

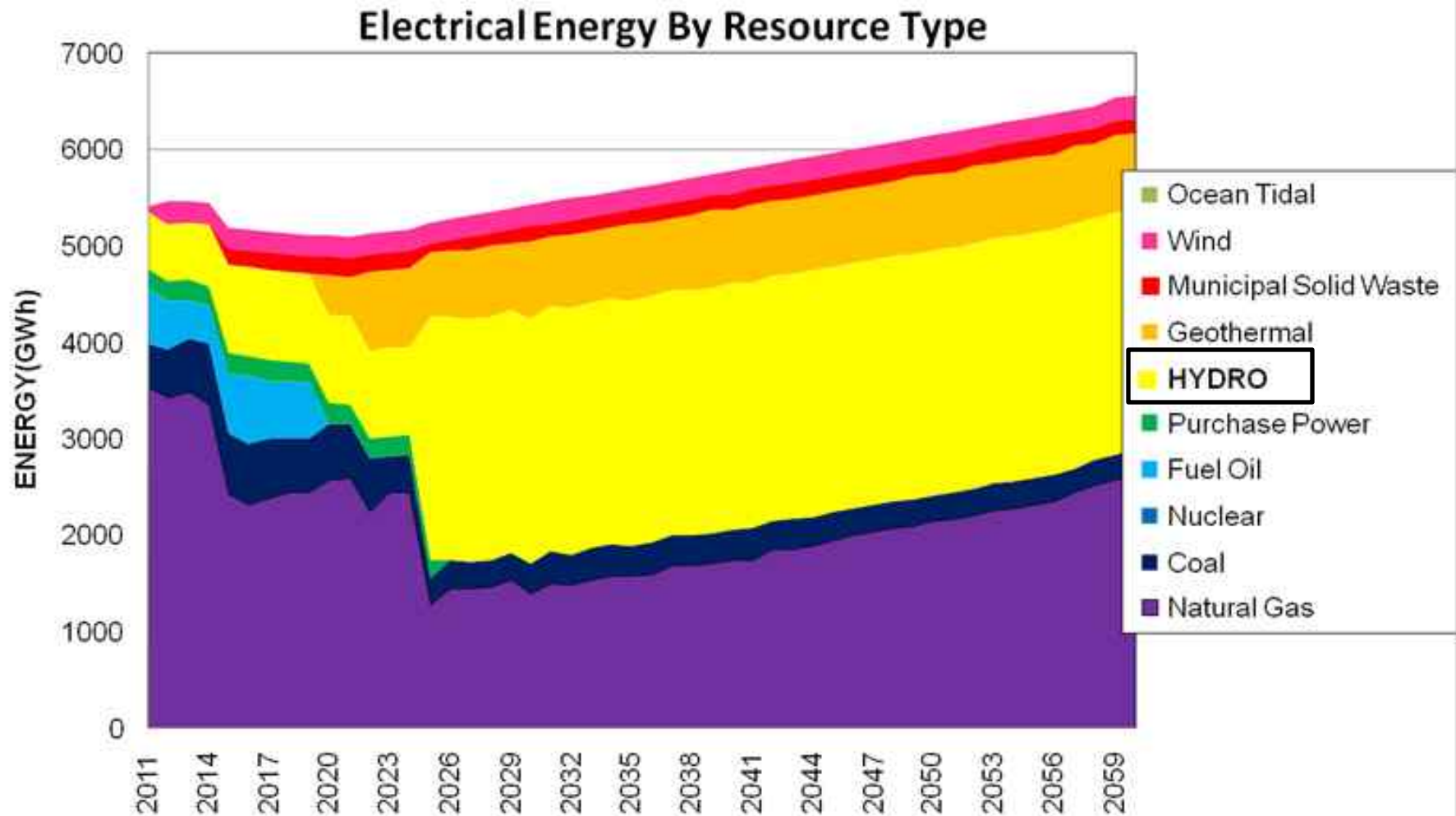
Identifying challenges & addressing data needs:

Water Management in Alaska – the Susitna Hydropower Dam



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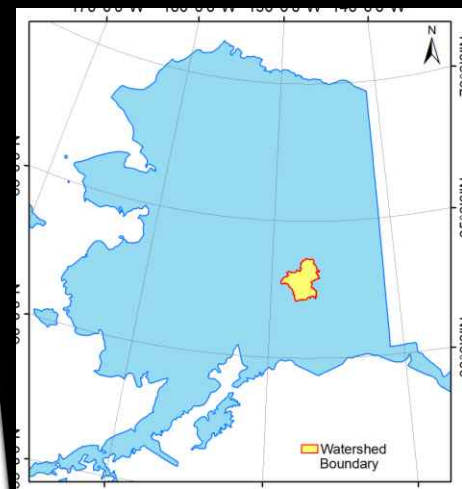
“A large hydroelectric project in the Railbelt region is the only solution to supply 50 percent of Alaska’s electricity from renewable and alternative sources” A E A, 2008



