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

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Outline

• SEAMONSTER
• Lemon Creek Watershed
• Year 1 Observations
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.
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
Long term monitoring of the Juneau Icefield to observe watershed and ocean ecological impacts of glacial recession
Scientific Motivation, 2

Detection of transient glacial lake outburst floods and observation for watershed impacts
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
- GPS and Seismic
- Met Station
- Water Quality Probe
- User controllable camera

Water Quality Probe

User controllable camera
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

1. plug breaks
2. lake drains

Gauging station
2007 Results: Precip, Lake

Precipitation measurements

Stage measurements for Upper Lemon Lakes
2007 Results: Temp, Lake

Temperature measurements

- Lower Lemon Creek
- Upper Lemon Glacier

Stage measurements for Upper Lemon Lakes

Upper Lemon Lakes
2007 Results: Precip, Creek
2007 Results: Lake, Creek

Stage measurements for Upper Lemon Lakes

Discharge measurements for USGS Lower Lemon Creek
2007 Results: Lake, Creek

Huh?
Lemon Glacier Geometry

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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
A combination of weather and water quality measurements provided the main data streams for SEAMONSTER in year 1.
There are three different platforms in use, with relative computation, storage, and sensing capabilities as well as power requirements and cost.
Access Enables “Add-on”
2007 Results: Air, Water T