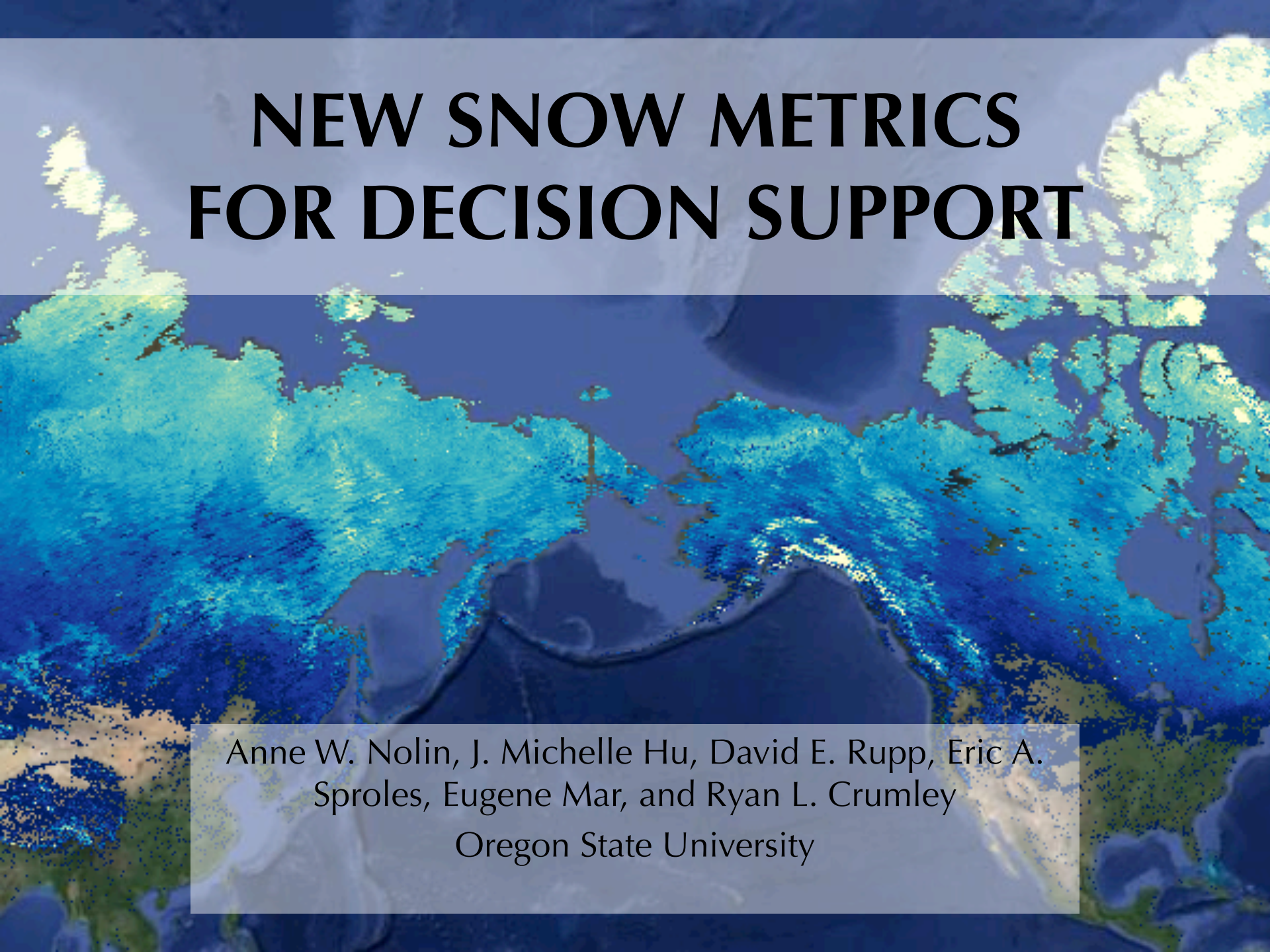


NEW SNOW METRICS FOR DECISION SUPPORT

Anne W. Nolin, J. Michelle Hu, David E. Rupp, Eric A. Sproles, Eugene Mar, and Ryan L. Crumley