LOW WATANA EXPANDABLE

- ✕ 700' Rock filled embankment dam
- ✕ 39 mile long reservoir
- ✕ Produce about 40% of Railbelt annual energy
- ✕ Dam crest may be raised in the future (would provide a 39% increase in energy)

Source: Alaska Energy Authority, 2010

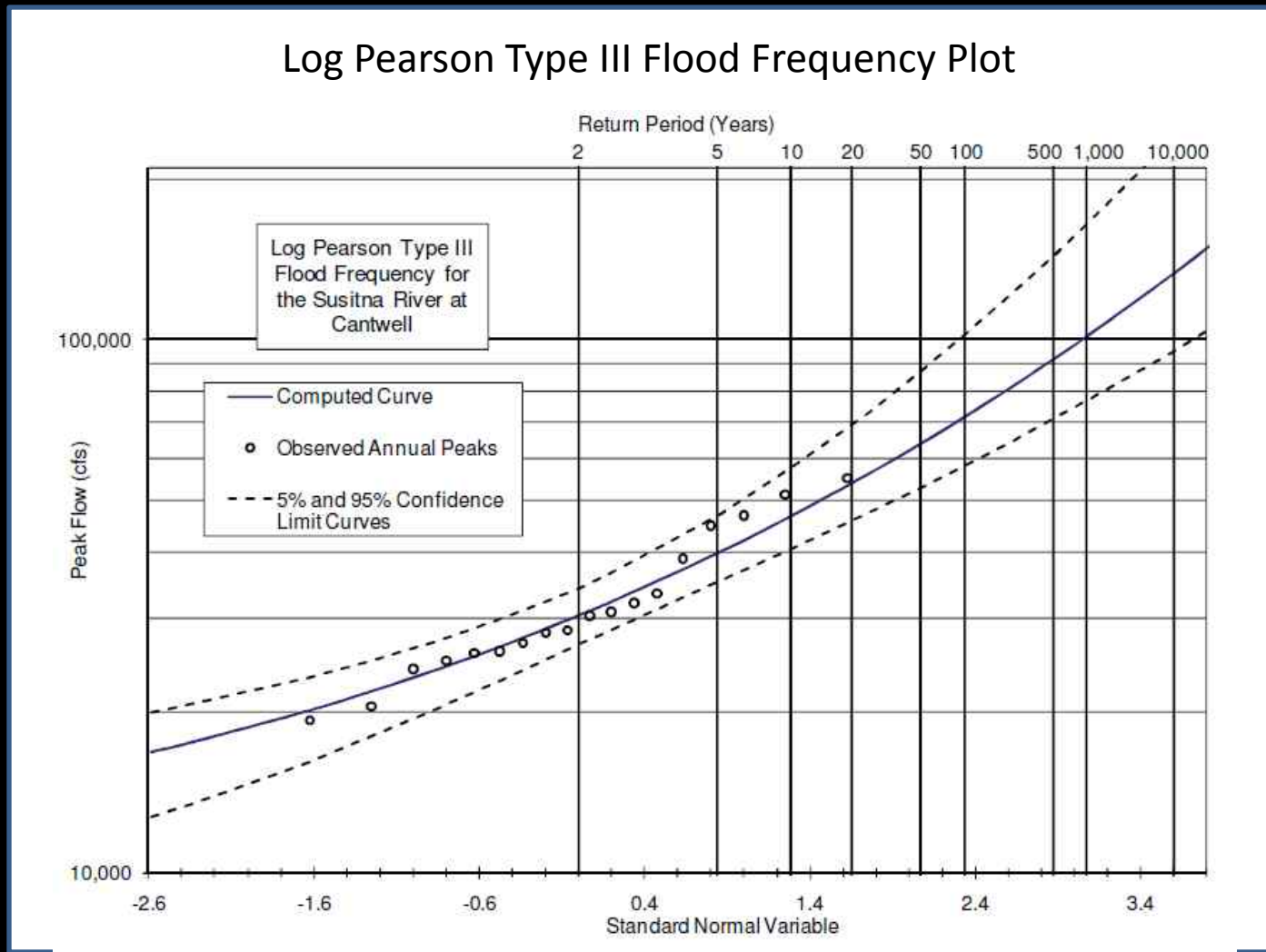


HYDROLOGY

- ✗ Reservoir traps 80 to 90% of incoming sediment. No detrimental effects on project energy.
- ✗ Environmental flows do not reduce project energy
- ✗ 50 years of water flow data
- ✗ Little variability of annual water flow in different climate patterns

