MODIS and VIIRS

Data metrics and use cases

by Kara Gergely and Paul Moth

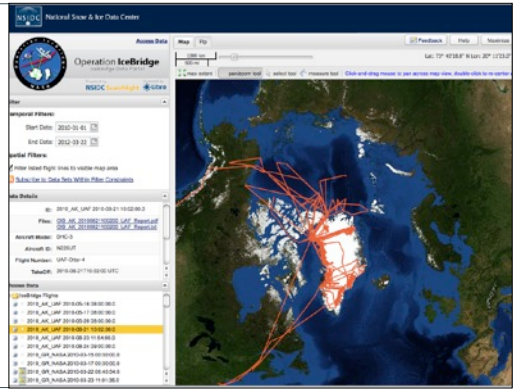
NSIDC National Snow and Ice Data Center
Advancing knowledge of Earth's frozen regions

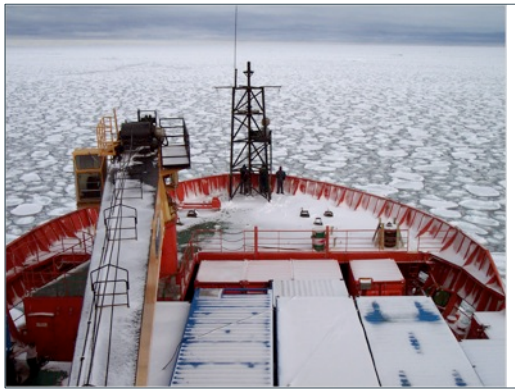
CIRES

National Snow and Ice Data Center

manages and distributes scientific data

provides tools for data access





researches the cryosphere and data science