Oregon State University

Snow Affects Multiple Sectors

Water

Energy

Forest

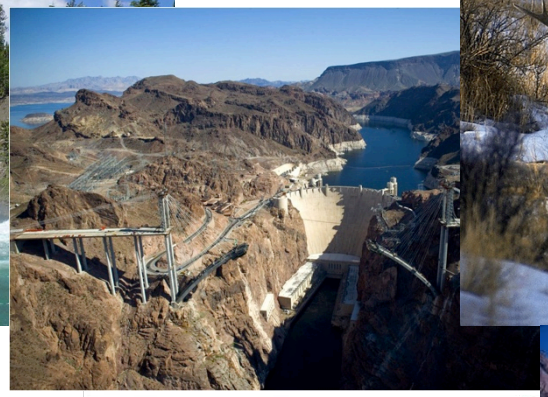
Fish & wildlife

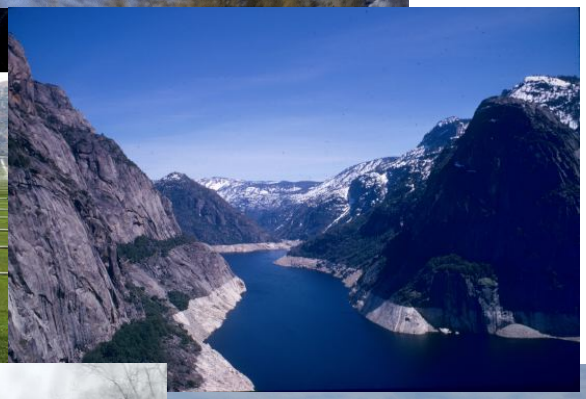
Agriculture

Reservoir operations

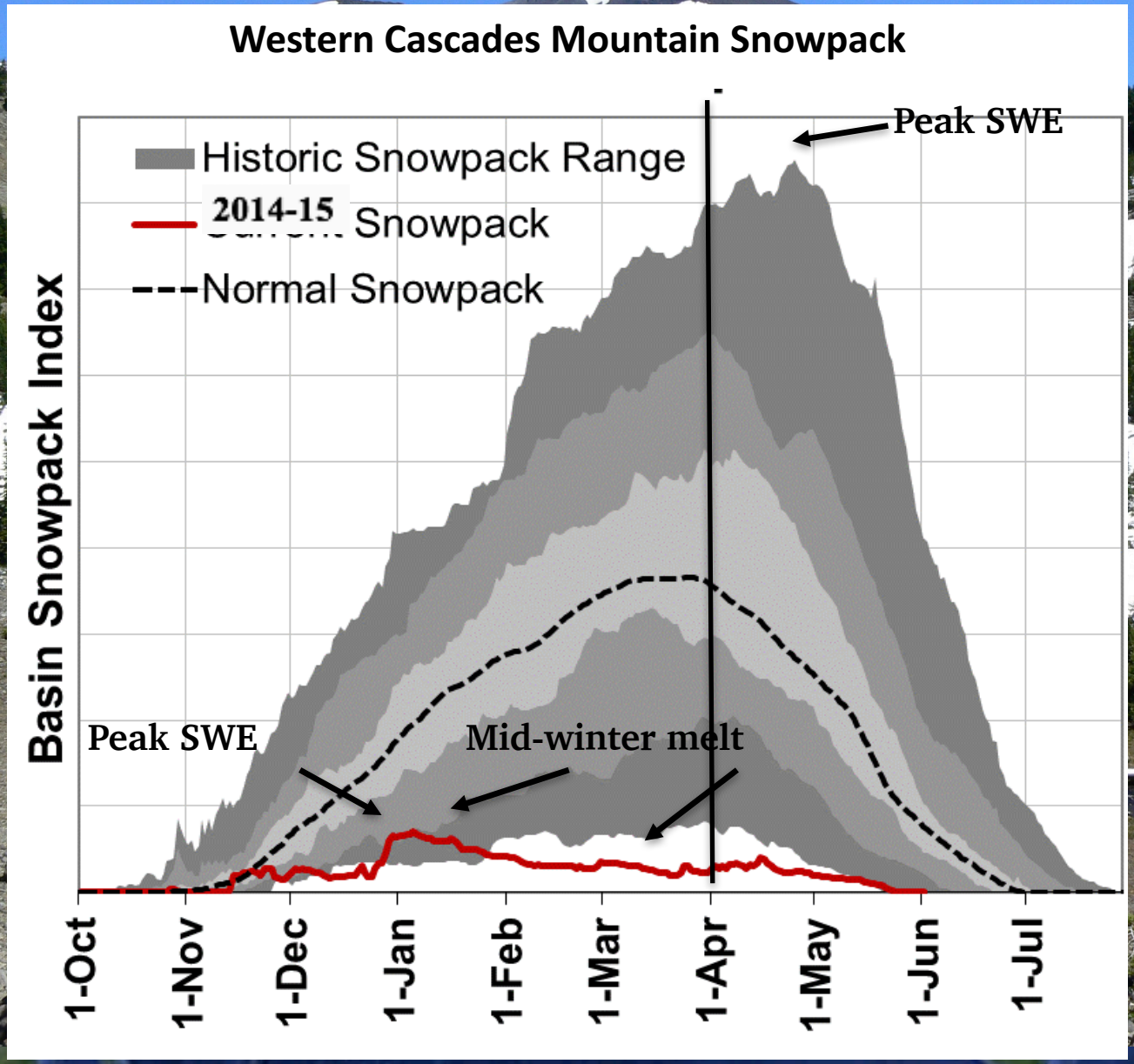
Transportation

Recreation & tourism

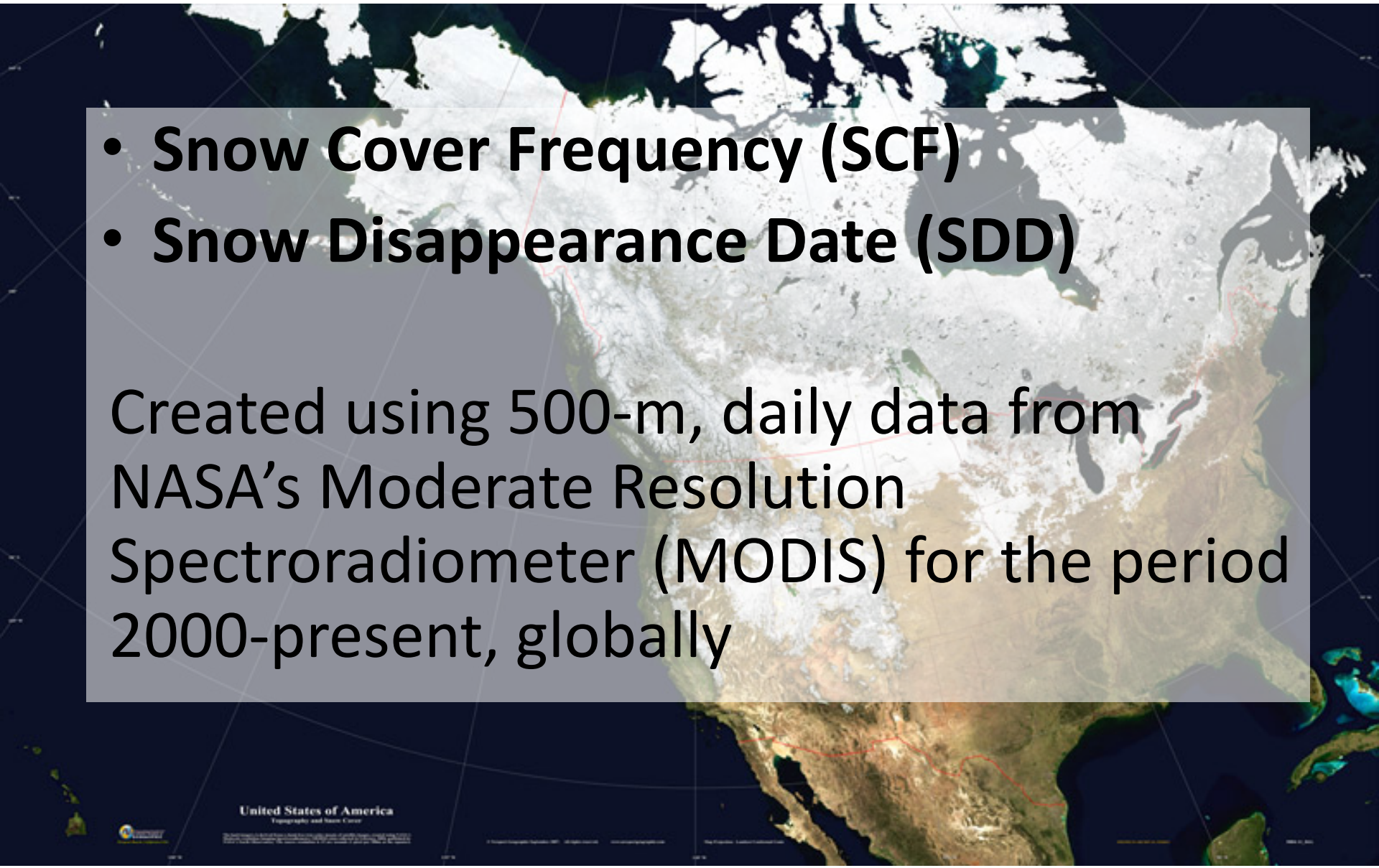




Why do we need new snow metrics?



New Snow Metrics - 1



- **Snow Cover Frequency (SCF)**
- **Snow Disappearance Date (SDD)**

Created using 500-m, daily data from NASA's Moderate Resolution Spectroradiometer (MODIS) for the period 2000-present, globally

New Snow Metrics - 2

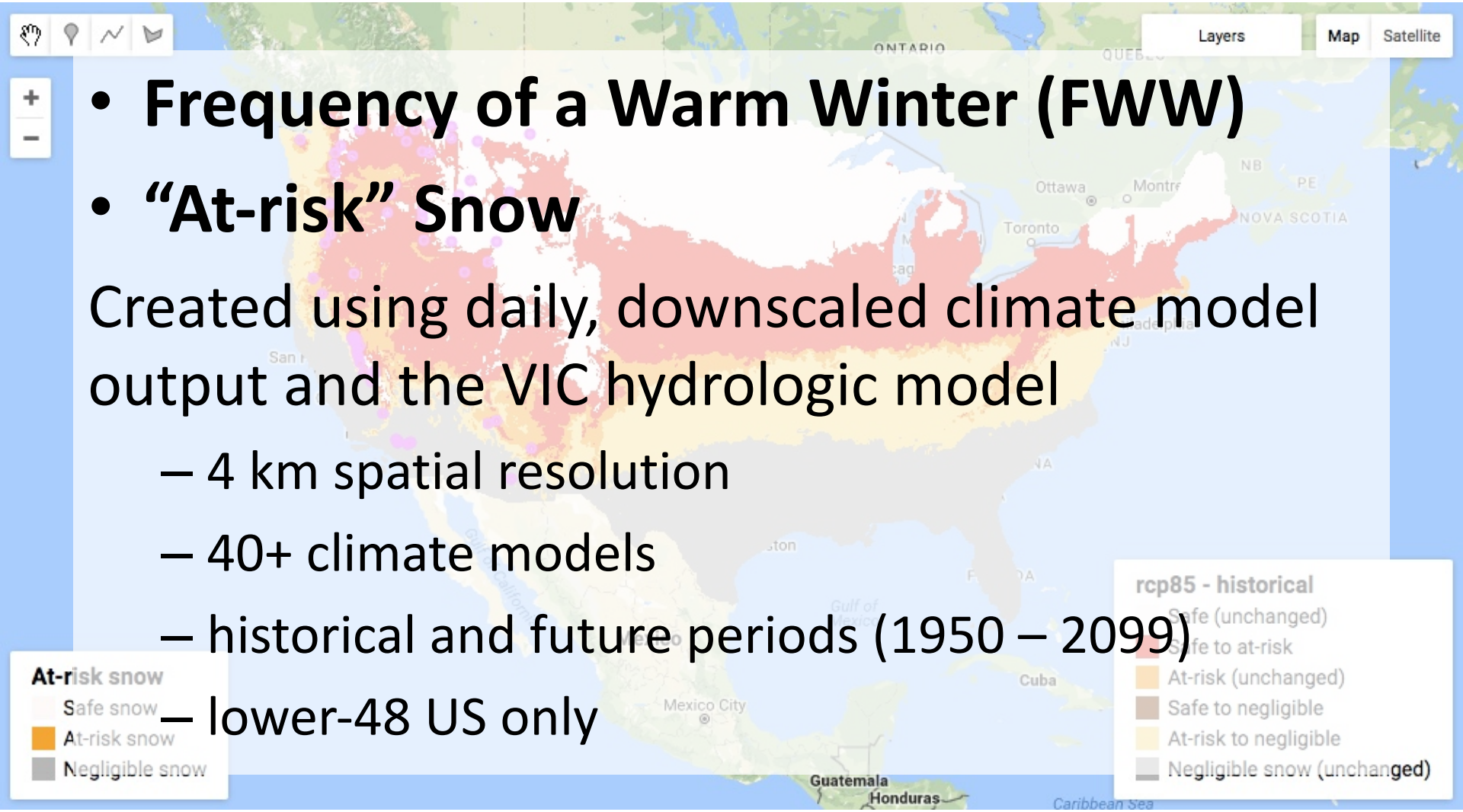
- **Snowstorm Temperature**

Created using daily data from NRCS Snow Telemetry sites (SNOTEL)

800+ sites across the western US, 1984-present

For each site, we identify the min/max/mean daily temperature on days when the snow pillow indicates that snowfall has occurred

