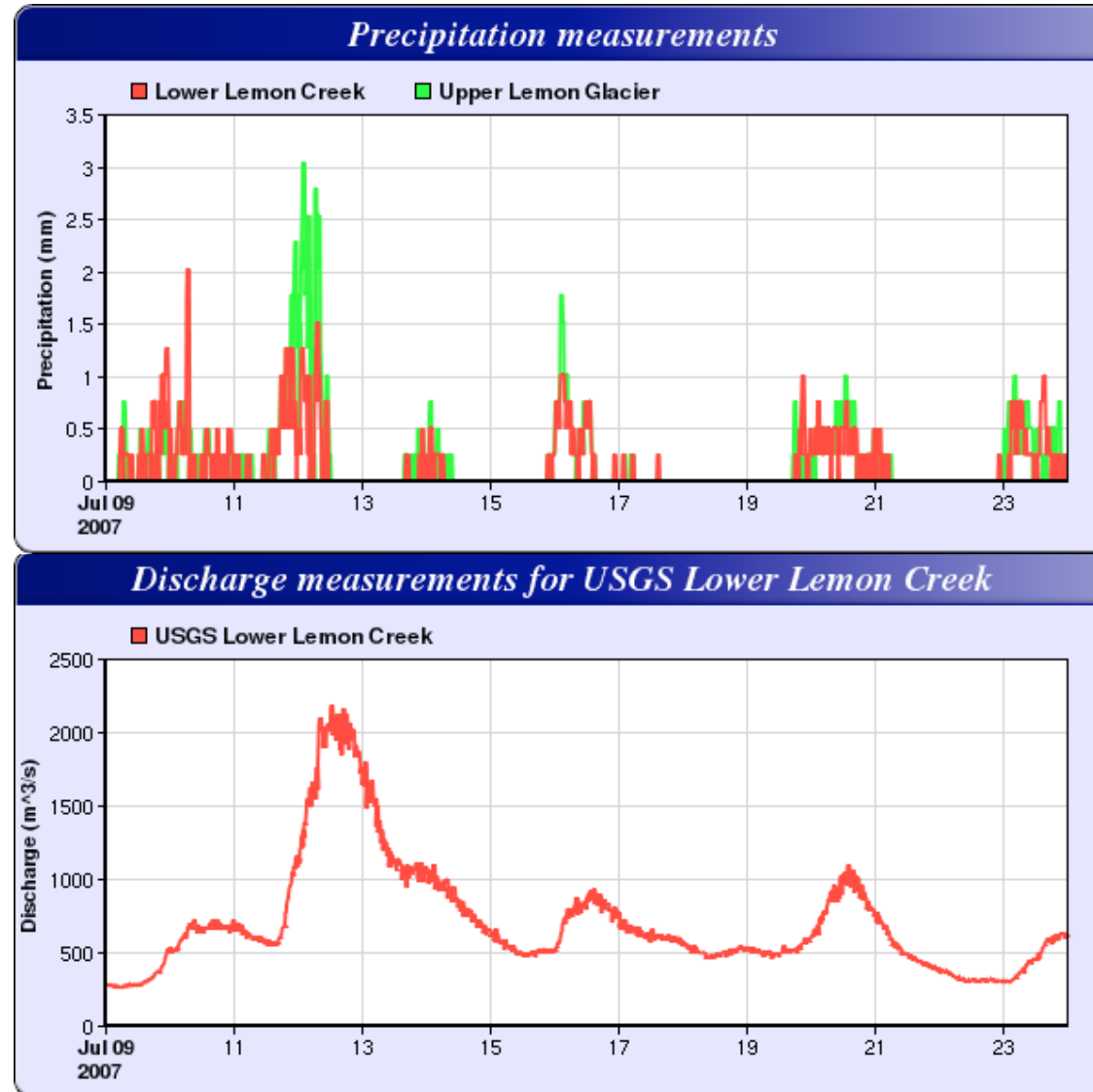




2007 Results: Temp, Lake

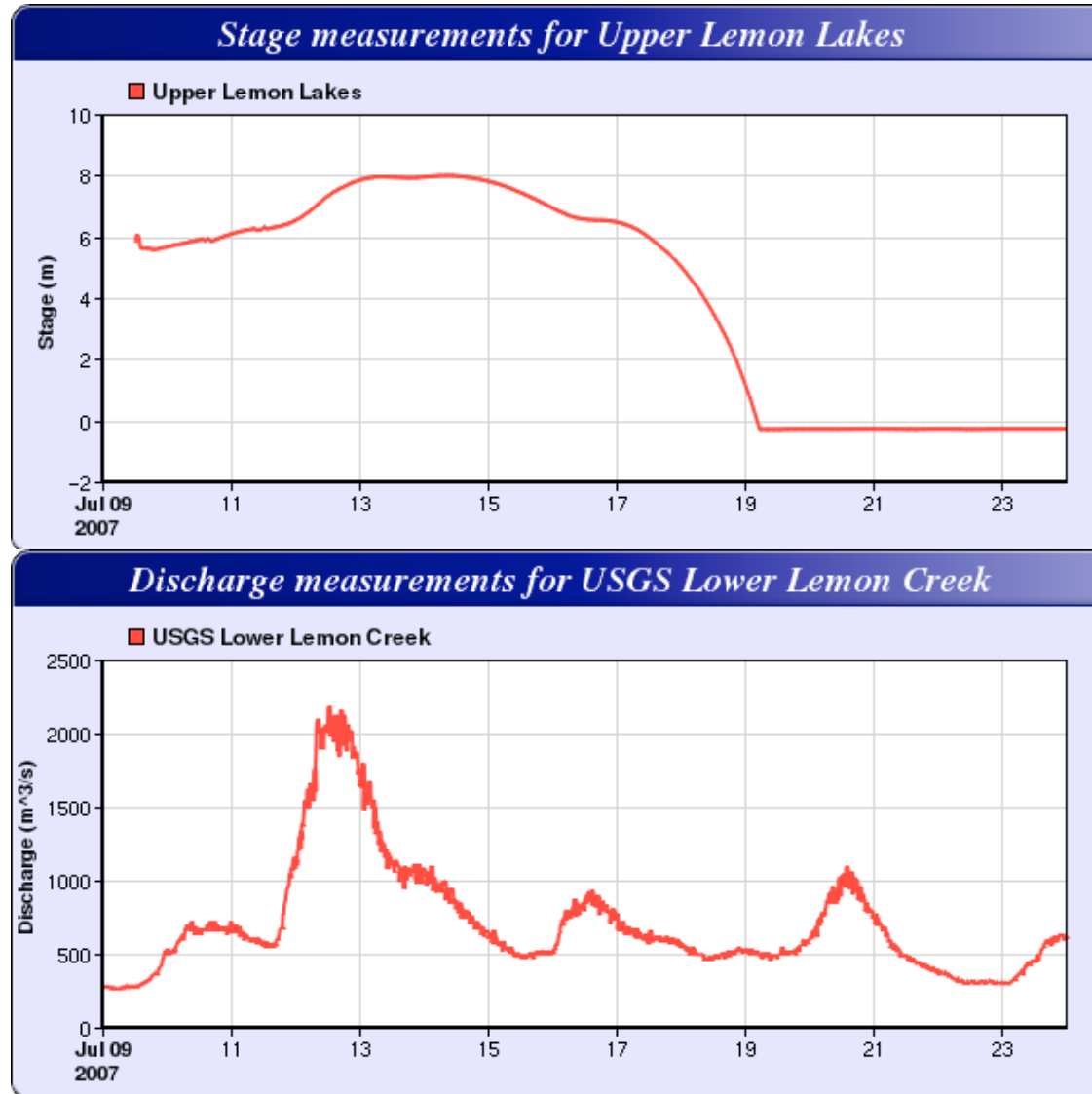


2007 Results: Precip, Creek



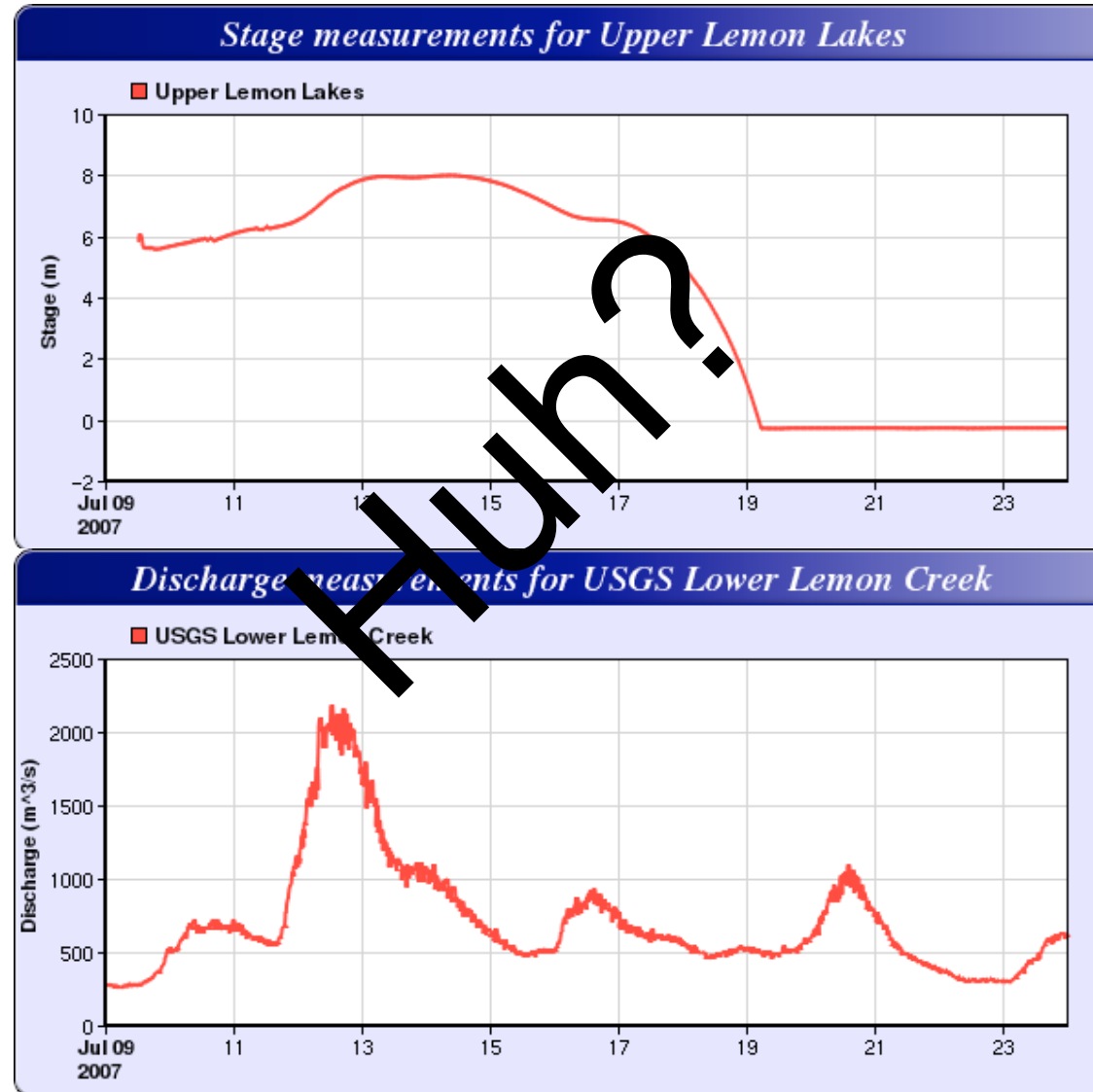


2007 Results: Lake, Creek





2007 Results: Lake, Creek





Lemon Glacier Geometry

Total surface elevation change head-to-terminus: 400 meters

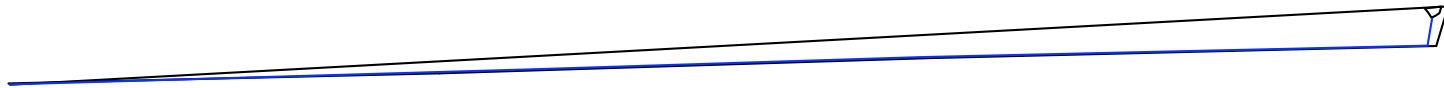
Longitudinal reach: 7500 meters

Bathymetry (best guess, Marcus 1995)

200+ meters deepest (first 1/3)

150 meters (second 1/3)

Linear to terminus



Compare results with Bartholomaus, Anderson,
and Anderson, Nature Geoscience, Jan 2008
results of Kennicott Glacier



Goals of SEAMONSTER

- Event -> End User Sensor Web
 - Technology Testbed
 - Technology Infusion
 - Science
 - Resource Management
 - Education