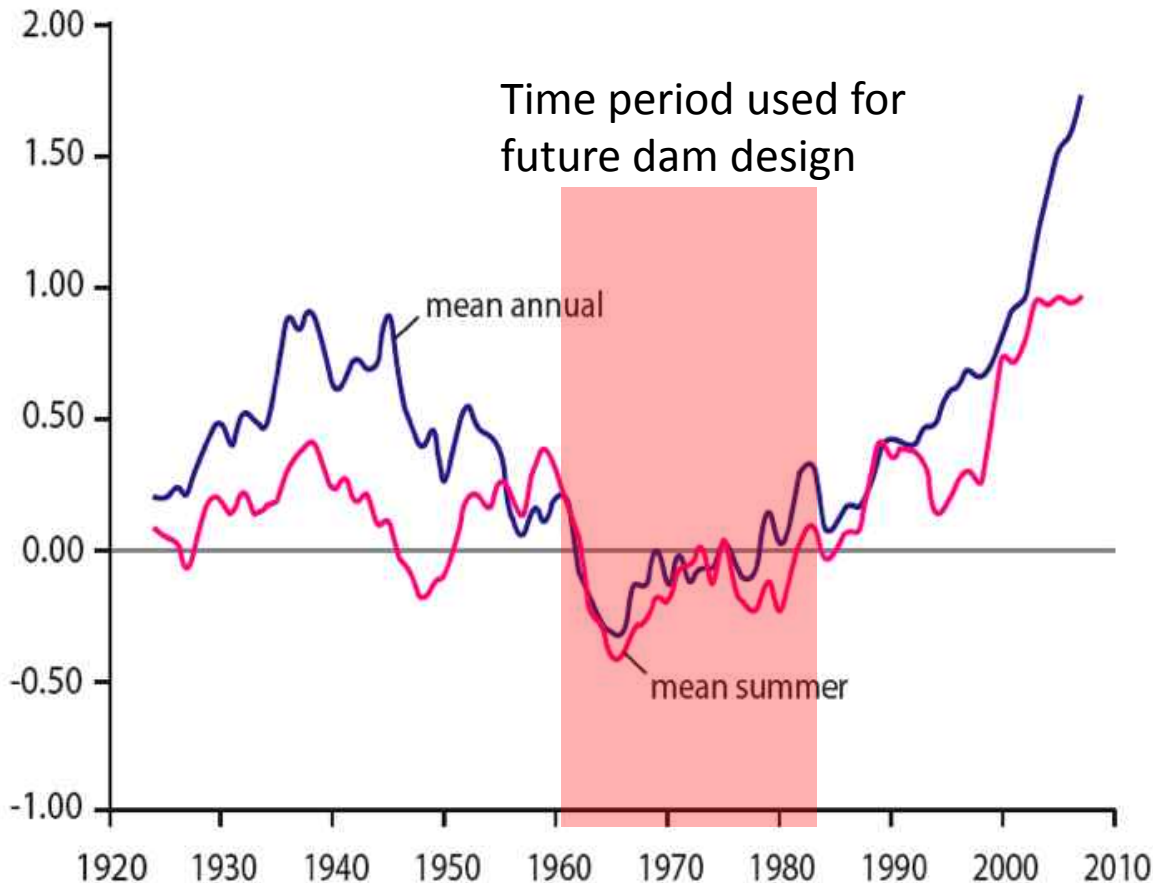
Source: Alaska Energy Authority, 2010

Traditional approach: Flood frequency & magnitude analysis using historical datasets