New Snow Metrics - 3

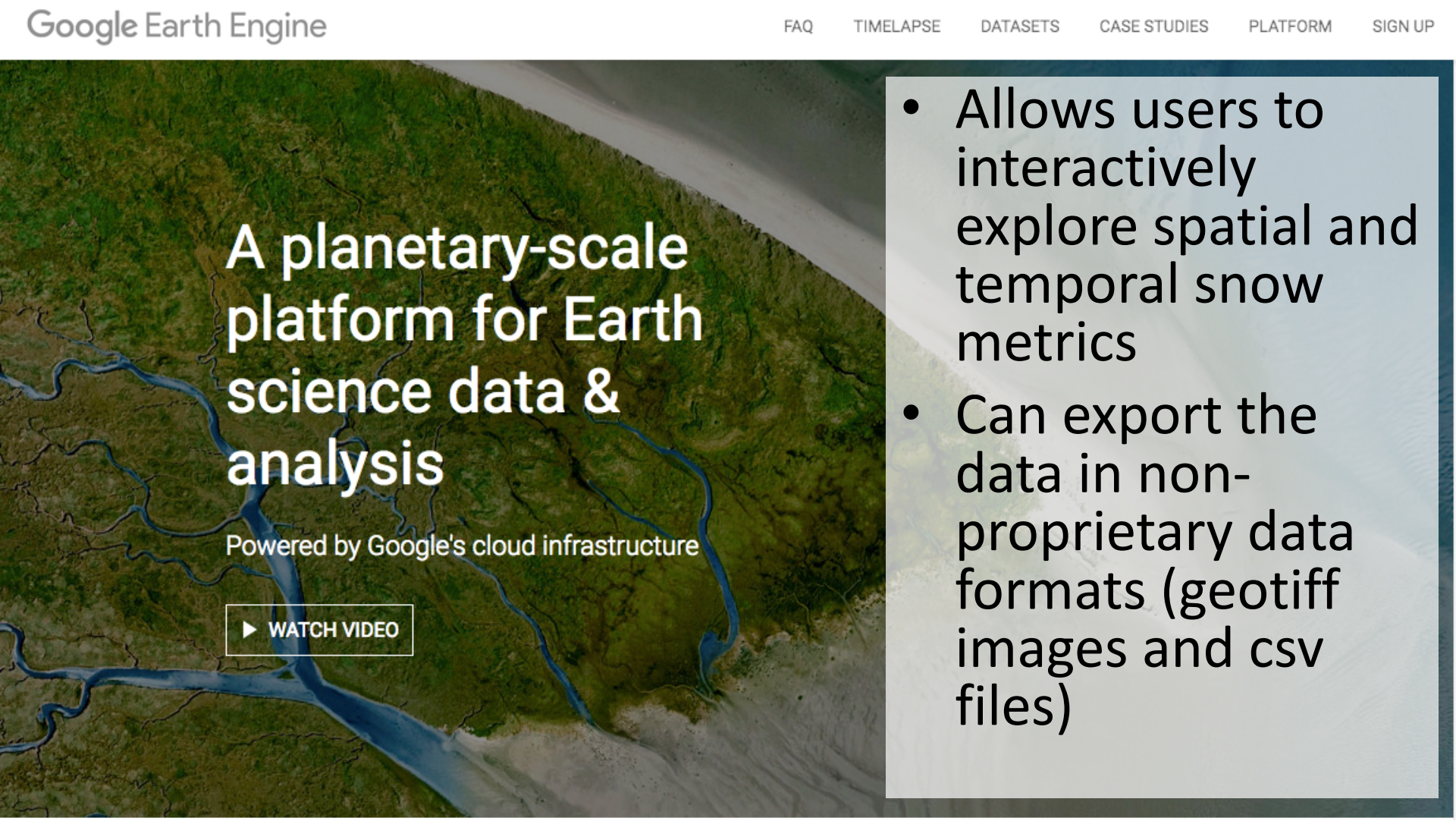


- **Frequency of a Warm Winter (FWW)**
- **"At-risk" Snow**

Created using daily, downscaled climate model output and the VIC hydrologic model

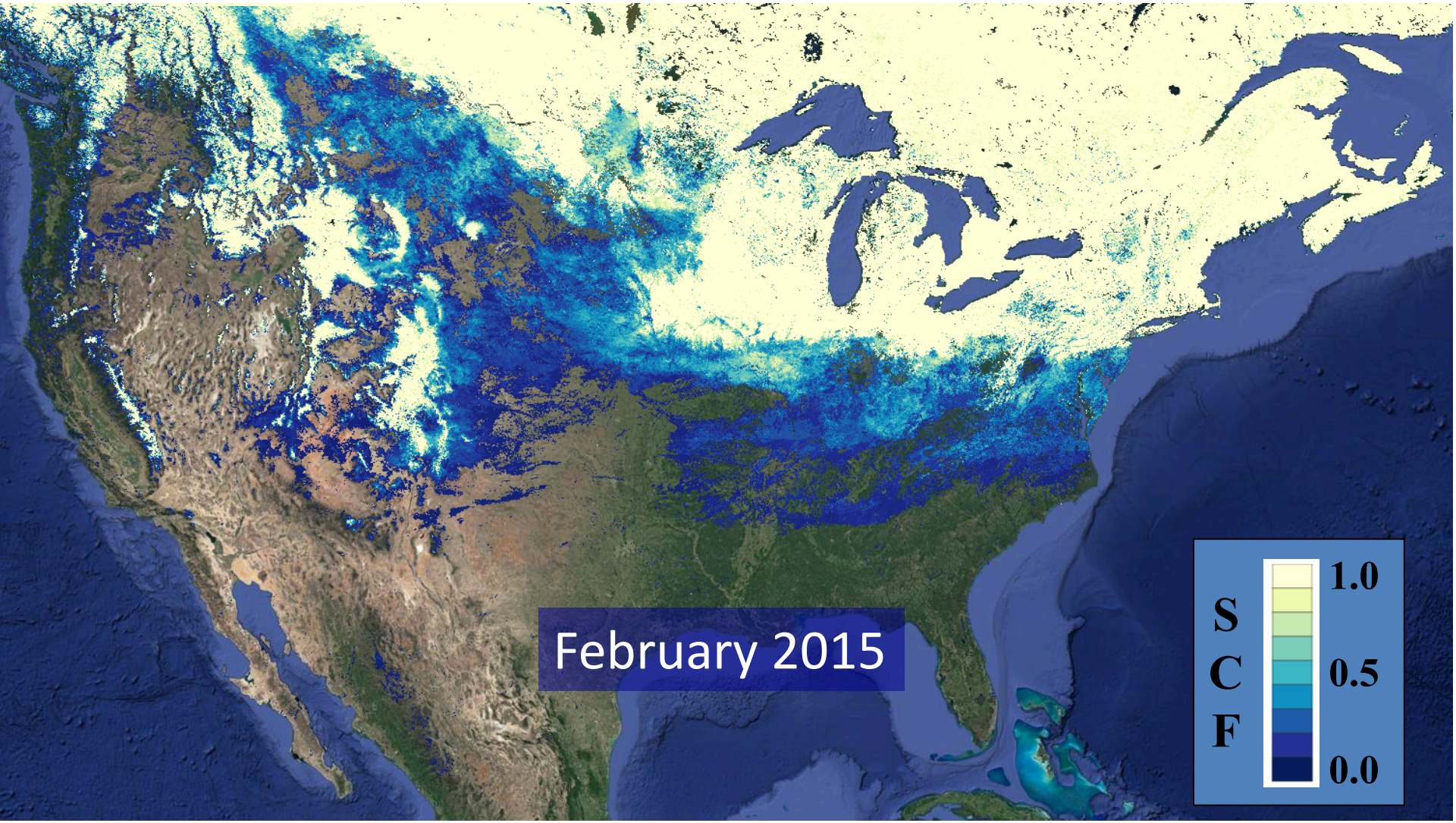
- 4 km spatial resolution
- 40+ climate models
- historical and future periods (1950 – 2099)
- lower-48 US only

How we do this: Cloud-computing and Visualization using Google Earth Engine

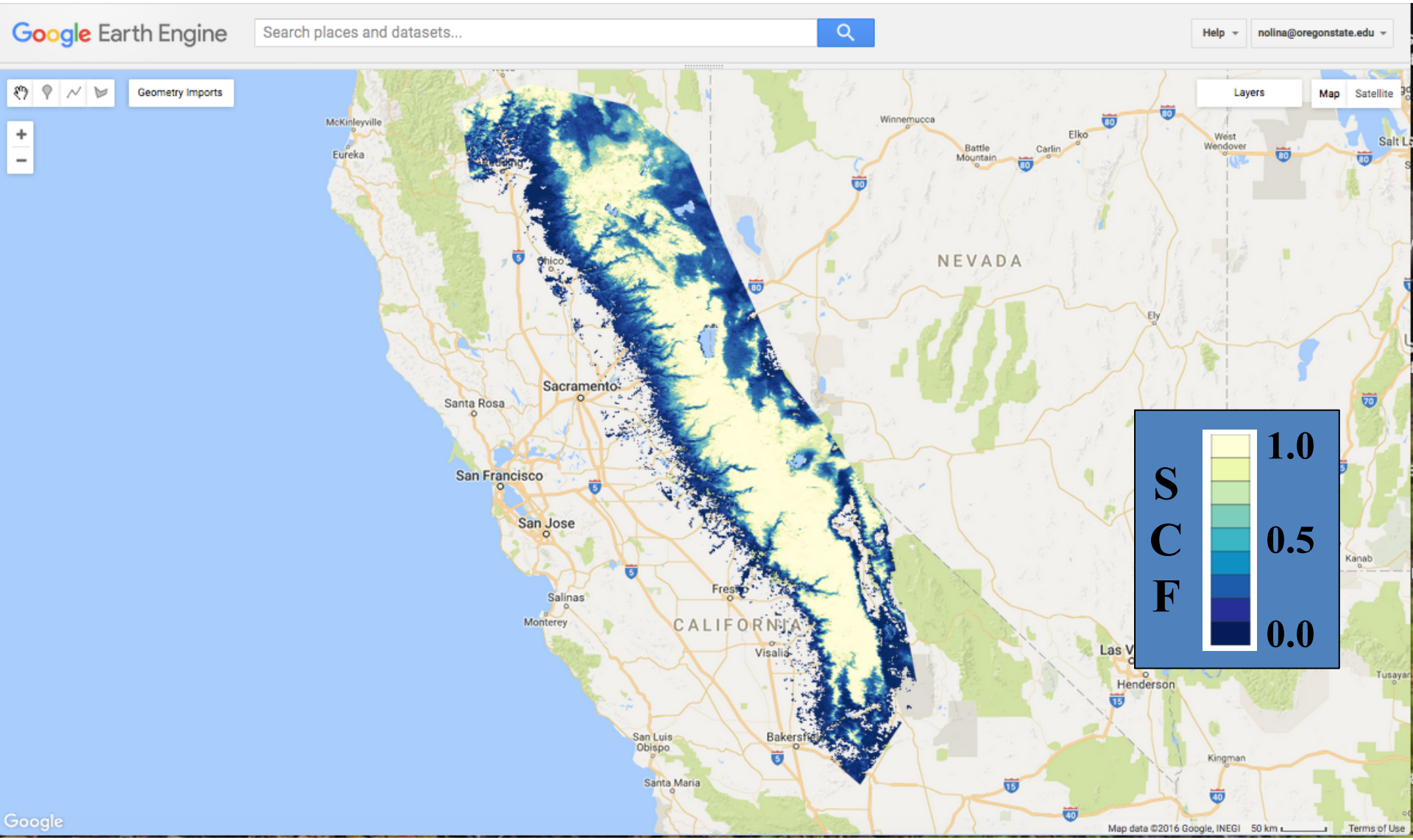


- Allows users to interactively explore spatial and temporal snow metrics
- Can export the data in non-proprietary data formats (geotiff images and csv files)

