An integrated hydro-physiographic metadata archive for pan-Arctic rivers (IHPGM-Arctic)

Kurt Solander, Feng Yu, Jon Schwenk, Joel Rowland
Los Alamos National Laboratory, Earth and Environmental Sciences Division

Los Alamos NATIONAL LABORATORY EST.1943

LA-UR 20-28005

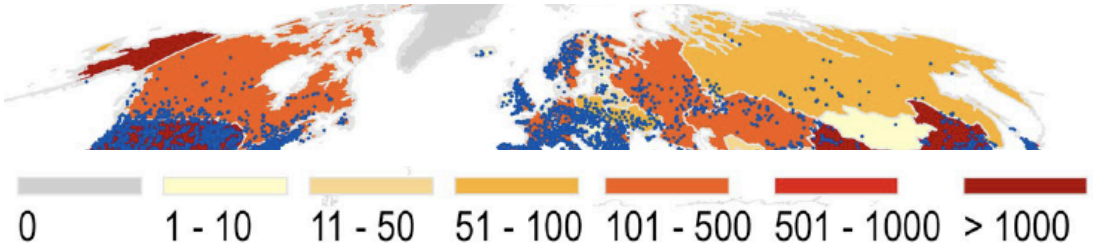
What is IHPGM-Arctic?

Integration of multiple datasets to the streamflow gauge

Grill et al., 2019 Free-flowing river reaches

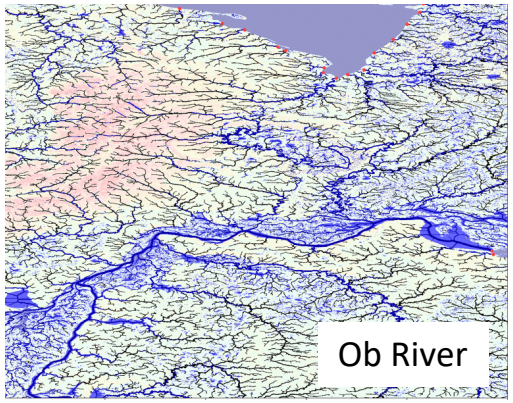
- Global dataset of river reach-based attributes
  - Flow Volume
  - Degree of fragmentation
  - Degree of regulation
  - Sediment trapping
  - Water consumption
  - Connectivity status

Mulligan et al., 2020 GOODD Dam dataset



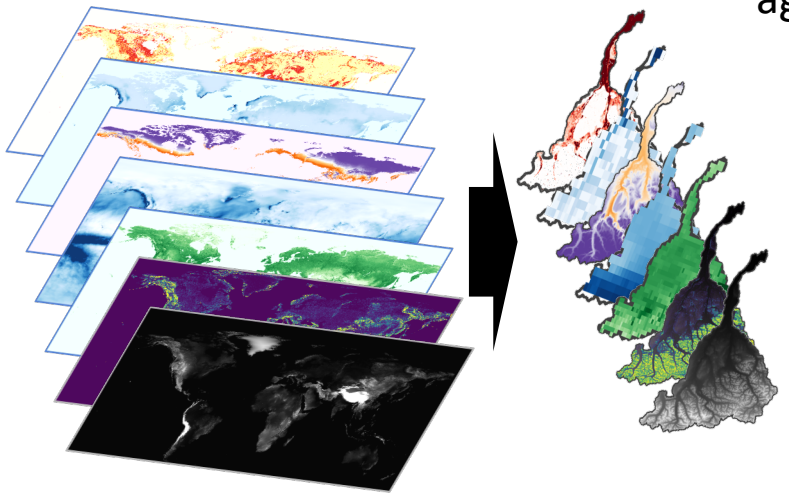
- GlObal geOreferenced Database of Dams (GOODD)
- 38,000+ dam locations
- Merged with attributes from Global Reservoir and Dam (GRAND) database
  - Number dams upstream
  - % streamflow impacted

Yamazaki et al., 2019 MERIT Hydro DEM



- Flow direction, elevation & water bodies dataset
  - Mean river width
  - Mean river gradient
  - Local slope