Increase in air temperature & glacier melt

Air temperature anomaly for the Arctic region, °C



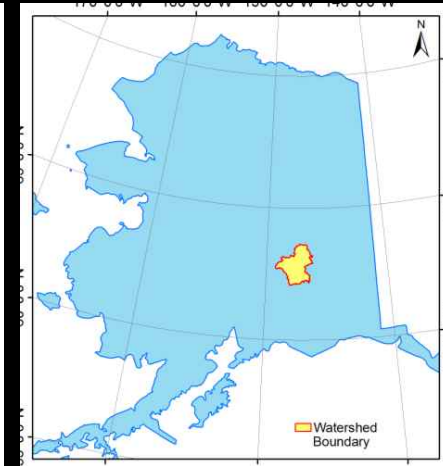
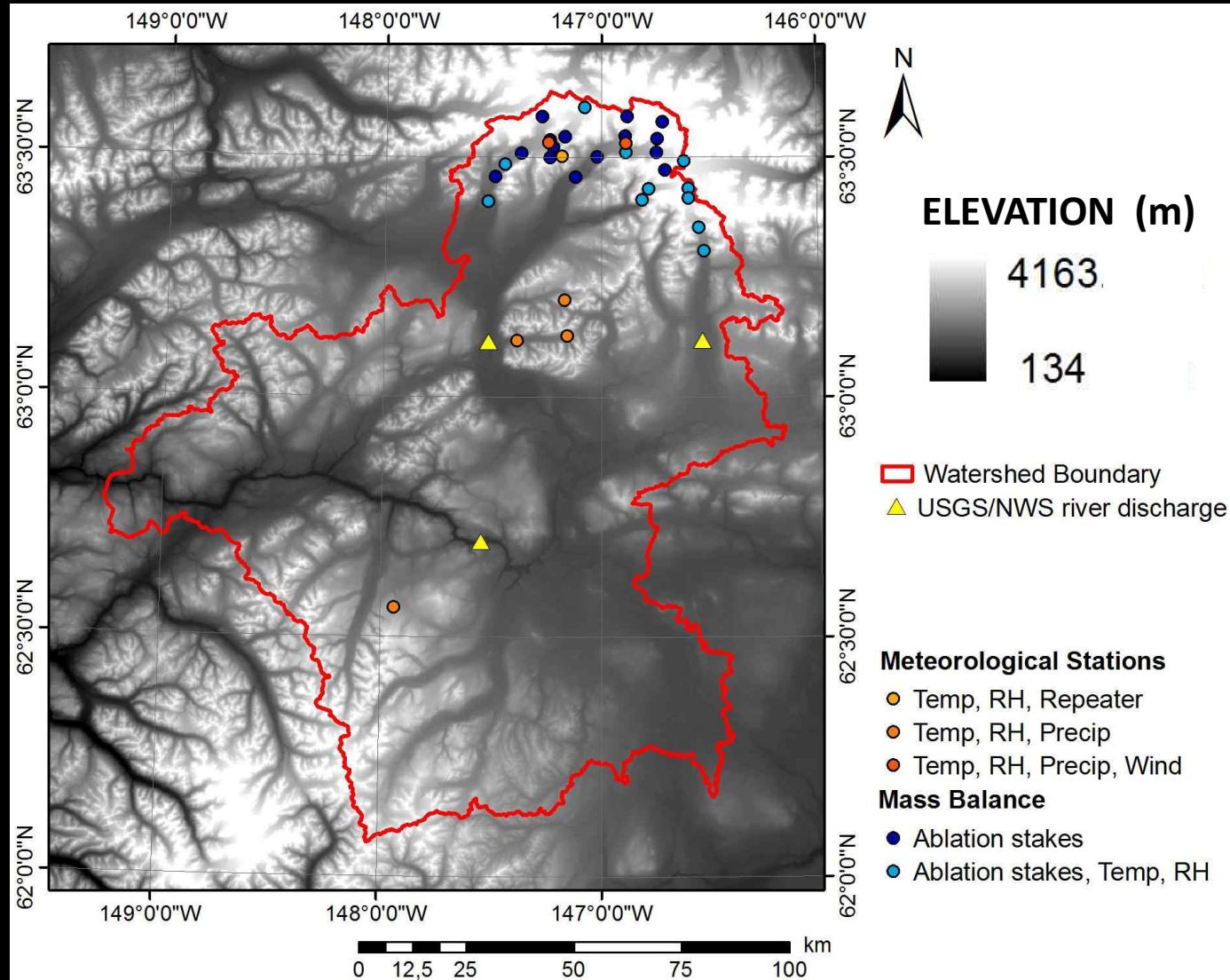
AMAP, 2011