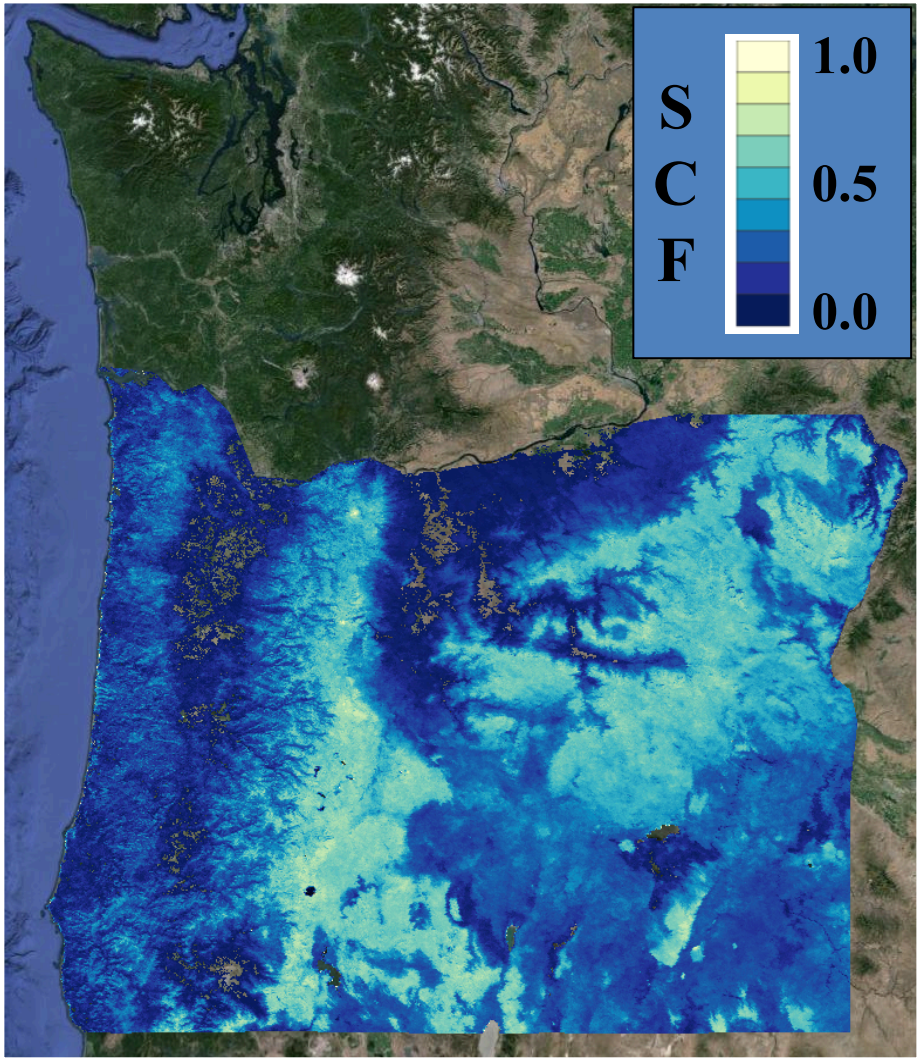
Example of Snow Cover Frequency over a 28-day period



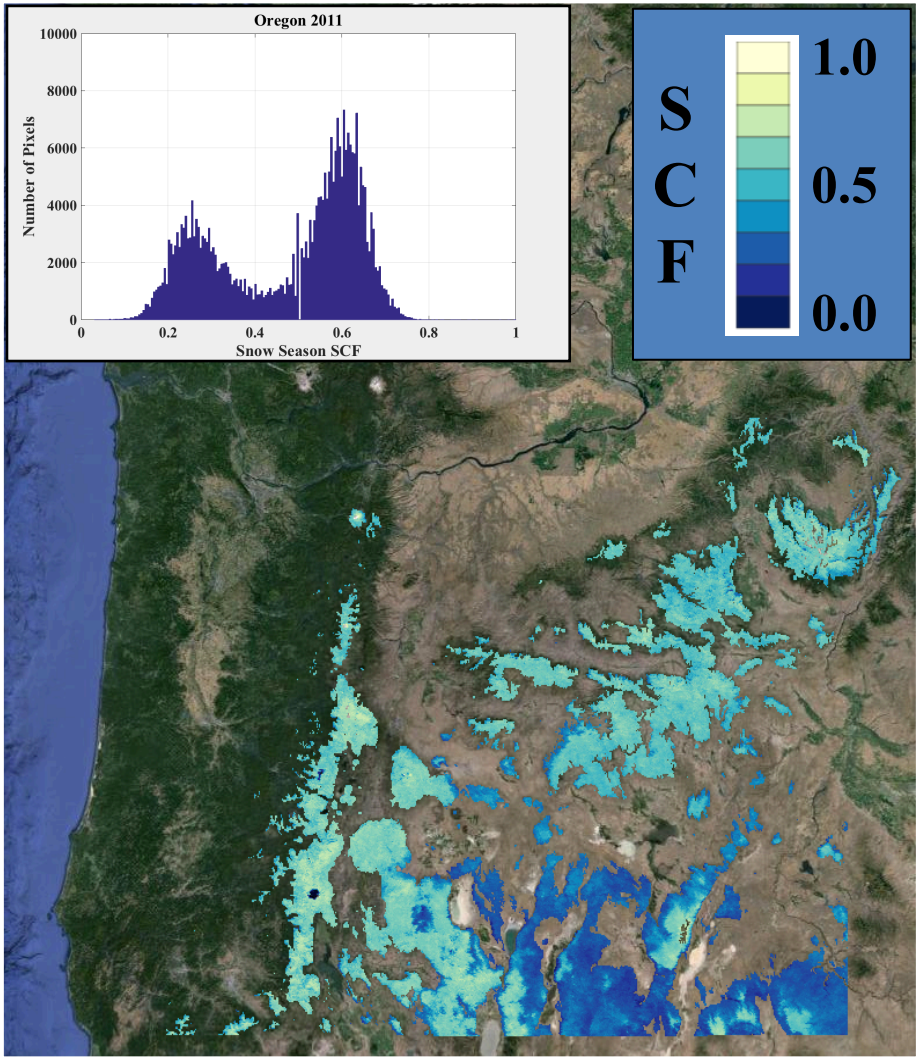
Polygon subsetting: draw (or import shapefile)