River and Basin Profiler (RaBPro) Python Package

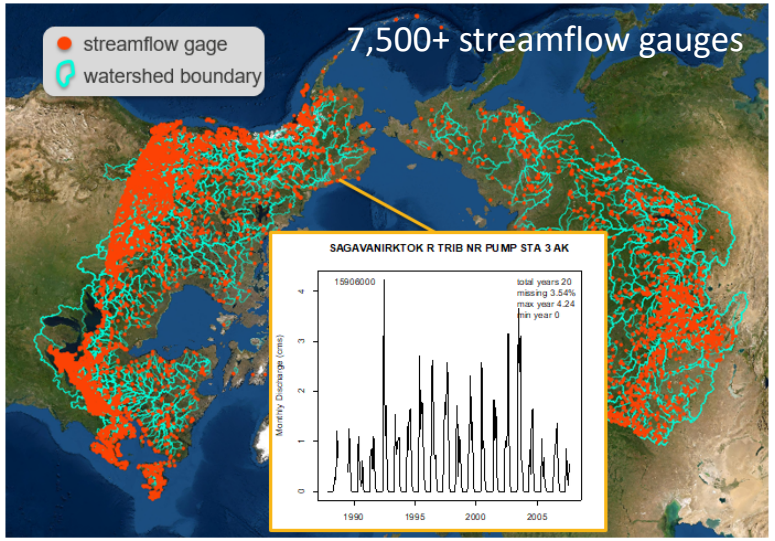


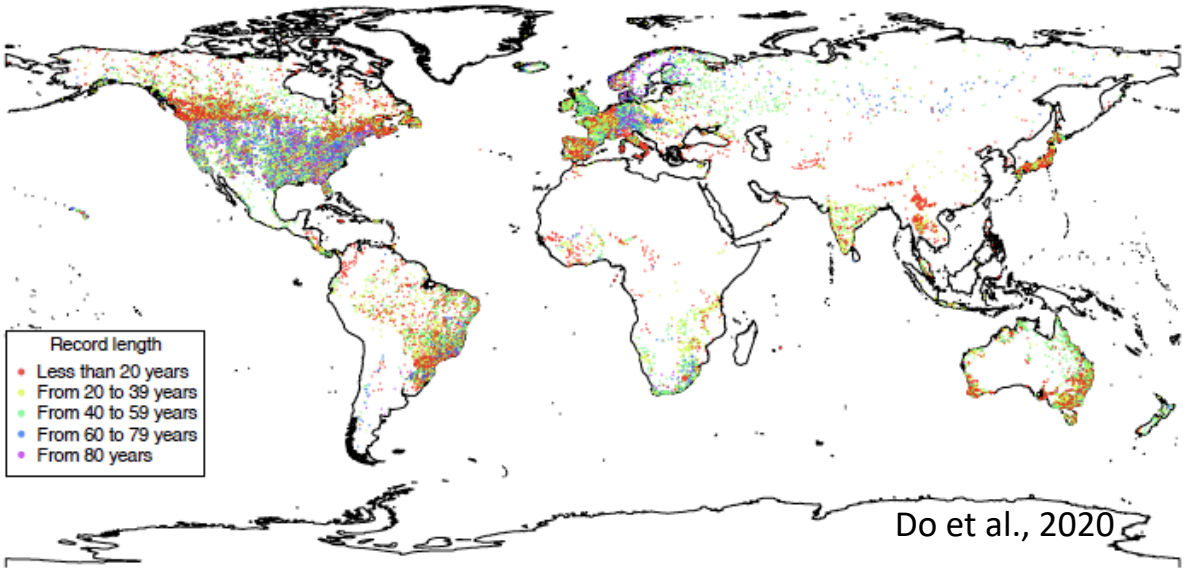
- Climate, topographic, vegetation hydrologic attributes aggregated to watershed
  - Köppen-Geiger Zones
  - Baseflow
  - Permafrost thickness
  - Snow Water Equivalent
  - Precipitation
  - Temperature
  - Leaf Area Index
  - NDVI

LA-UR 20-28005

Why did we do this?