supports local and traditional knowledge

supports data users

educates the public about the cryosphere

ICSU WORLD DATA SYSTEM CIRES NASA NSF NSIDC

Affiliations

CIRES Cooperative Institute for Research in Environmental Sciences

University of Colorado Boulder

World Data System

ICSU WORLD DATA SYSTEM

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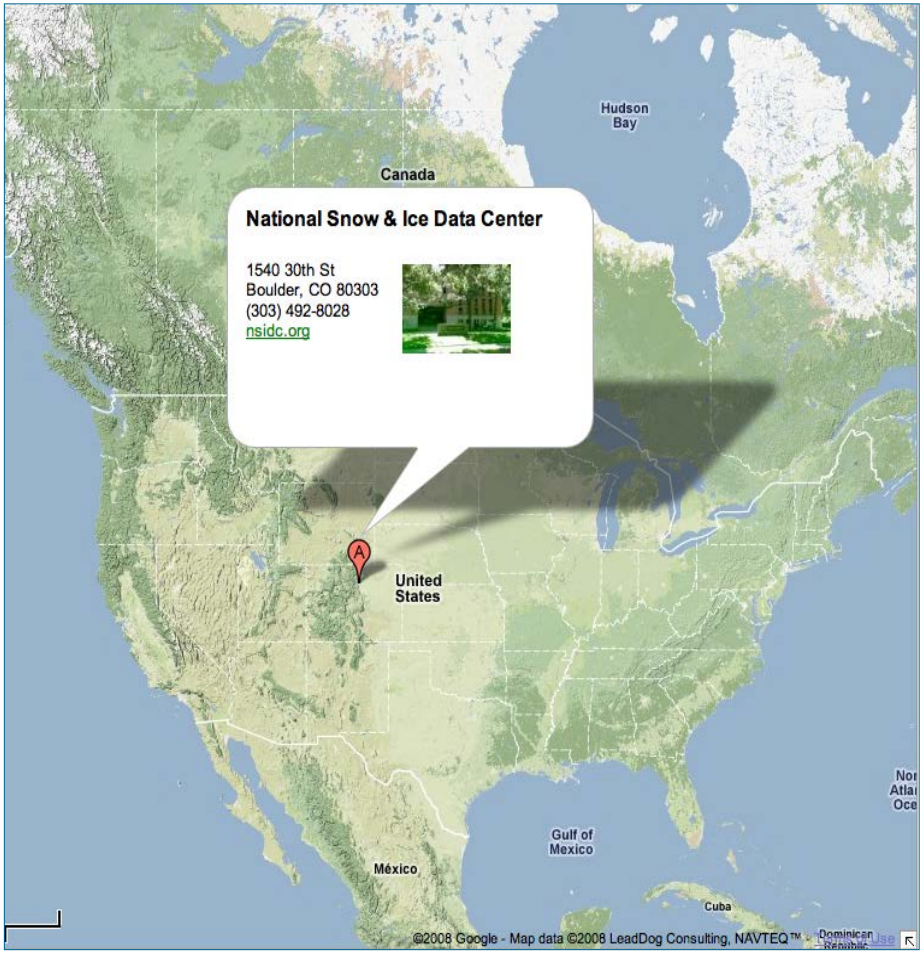
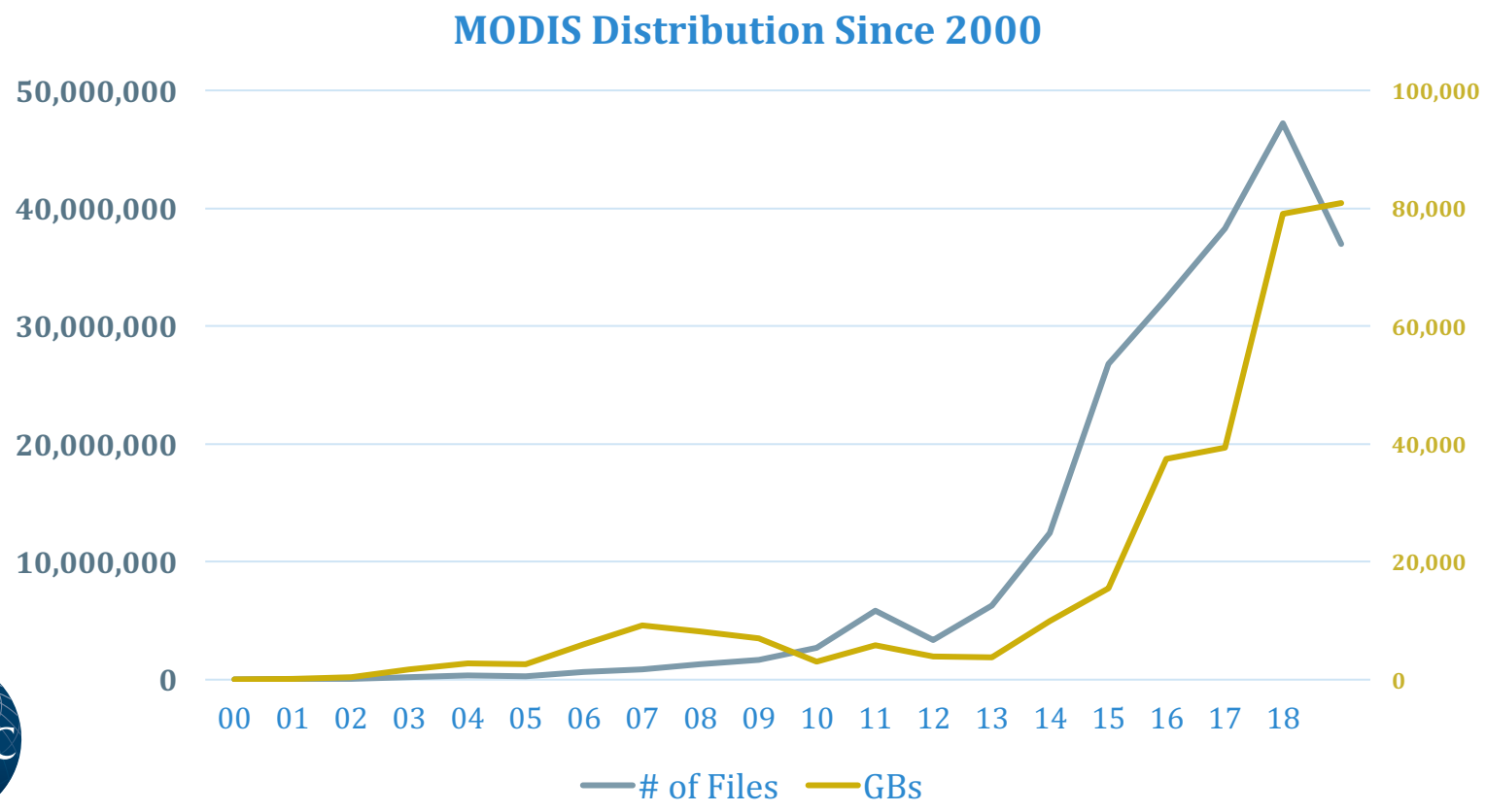