Oregon Oct 1 – Apr 1, 2011



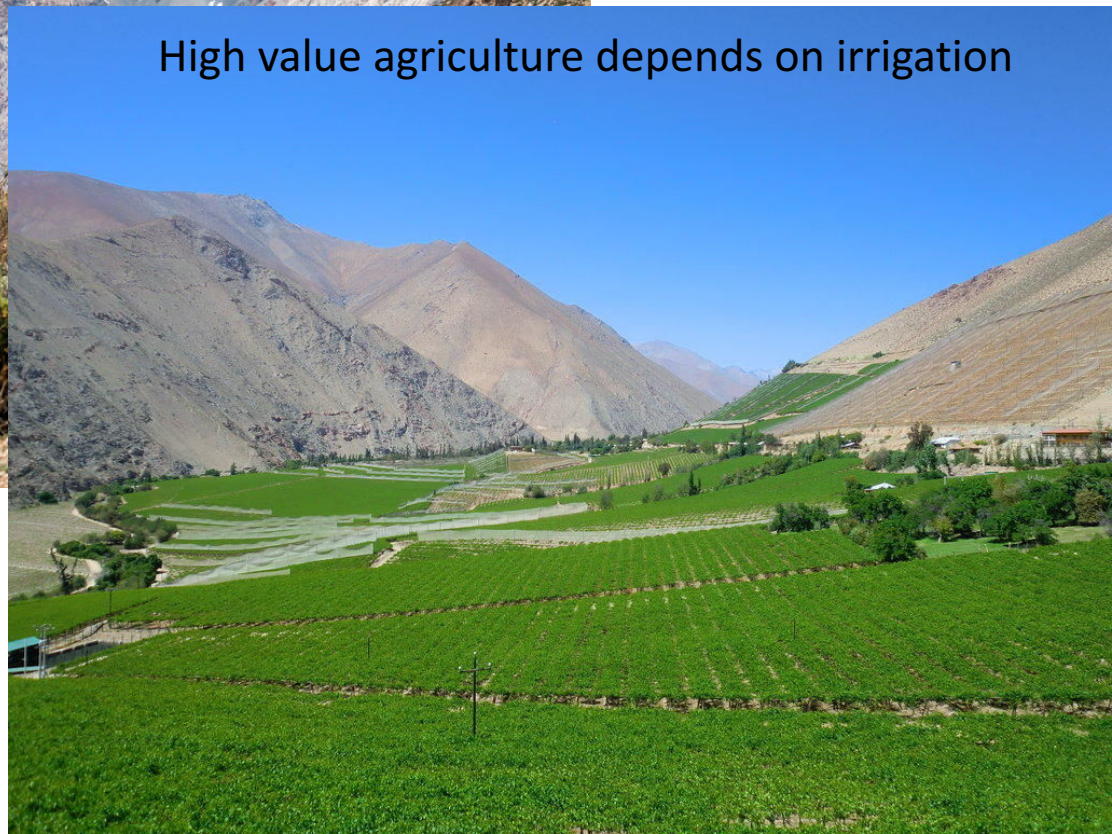
1500 m – 2500 m elev. band



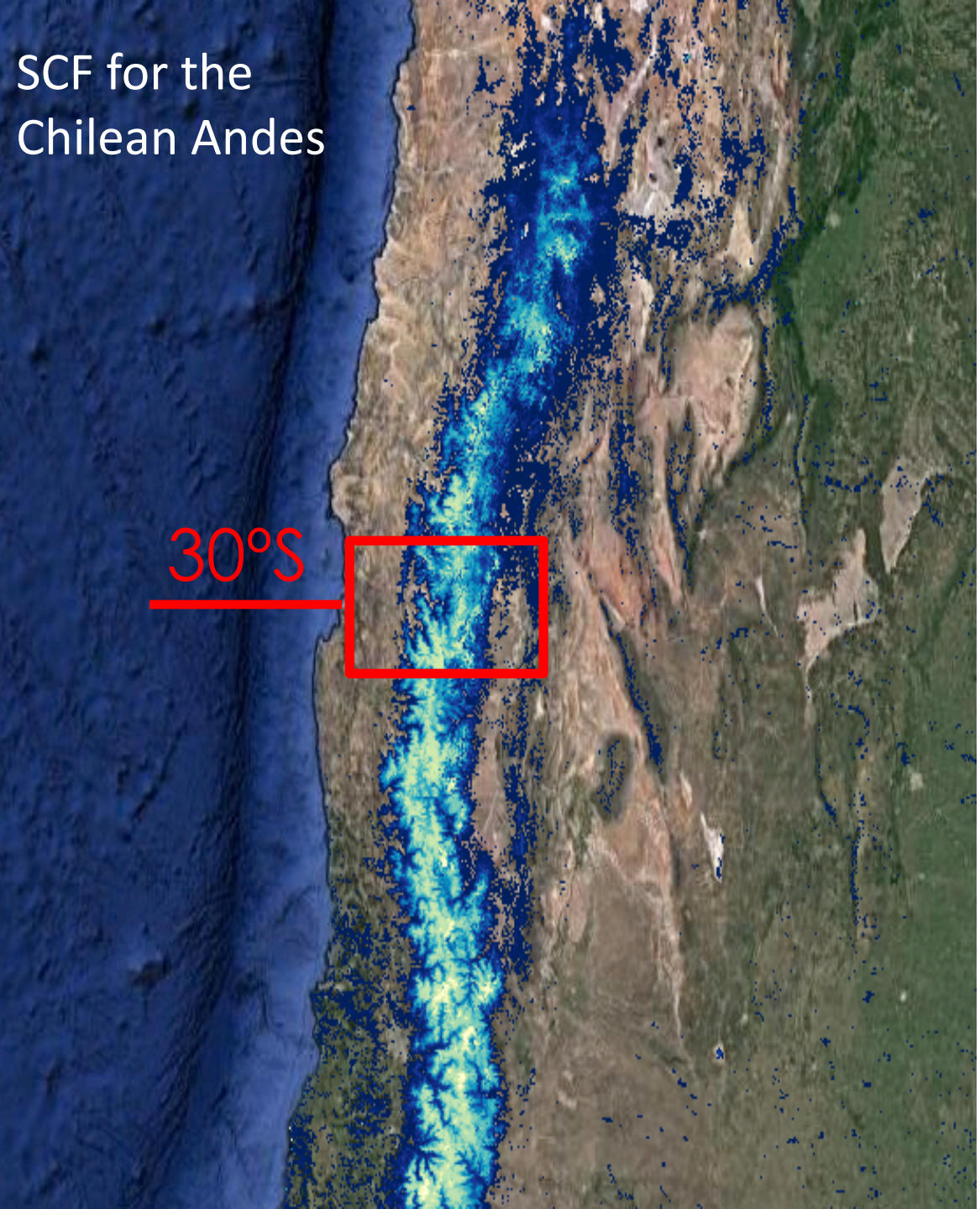
Examples of Applications

1. Streamflow forecasting (SCF + hydro model)
2. Post-fire vegetation recovery and snow (SCF)
3. Identifying temperature thresholds for snow vs. rain (Snowstorm temperature)
4. Potential impacts of future climate change on watersheds (“At-risk” snow, FWW)
5. Potential impacts of future climate change on ski areas (FWW)

Streamflow forecasting in a snow-dominated watershed using SCF as input to a simple, statistical model



Sproles et al. 2016
Water Resources Management



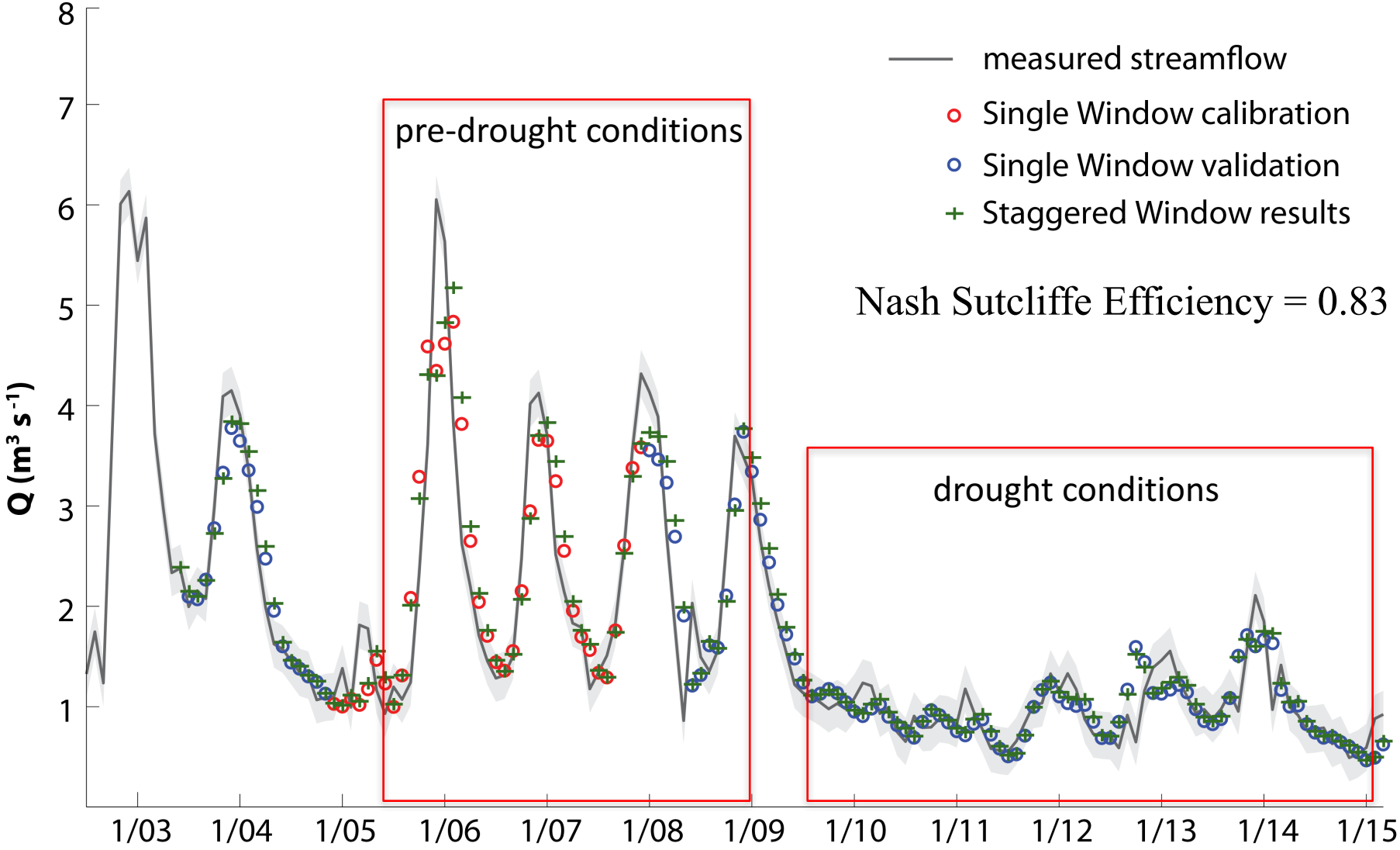
Input data

- Prior monthly mean streamflow
- Prior monthly **SCF** for the watershed

Output data

- Next month's mean streamflow

La Laguna, Chile
Measured and Modeled Monthly Mean Streamflow



See: http://mountains.ceoas.oregonstate.edu/snowcloud/

http://mountains.ceoas.oregonstate.edu/snowcloud/

The OSU Mountain Hydroclimatology Research Group

Snow – Ice – Climate – Hydrology – Communities

Home | Welcome | SnowCloud | Research | People | Recent Publications | Links | Nolin CV