- First part of analysis involving streamflow observations involves data filtering
  - Upstream dam impacts
  - Sediment transport
  - Flow volume or seasonality
  - Vegetation
  - Climate
  - Completeness of record
- Filtering streamflow gauge data time consuming
  - Difficulty of locating and merging multiple datasets containing different types of information
- Distinct from existing streamflow gauge metadata databases (e.g. GSIM)
  - Tailored to the Arctic (e.g. permafrost)
  - New data has since come online
  - Inclusion of climate, vegetation & hydrologic properties

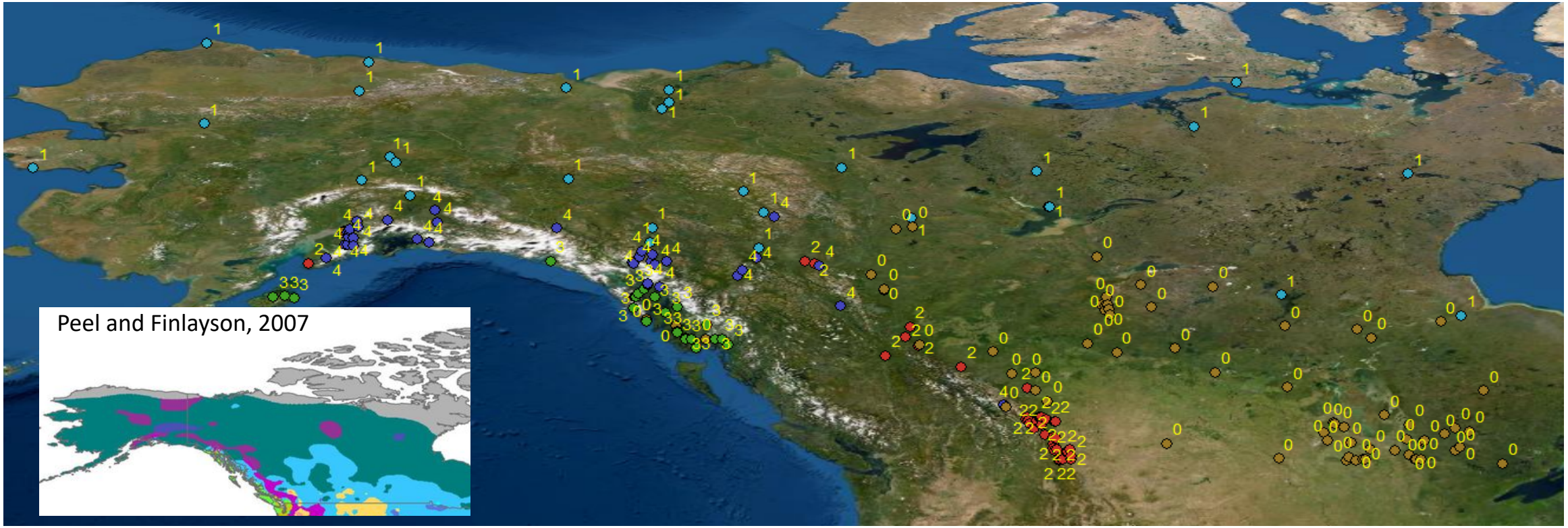




Global Streamflow Indices and Metadata (GSIM) Archive

LA-UR 20-28005

What sorts of analysis could be supported?



- K-means cluster analysis used to examine spatial relationships of streamflow gauge attributes and drivers of streamflow
- Precipitation (including snow), evapotranspiration, runoff and permafrost rank highly for clustering