MODIS Global Distribution

- 316,000 GBs and 217 million science files distributed since 2000

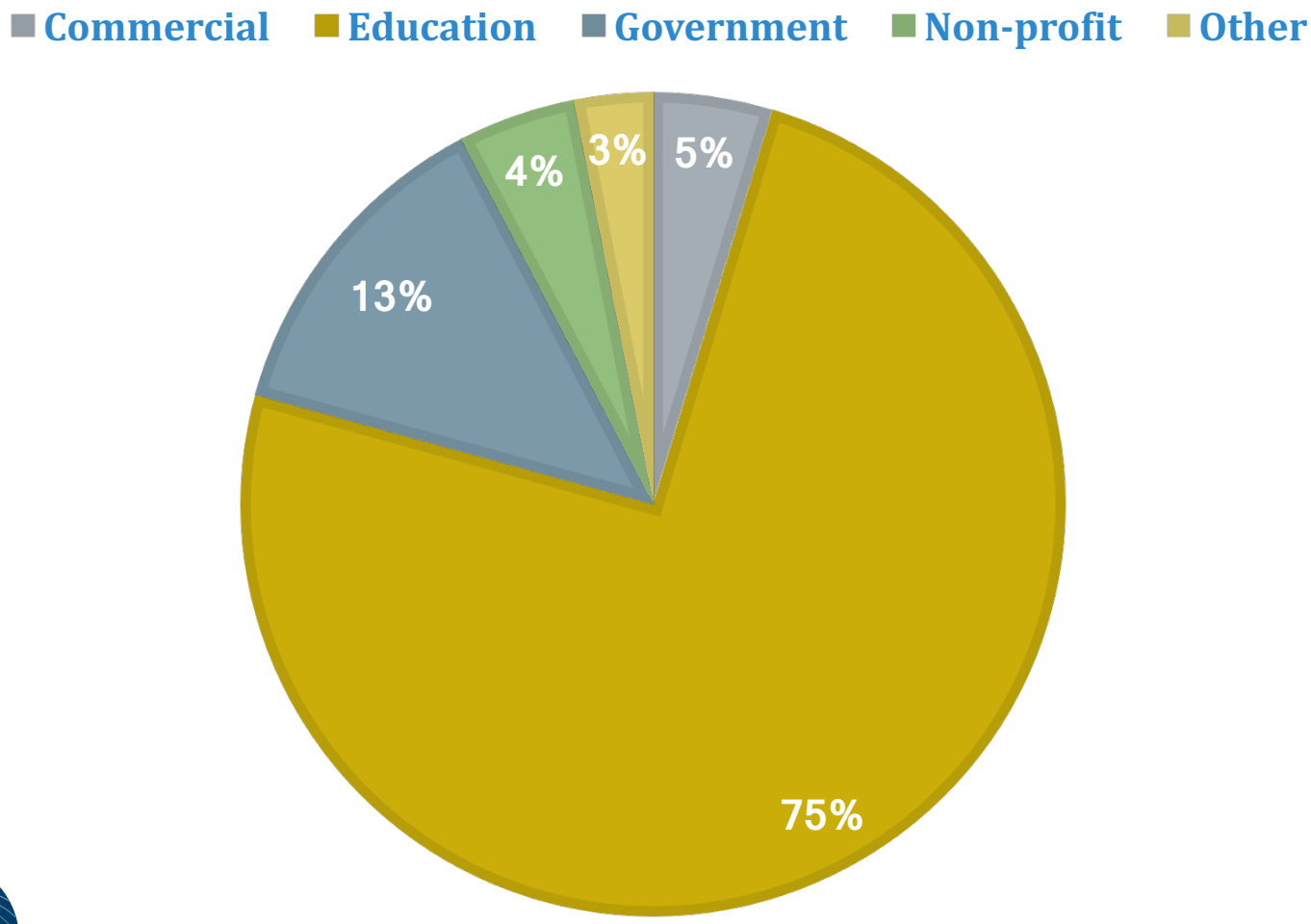


MODIS Global Distribution

- Distributed to ~125 countries since 2000

Top 10	# of Users
United States	3935
China	2842
Iran	1134
Germany	854
United Kingdom	798
Canada	717
Pakistan	624
Italy	601
India	538
Chile	423