SnowCloud

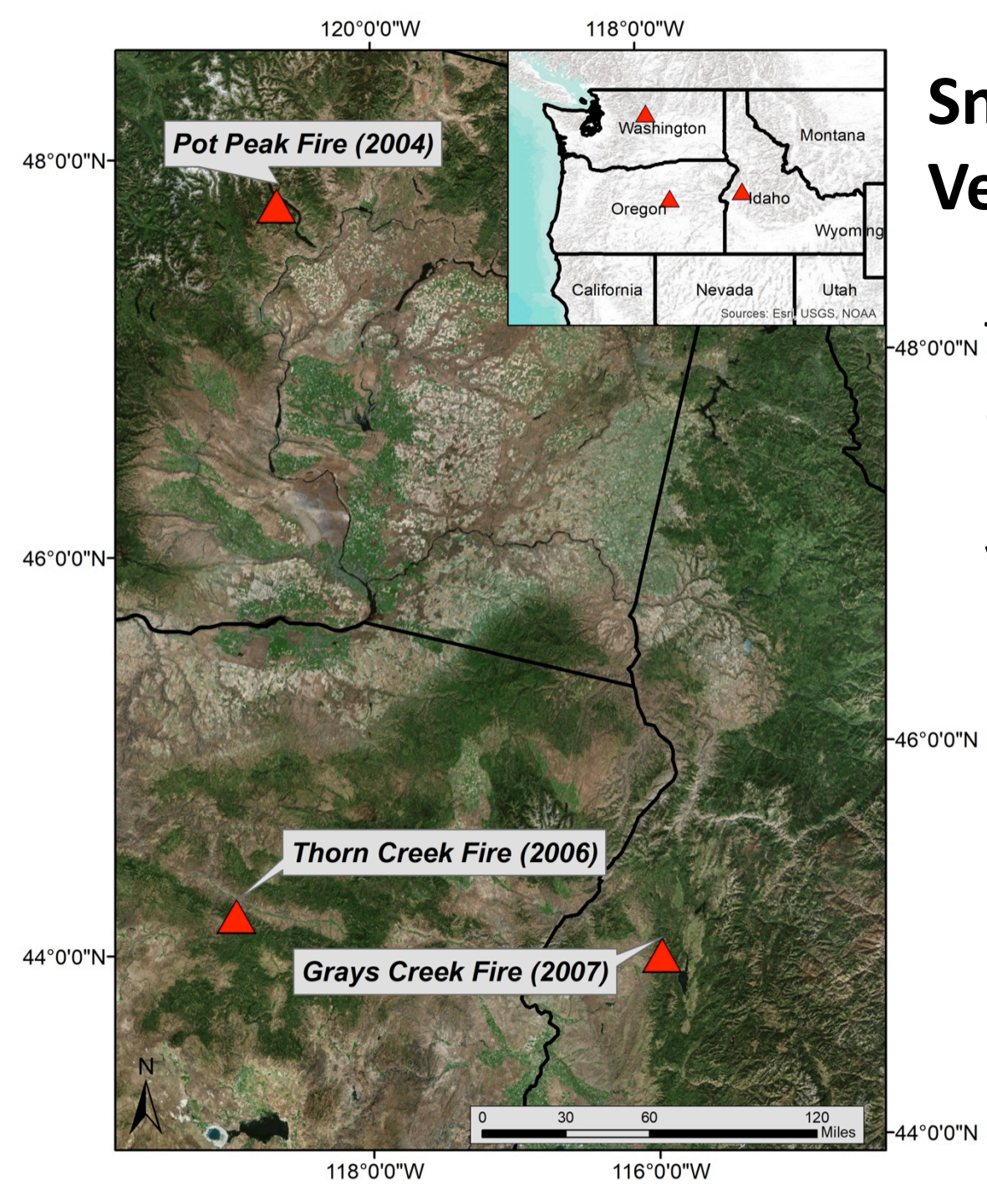
¡Haga clic aquí para la versión en español!

How do you predict streamflow in the absence of field data?
This challenge is particularly vexing in snowy mountain regions. Critical data are often absent and prediction efforts are hampered by lack of timely snow data. Predicting low flows is particularly important where water resources are limited.

Remote sensing, cloud computing, and interactive web-based mapping tools offer a new paradigm for delivering key streamflow data to water resource managers.

LATEST NEWS

- Nolin to join UNR as Director of Hydrologic Sciences program
- March 17-25 Nolin and Cosgrove complete snow surveys in Alaska
- Nolin hosts Mountain Sentinels workshop in Bend, Oregon
- Chris Cosgrove receives a



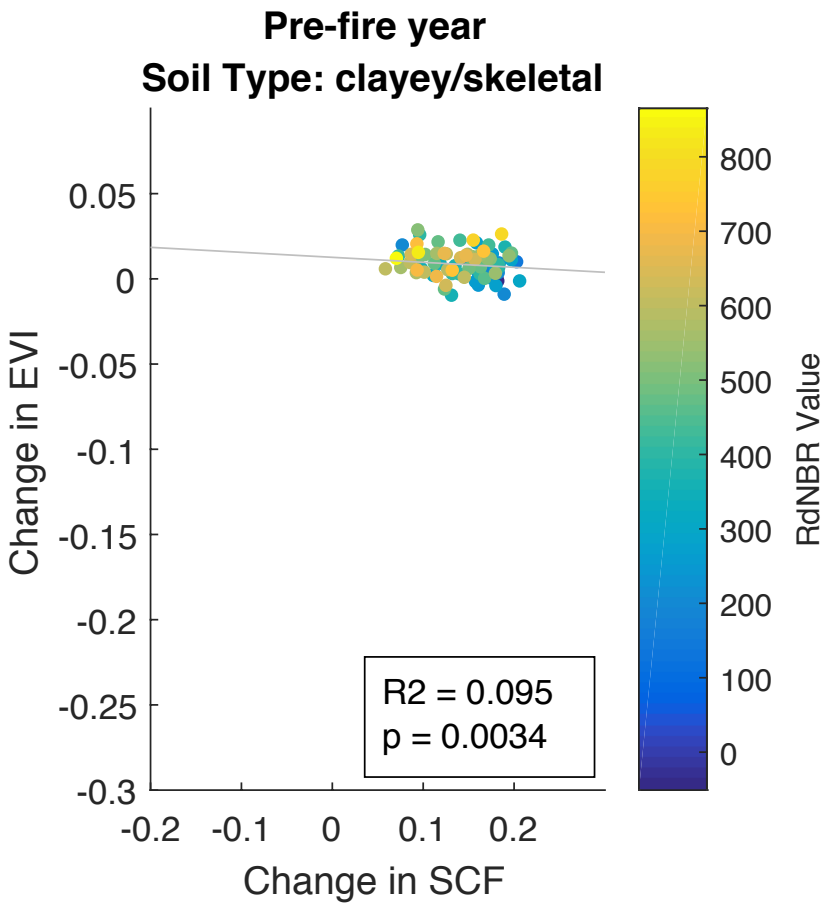
Snow and Post-fire Vegetation Recovery

Thorn Creek (2006)
Grays Creek (2007)

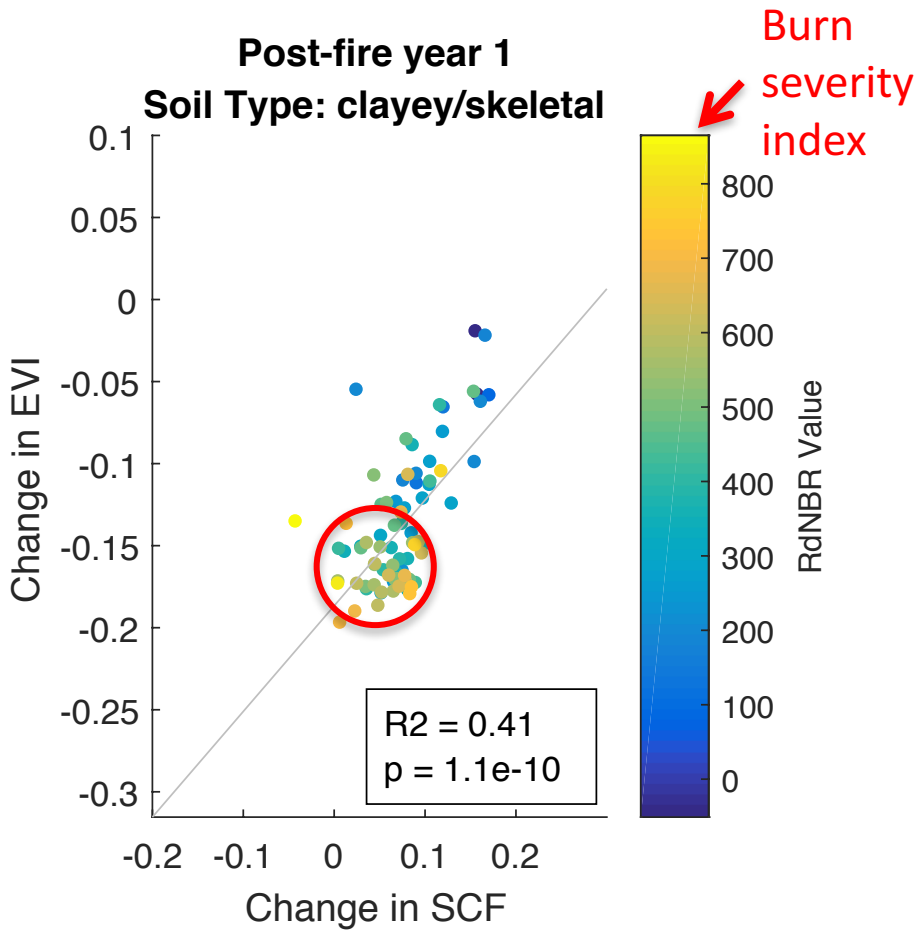
Variables:

- Max summer greenness (from MODIS EVI)
- Prior winter SCF
- Soil type
- Land cover type
- Burn severity