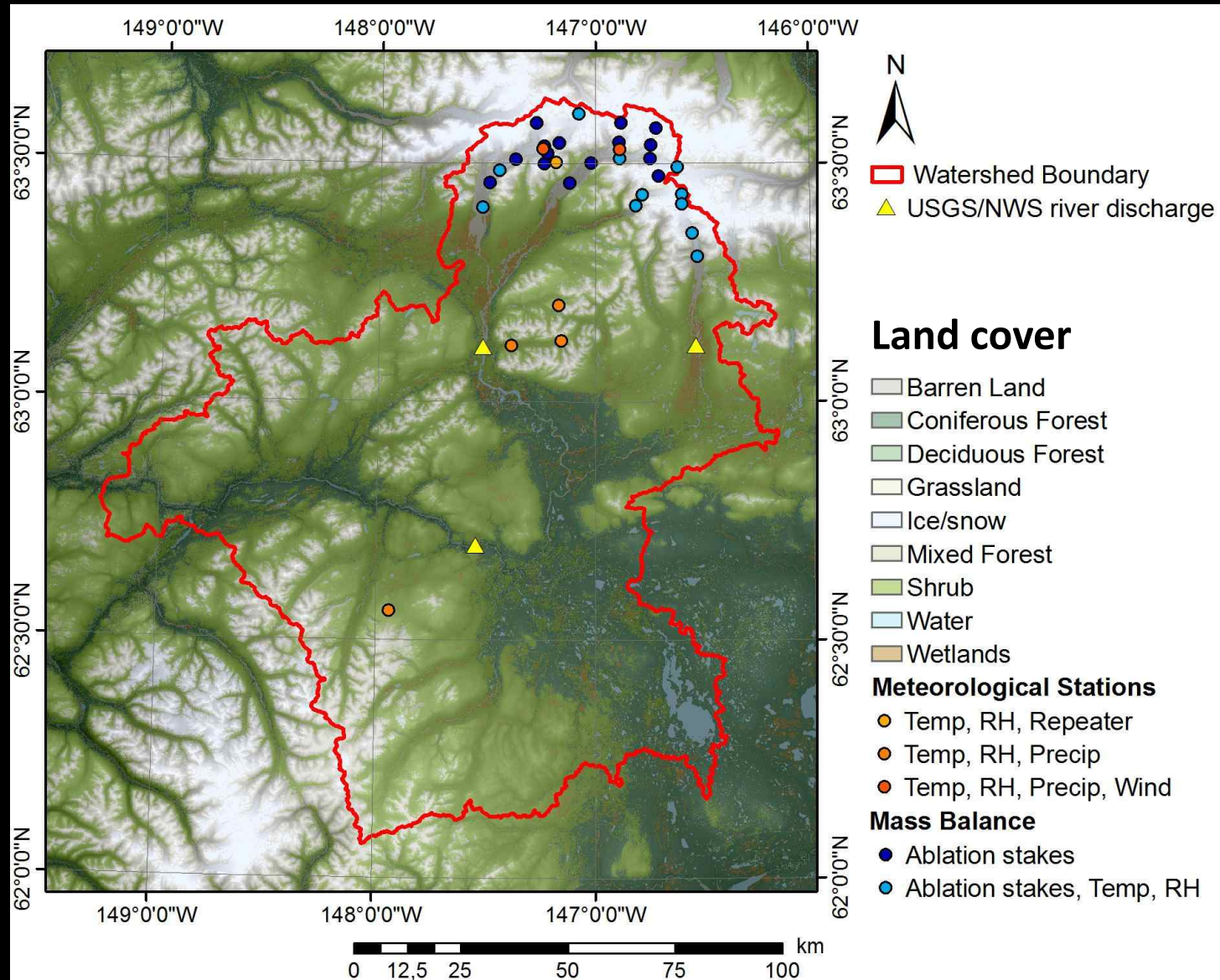
Matt Nolan

Our objective:

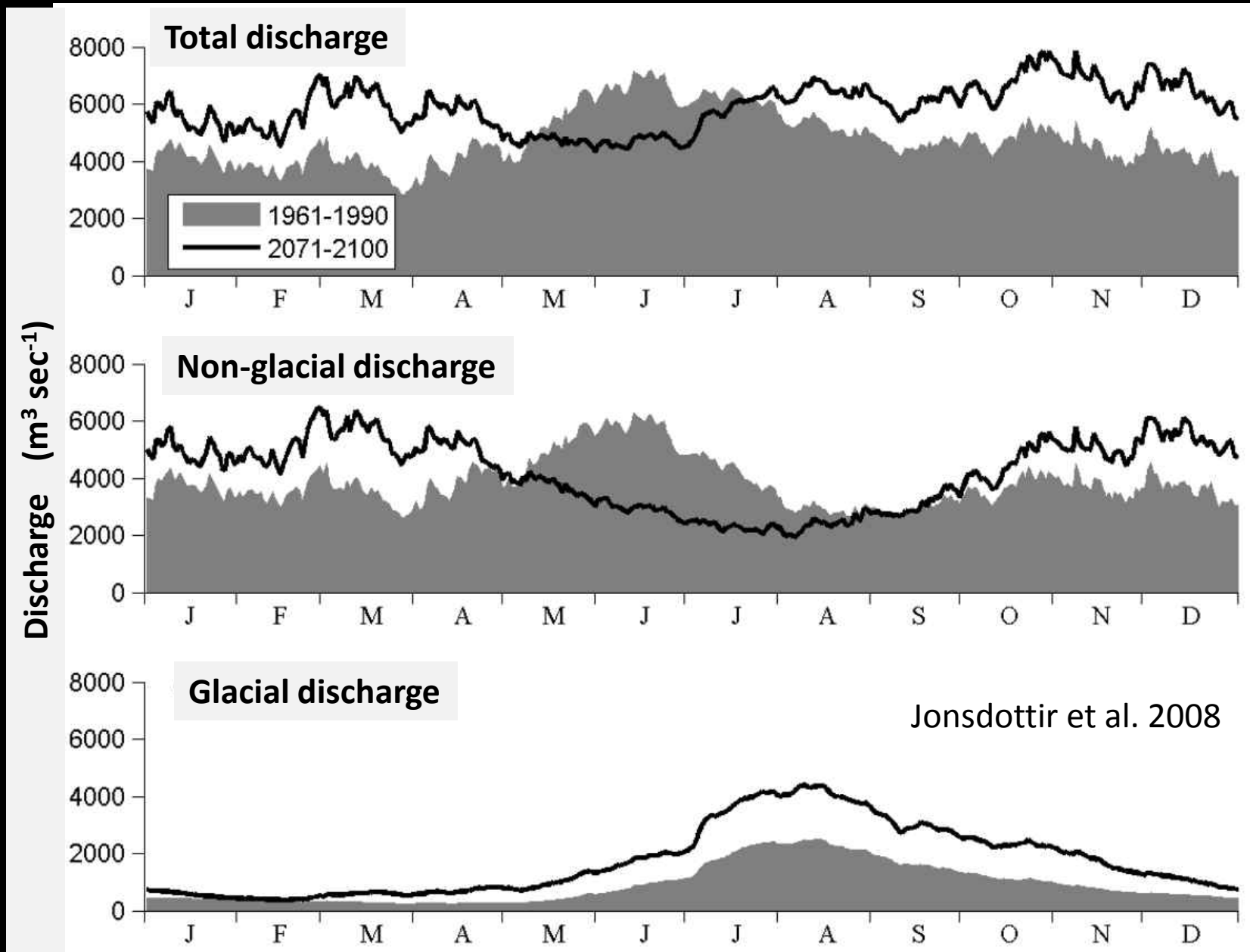
Assess the effects of future climate change on river runoff in the Upper Susitna basin (14,800 km²)