MODIS Global Distribution



MODIS Users by Product

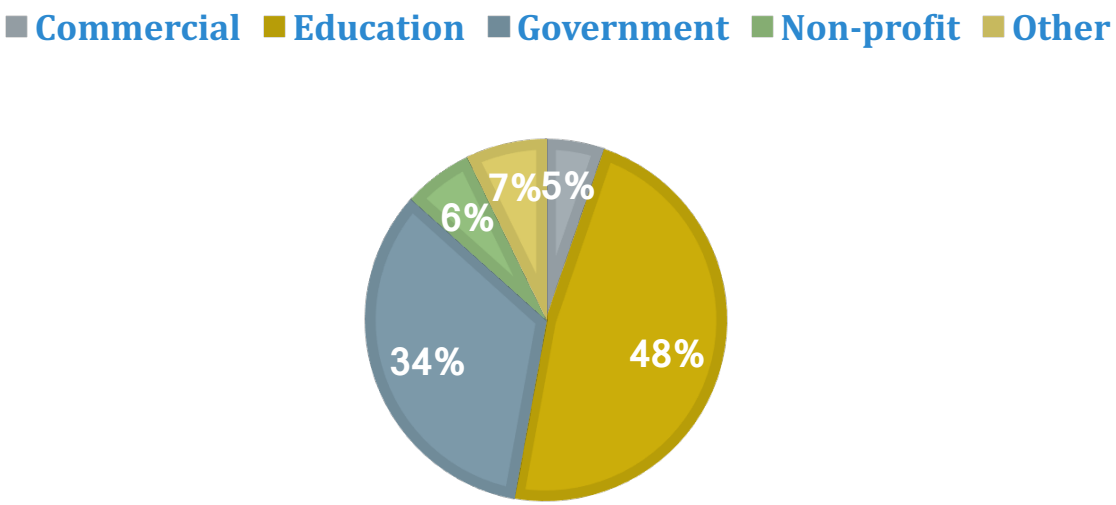
- 4974 MODIS users in prior year

Shortname	Longname	# of Users
MOD10_L2	MODIS/Terra Snow Cover 5-Min L2 Swath 500m	238
MOD10A1	MODIS/Terra Snow Cover Daily L3 Global 500m Grid	2,356
MOD10A2	MODIS/Terra Snow Cover 8-Day L3 Global 500m Grid	1,388
MOD10C1	MODIS/Terra Snow Cover Daily L3 Global 0.05Deg CMG	295
MOD10C2	MODIS/Terra Snow Cover 8-Day L3 Global 0.05Deg CMG	143
MOD10CM	MODIS/Terra Snow Cover Monthly L3 Global 0.05Deg CMG	594
MOD29	MODIS/Terra Sea Ice Extent 5-Min L2 Swath 1km	130
MOD29E1D	MODIS/Terra Sea Ice Extent and IST Daily L3 Global 4km EASE-Grid Day	80
MOD29P1D	MODIS/Terra Sea Ice Extent Daily L3 Global 1km EASE-Grid Day	108
MOD29P1N	MODIS/Terra Sea Ice Extent Daily L3 Global 1km EASE-Grid Night	22
MYD10_L2	MODIS/Aqua Snow Cover 5-Min L2 Swath 500m	70
MYD10A1	MODIS/Aqua Snow Cover Daily L3 Global 500m Grid	775
MYD10A2	MODIS/Aqua Snow Cover 8-Day L3 Global 500m Grid	200
MYD10C1	MODIS/Aqua Snow Cover Daily L3 Global 0.05Deg CMG	110
MYD10C2	MODIS/Aqua Snow Cover 8-Day L3 Global 0.05Deg CMG	47
MYD10CM	MODIS/Aqua Snow Cover Monthly L3 Global 0.05Deg CMG	198
MYD29	MODIS/Aqua Sea Ice Extent 5-Min L2 Swath 1km	99
MYD29E1D	MODIS/Aqua Sea Ice Extent and IST Daily L3 Global 4km EASE-Grid Day	67
MYD29P1D	MODIS/Aqua Sea Ice Extent Daily L3 Global 1km EASE-Grid Day	70
MYD29P1N	MODIS/Aqua Sea Ice Extent Daily L3 Global 1km EASE-Grid Night	32