Relationship to Köppen Geiger Climate Zone

Cfb Temperate, Oceanic Climate = Cluster 3

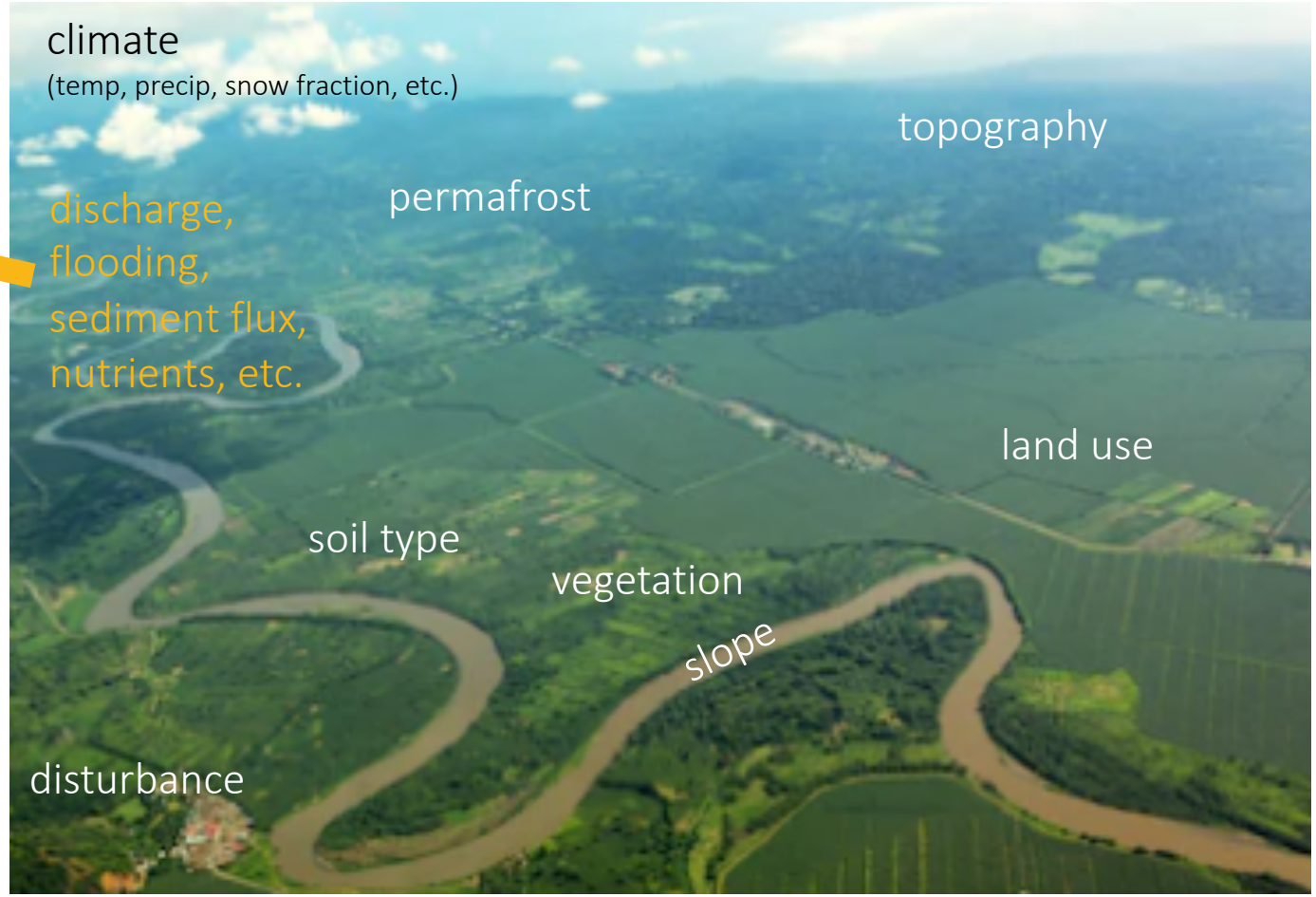
Dsc Cold Summer, Mediterranean Climate = Cluster 4

- Clusters 0, 1 & 2 not strongly associated with Köppen Geiger Climate Zone

LA-UR 20-28005

Challenges in linking terrestrial to coastal processes

- Arctic streamflow properties are driven by many factors
- Coastal processes a function of streamflow: erosion, sediment & nutrient deposition, salinity
- Important to be able to filter datasets based on streamflow attributes to understand drivers of streamflow behavior and resulting impacts on coastal processes
- Dataset ultimately available on DOE public data repository Environmental System Science Data Infrastructure for a Virtual Ecosystem (ESS-DIVE)



Thank You

LA-UR 20-28005