Grays Creek Fire: ΔGreenness vs. ΔSCF

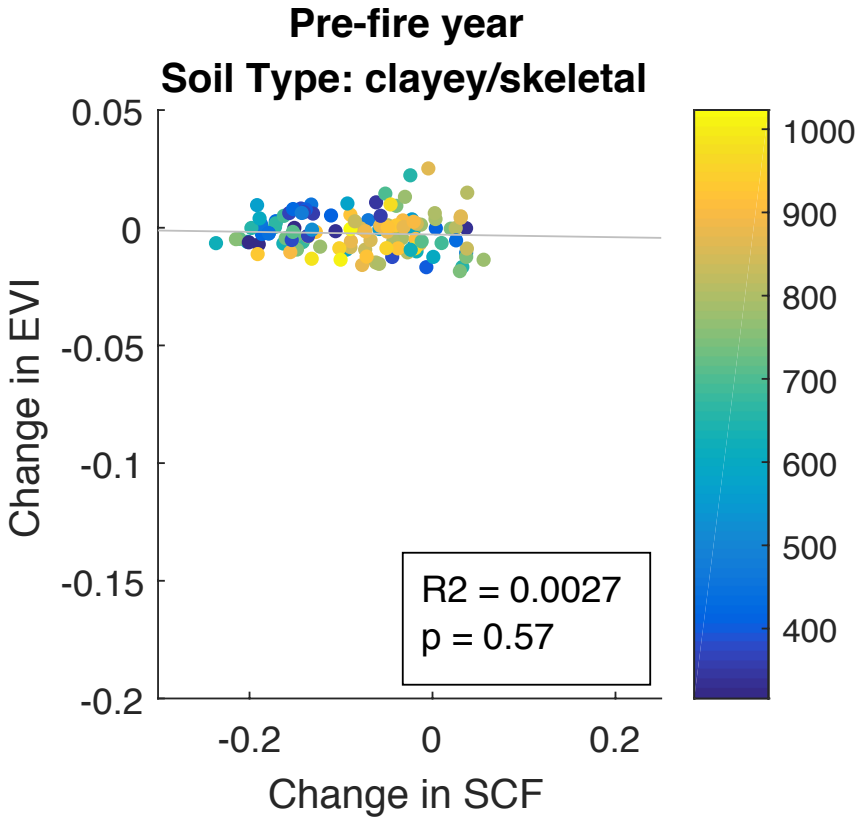


Pre-fire ΔEVI vs. ΔSCF; the relationship is not significant

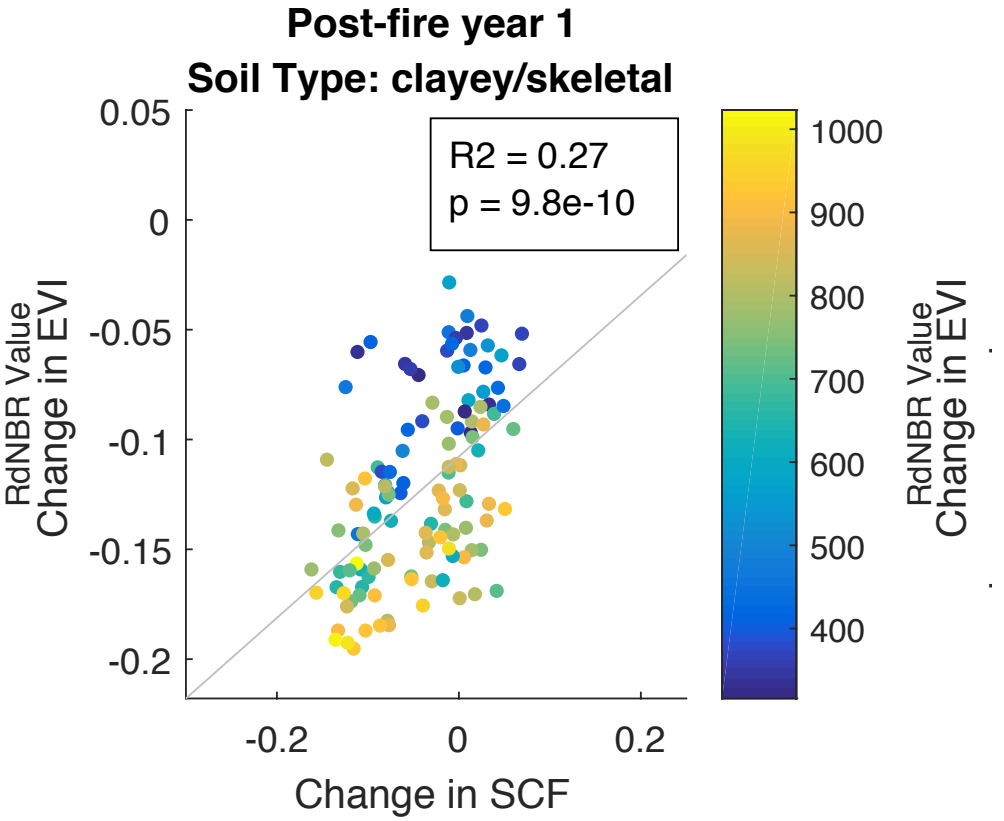


Year 1 post-fire ΔSCF explains **41%** of variance in ΔEVI

Thorn Creek Fire: ΔGreenness vs. ΔSCF

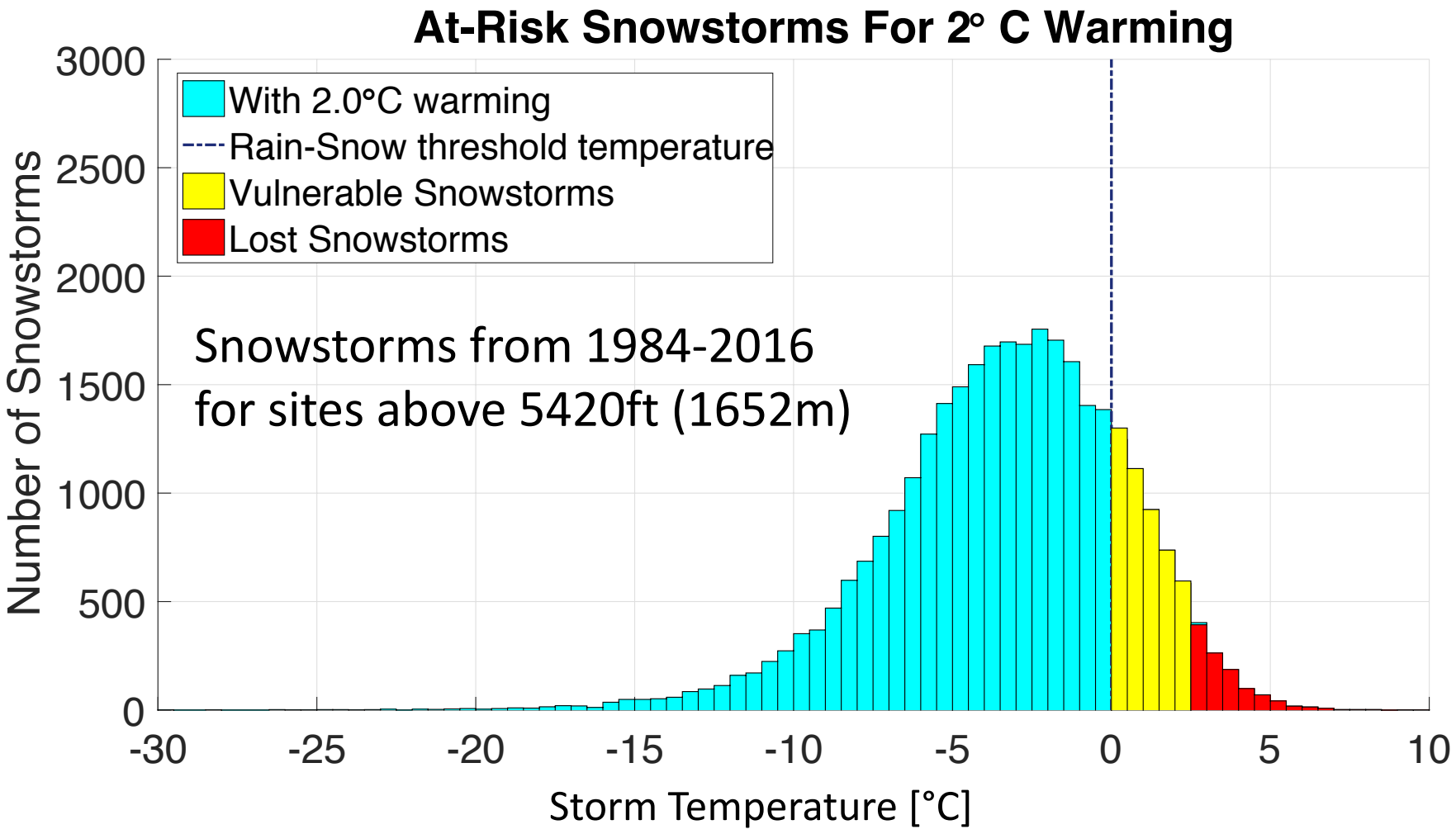


Pre-fire ΔEVI vs. ΔSCF; the relationship is not significant

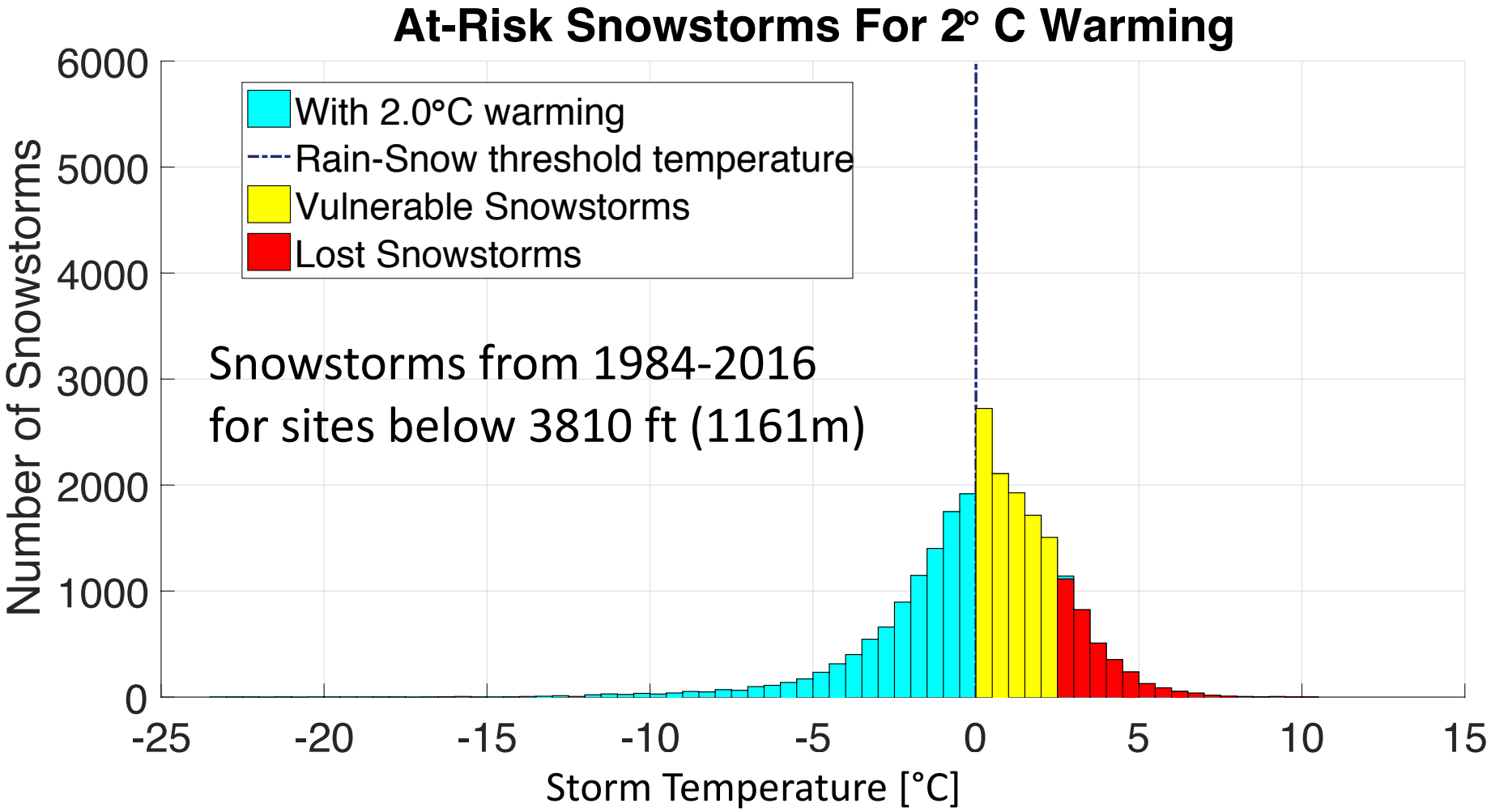


Year 1 post-fire ΔSCF explains **27%** of variance in ΔEVI

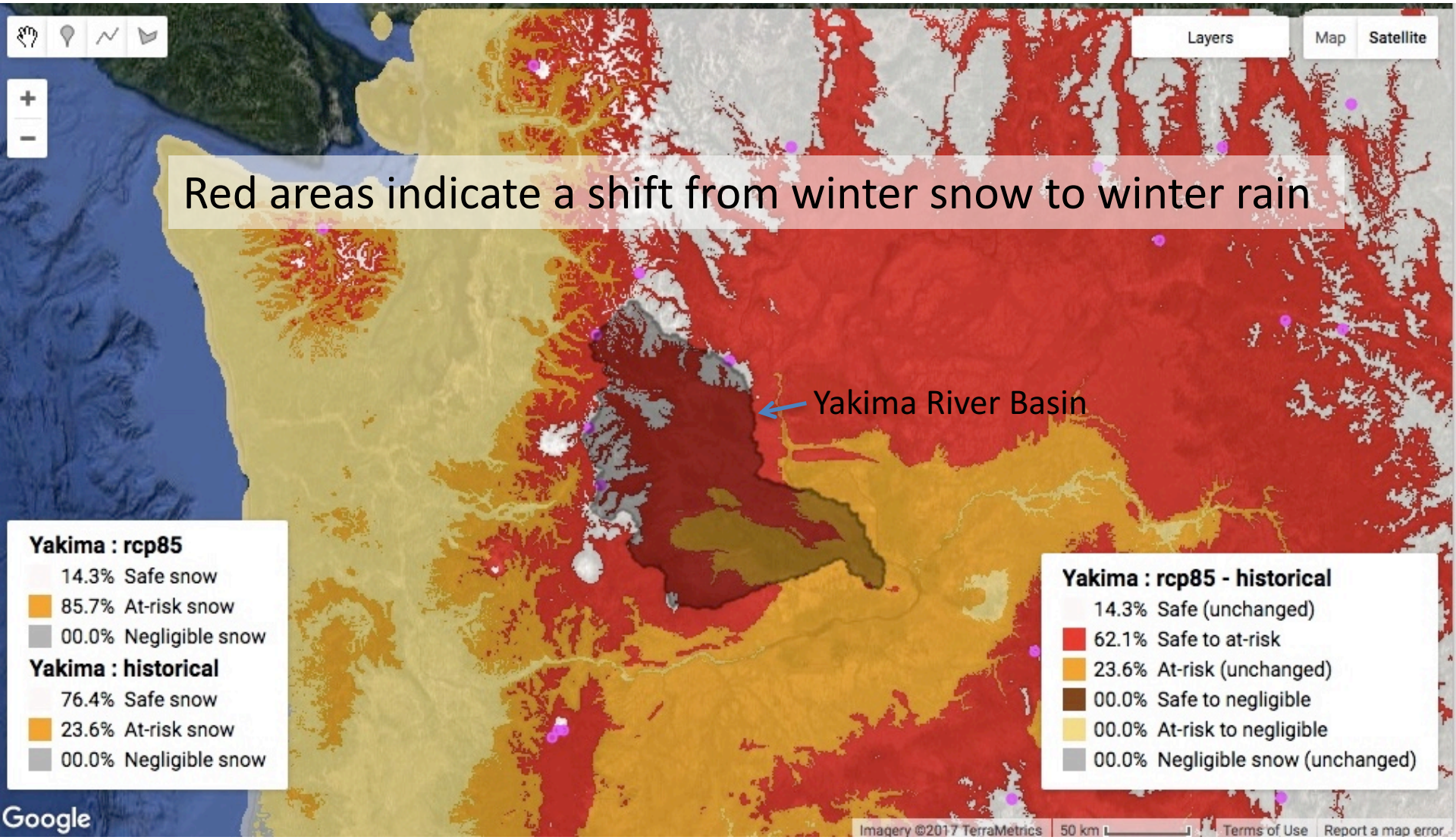
Snowstorm Temperatures: PNW High Elevation