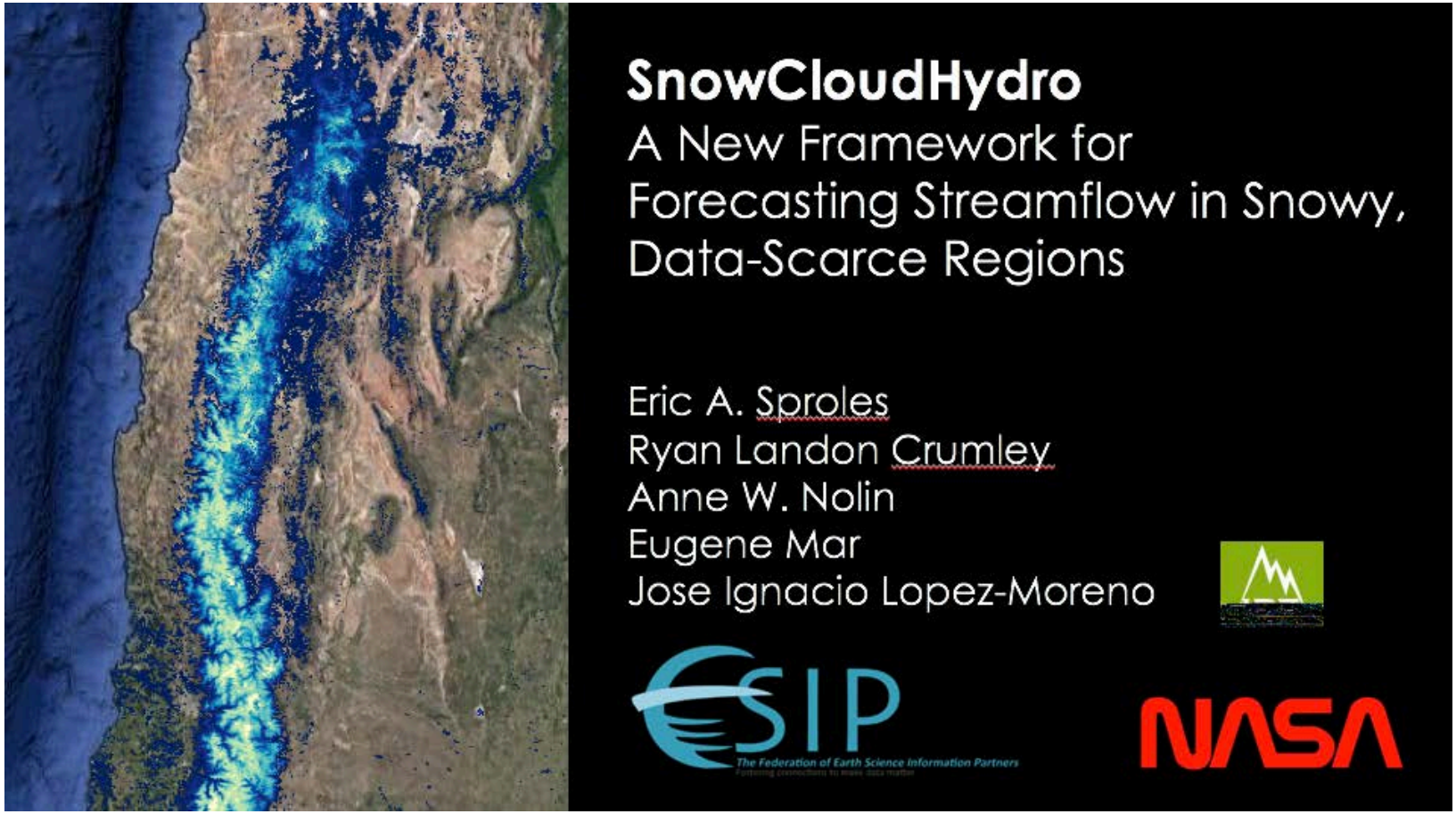
VIIRS Distribution Since 2017

- 240,000 GBs and 204,232 science files distributed to 19 countries

	# of Users	Volume (GBs)	Files
VIIRS	95	14003	204,232
VNP10	55	1385	55,030
VNP29	18	8760	98,660
VNP30	36	3858	50,542