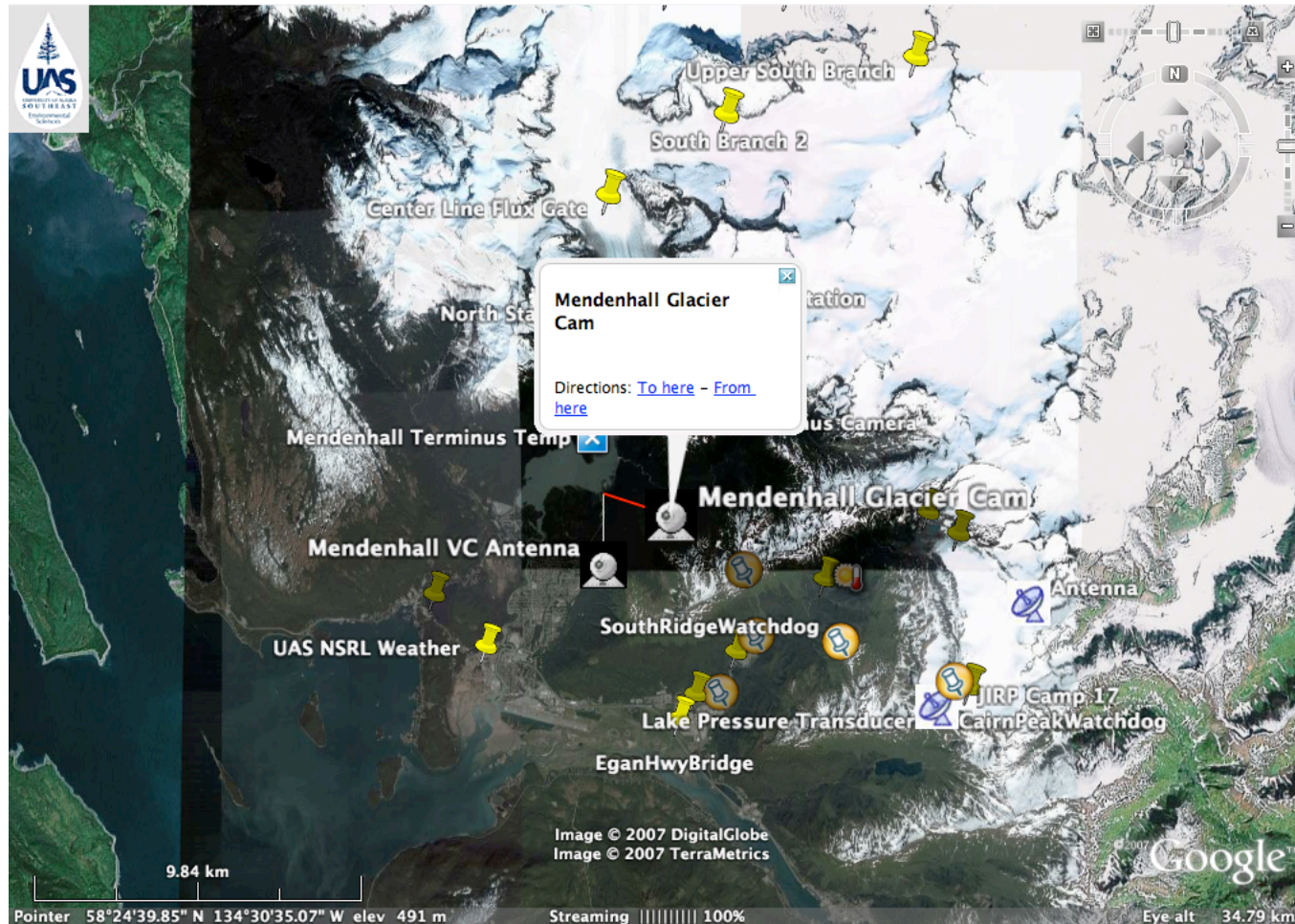
Conclusions

- SEAMONSTER is a testbed sensor web
Opportunity for other observations
- Compelling Technology and Science Use Case
- Results from Year 1:
More Accurate Lemon Glacier Drainage
Eran....

<http://seamonsterak.com/>



Sensor Web in Digital Earth





Transducers



A combination of weather and water quality measurements provided the main data streams for SEAMONSTER in year 1.

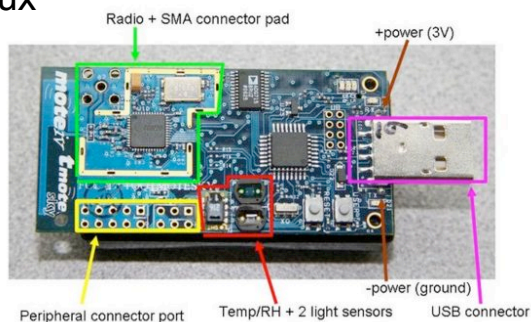


Platforms



Vexcel provided GeoBrick, Linux

There are three different platforms in use, with relative computation, storage, and sensing capabilities as well as power requirements and cost.