Snowstorm Temperatures: PNW Low Elevation



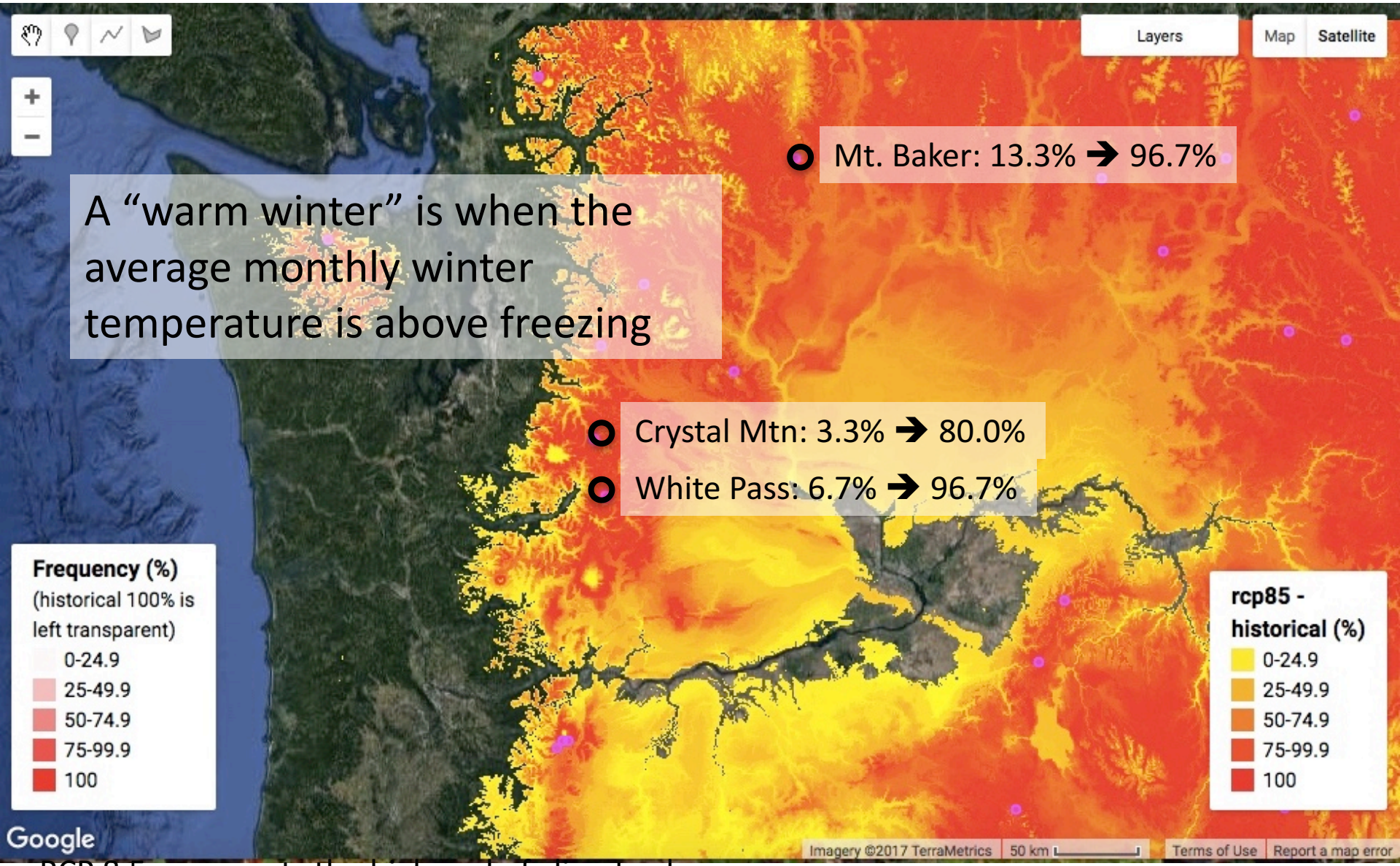
Historical and Future: Modeled “At-risk” Snow



RCP 8.5 represents the high end of climate change

Historical period is for 1970-1999; Future period is for 2079-2099

Historical and Future: Modeled Freq. Warm Winters



RCP 8.5 represents the high end of climate change

Historical period is for 1970-1999; Future period is for 2079-2099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Thank you.
Questions, please
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