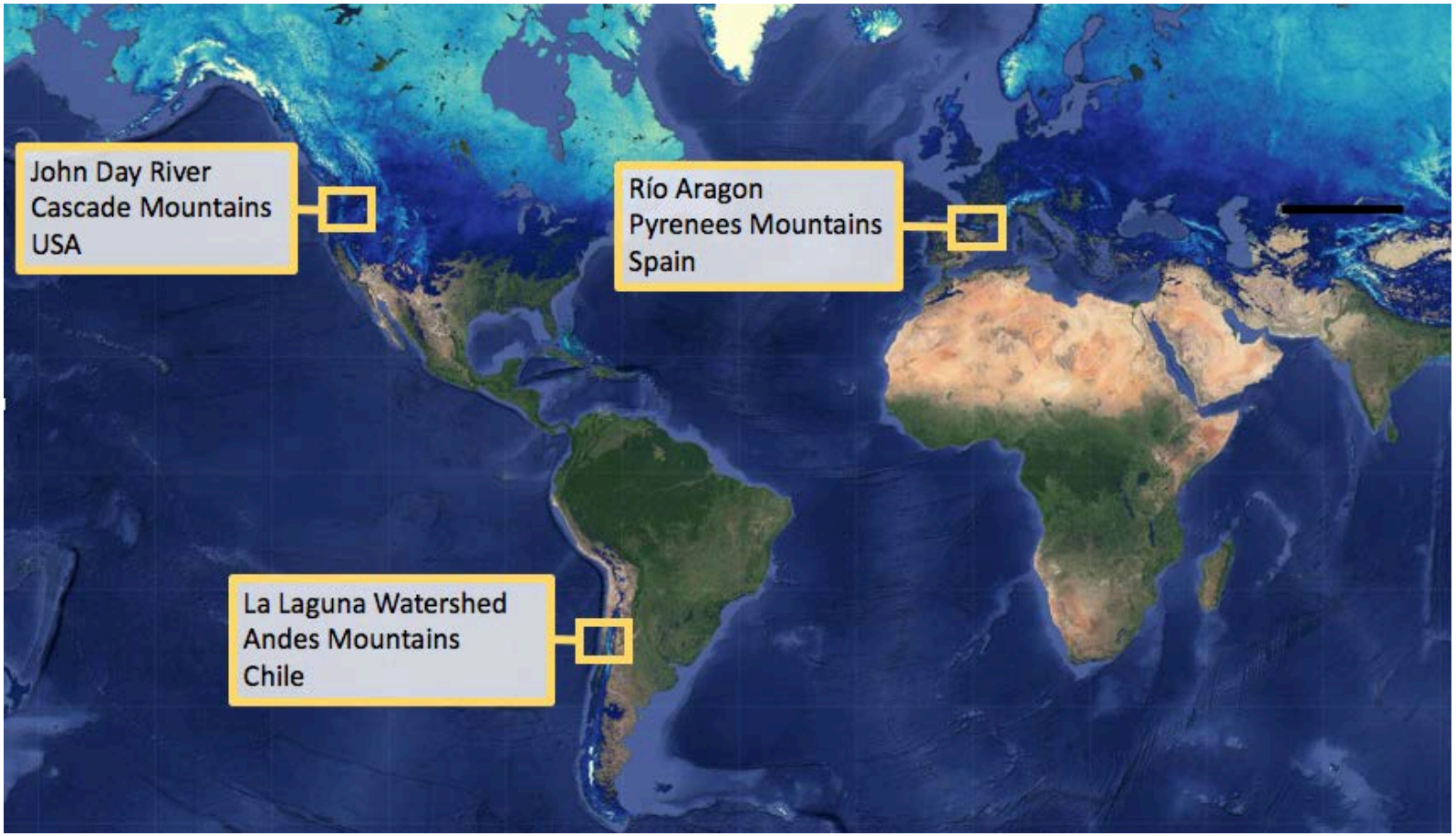
NSIDC MODIS Use Case



NSIDC MODIS Use Case

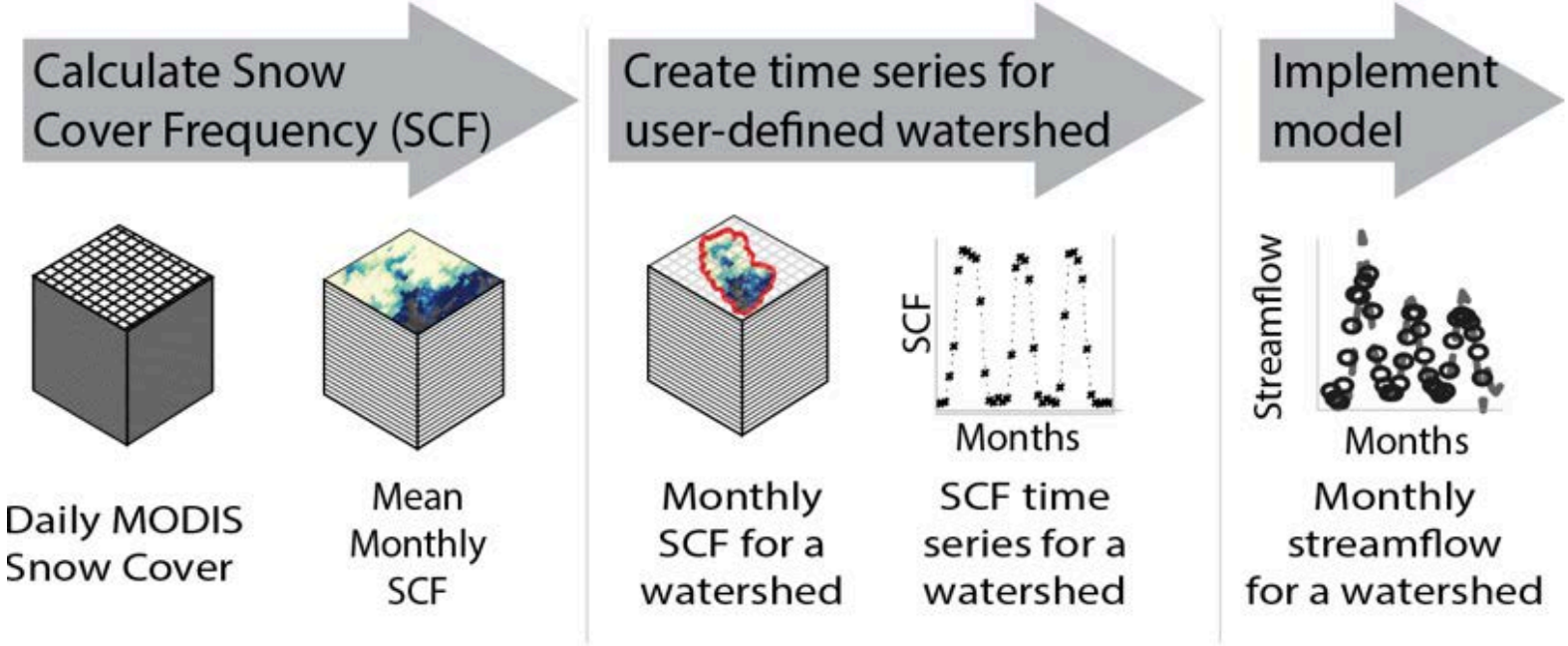
- Using Google Earth Engine to assess monthly snow cover frequency and previous months streamflow to predict the next months stream flow (Sproles et al., 2016)
- Assist water managers, scientists, and local populations in determining stream flow for water storage, agriculture, water use, etc.
- Cloud is particularly useful in these remote regions where data and bandwidth are inconsistent or unavailable