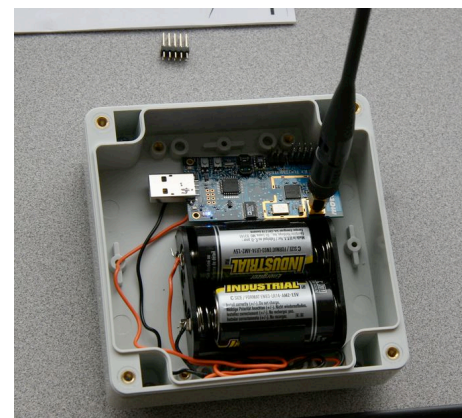


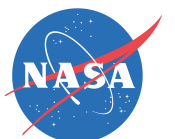
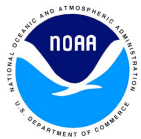
Tmote, tinyOS



Linksys NSLU-2, a UAS testbed platform, Linux

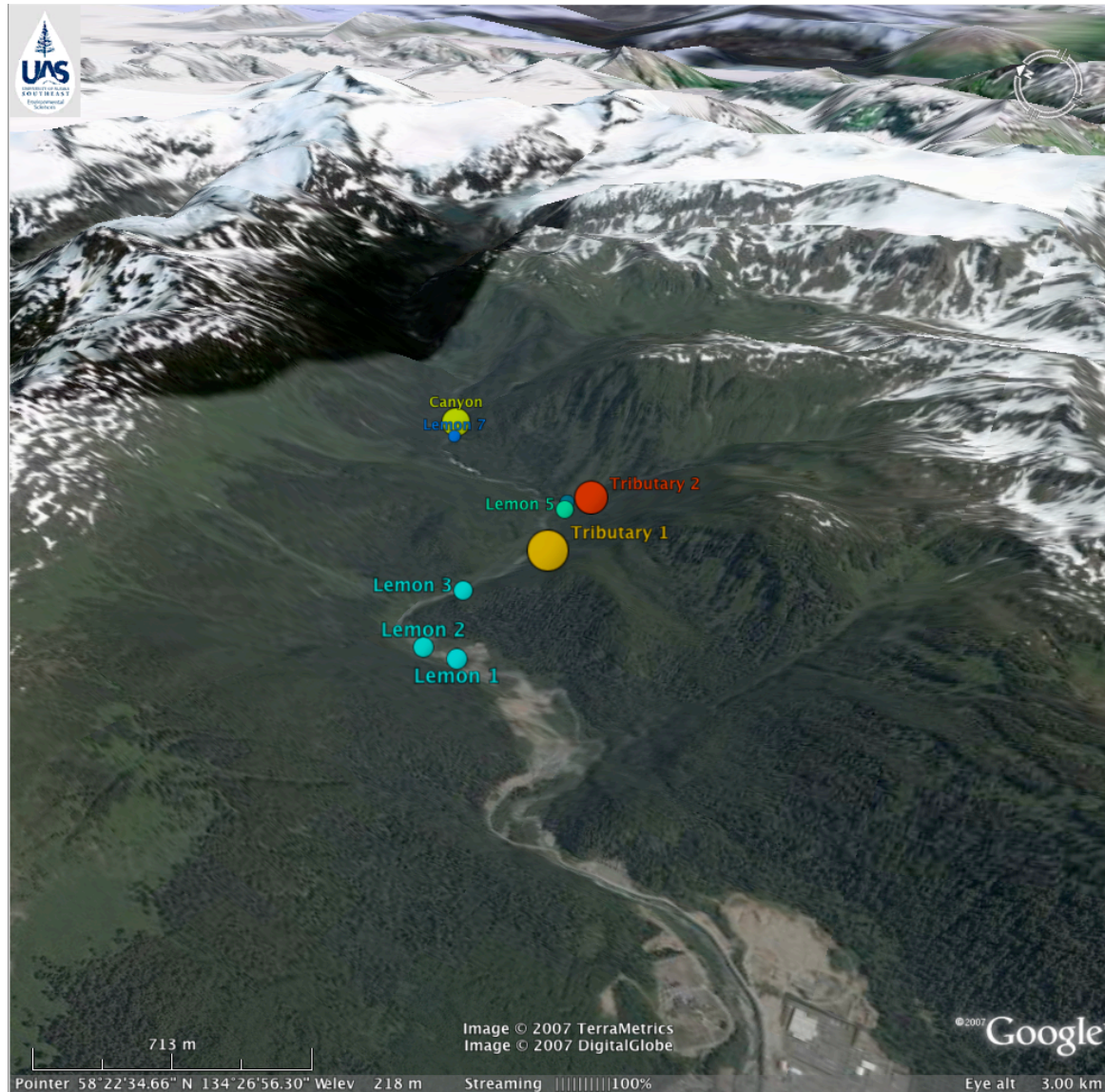
Deployment-ready tmote







Access Enables “Add-on”





2007 Results: Air, Water T