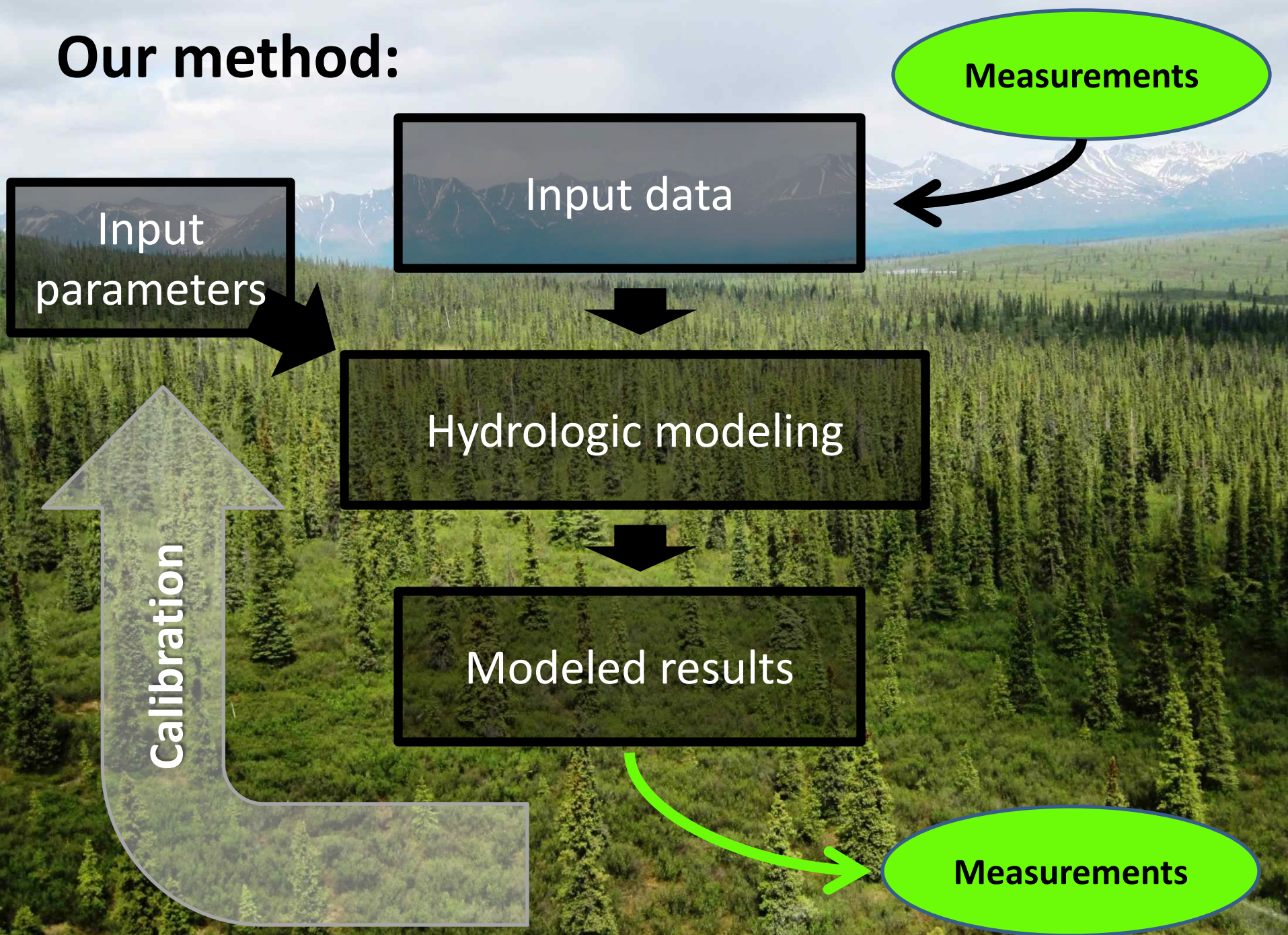
Our approach: Physically-based hydrologic modeling



Example: Runoff predictions for hydropower in Island



Our method:





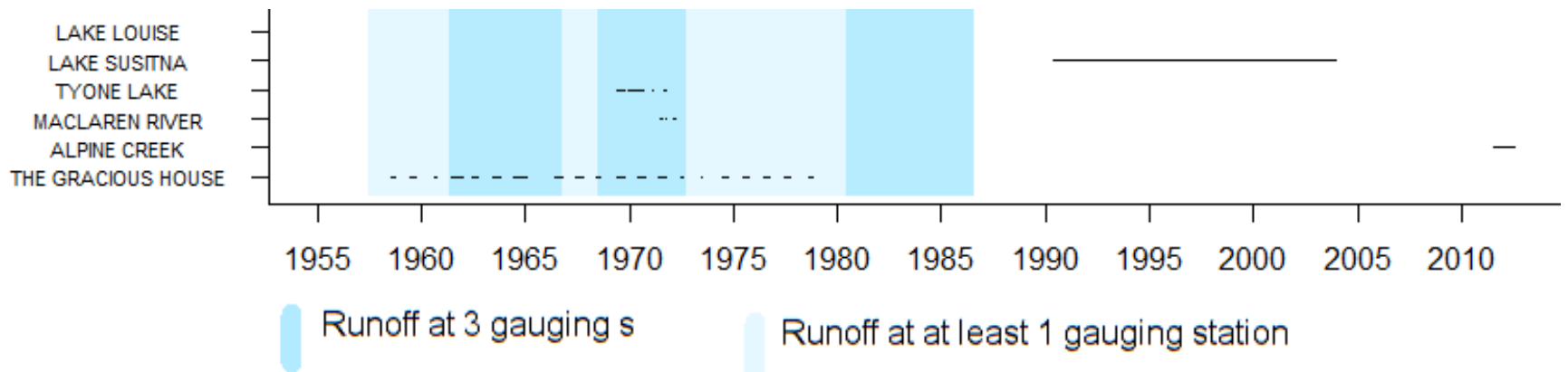
**Modeling + field measurements
= useful product**

Challenge #1

Limited coverage of field measurements



Climate data within Upper Susitna Basin (14,800 km²)



Challenge #1

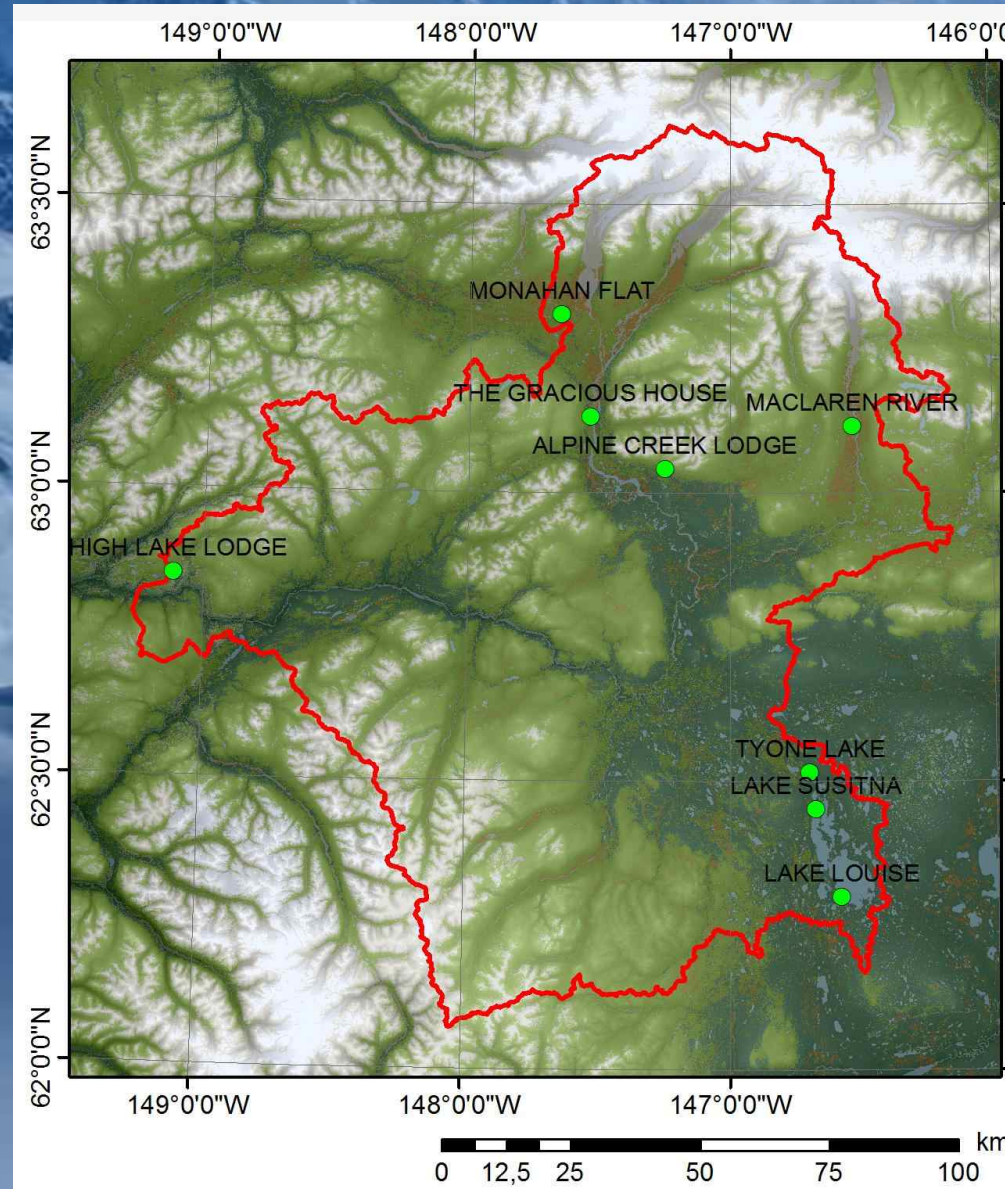
Major needs for hydrologic modeling:

Spatially variable

- Precipitation
- Air temperature

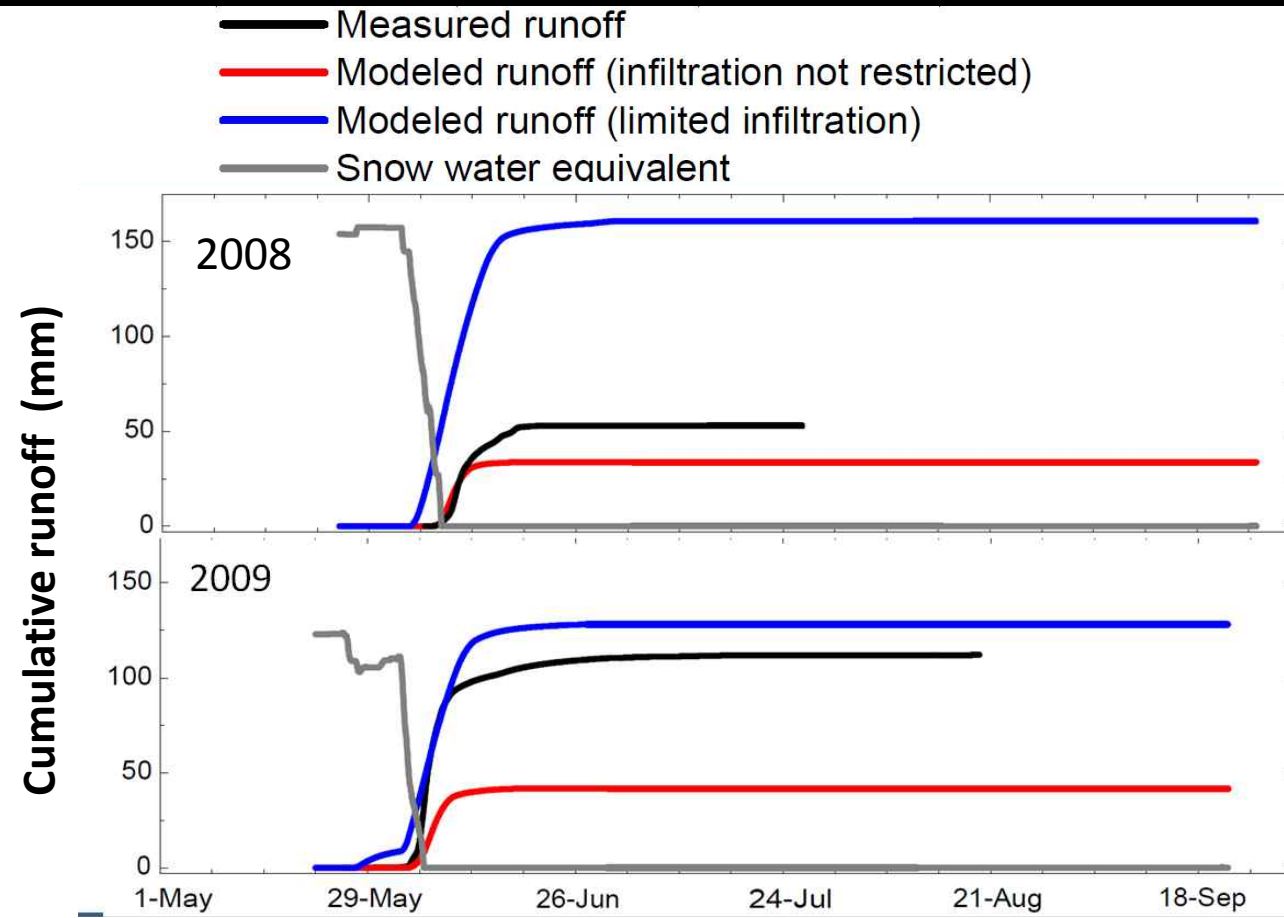
→ INPUT DATA TO MODEL

**+ Soil, vegetation maps
& DEM**



Challenge #2

Right result for the right reason?



Alt. 1:

Soil
moisture

Snow
cover



Alt. 2:

Snow
cover

Soil
moisture

Challenge #2

Information needs to *refine* hydrologic modeling:

* Surface storage changes *
water, snow, ice

* Timing of events *
soil freeze, snow melt...

* Geographical coverage *
Flooding, green-up...

* Fluxes *
Runoff, ET...

→ **VALIDATION & CALIBRATION DATA**



**Modeling + field measurements + imagery
= much more useful product**





Image courtesy: AEA

Water management in Alaska have the potential to strongly benefit from remote sensing products