NSIDC MODIS Use Case



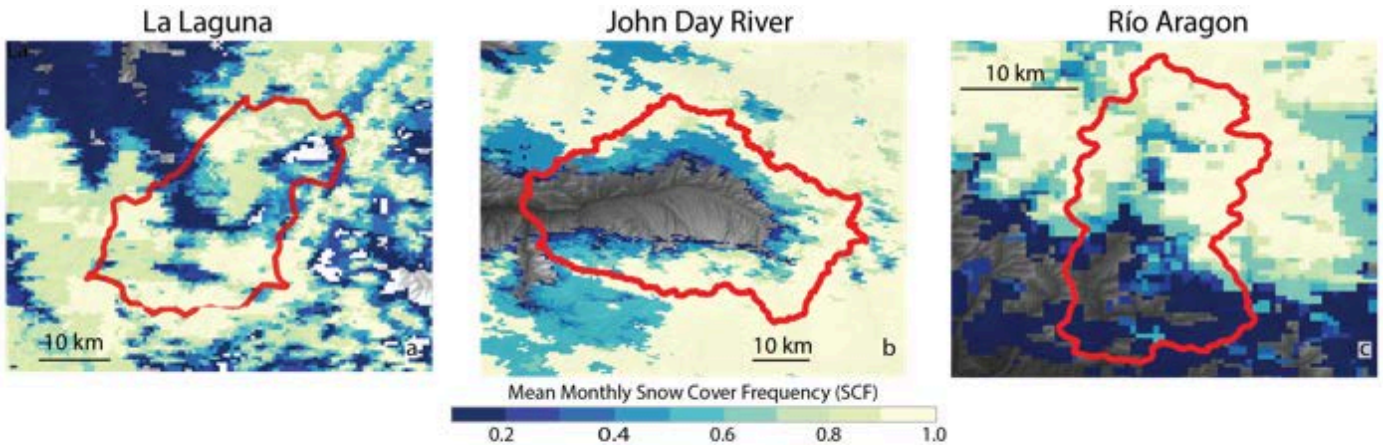
NSIDC MODIS Use Case

SnowCloudHydro a cloud-based application that transitions snowcover information from satellites into streamflow predicitions

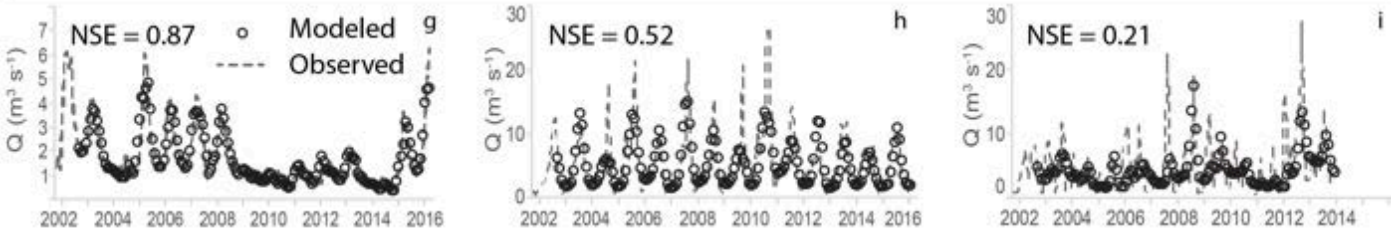


All data processing, calculations, and models are executed in the cloud

NSIDC MODIS Use Case



Mean Elevation	4300 m	Mean Elevation	1515 m	Mean Elevation	1600 m
Watershed Area	568 km^2	Watershed Area	1036 km^2	Watershed Area	242 km^2
Mean Precipitation	~250 mm yr^{-1}	Mean Precipitation	~600 mm yr^{-1}	Mean Precipitation	~800 mm yr^{-1}
OCTOBER 2015		FEBRUARY 2016		FEBRUARY 2016	
Mean SCF	68%	Mean SCF	48%	Mean SCF	54%
Min SCF	0 %	Min SCF	0 %	Min SCF	0 %
Max SCF	100%	Max SCF	100%	Max SCF	100%
StdDev SCF	31%	StdDev SCF	42%	StdDev SCF	41%
Median SCF	78% d	Median SCF	47% e	Median SCF	63% f



NSIDC MODIS Use Cases

- Wyoming Game and Fish Department using snow cover data to gauge severity of winters as it relates to big game herds

- Calibration of parameters in snow-runoff models using MODIS snow cover

Franz, K. J., & Karsten, L. R. (2013). Calibration of a distributed snow model using MODIS snow covered area data. Journal of Hydrology, 494, 160–175. https://doi.org/10.1016/j.jhydrol.2013.04.026

He, Z. H., Parajka, J., Tian, F. Q., & Blöschl, G. (2014). Estimating degree-day factors from MODIS for snowmelt runoff modeling. Hydrology and Earth System Sciences, 18(12), 4773–4789. https://doi.org/10.5194/hess-18-4773-2014

- Published research: https://nsidc.org/data/modis/research.html

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