



JPL Airborne Snow Observatory

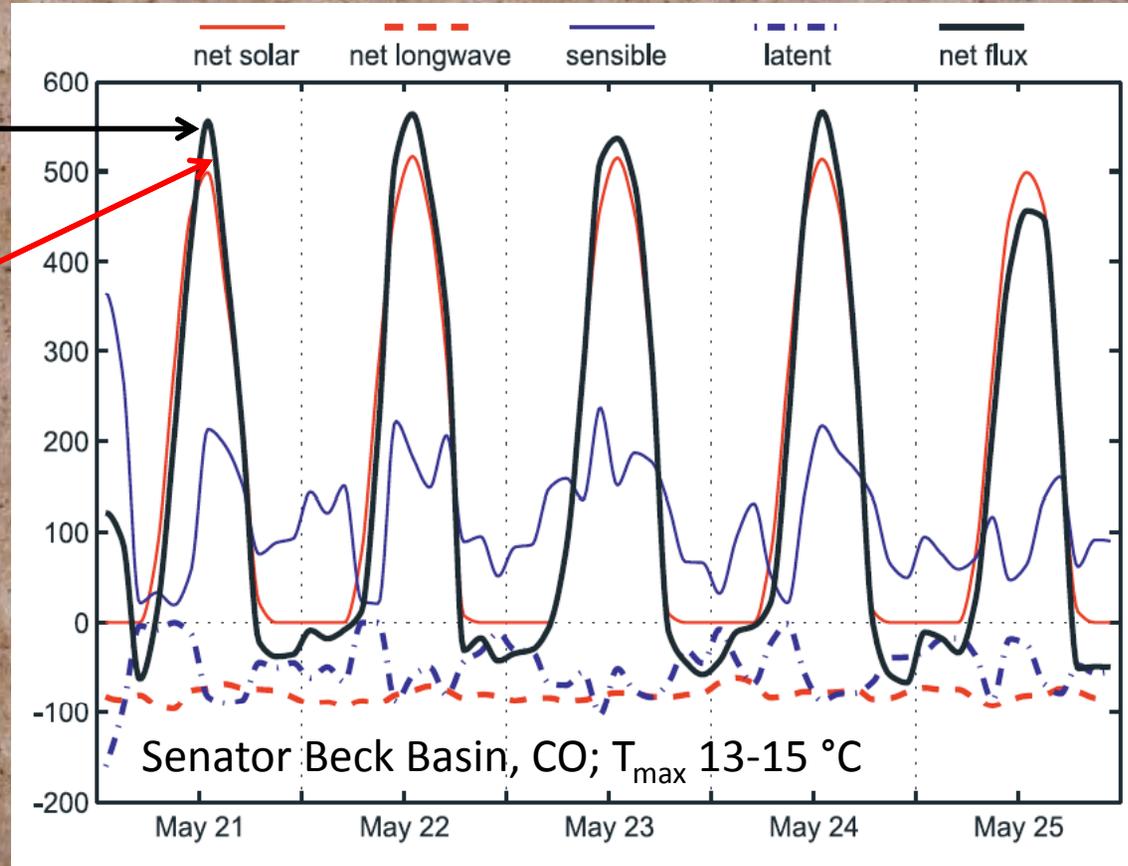
Imaging snow water equivalent and snow albedo

Principal Investigator: Thomas H. Painter, JPL/Caltech

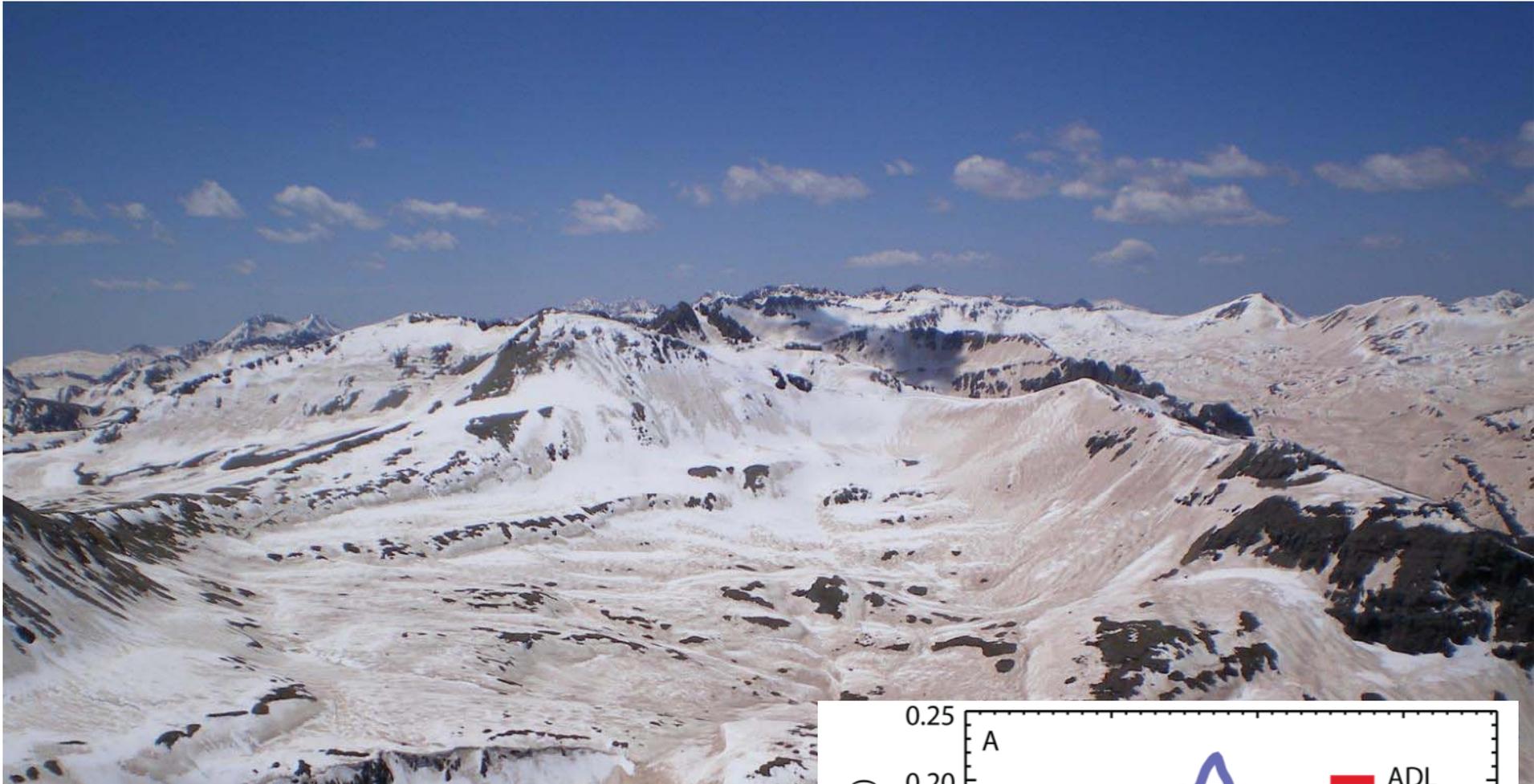
What controls snowmelt?

Energy for melting

Absorbed sunlight



Elk Range, Colorado River Basin, April 2009



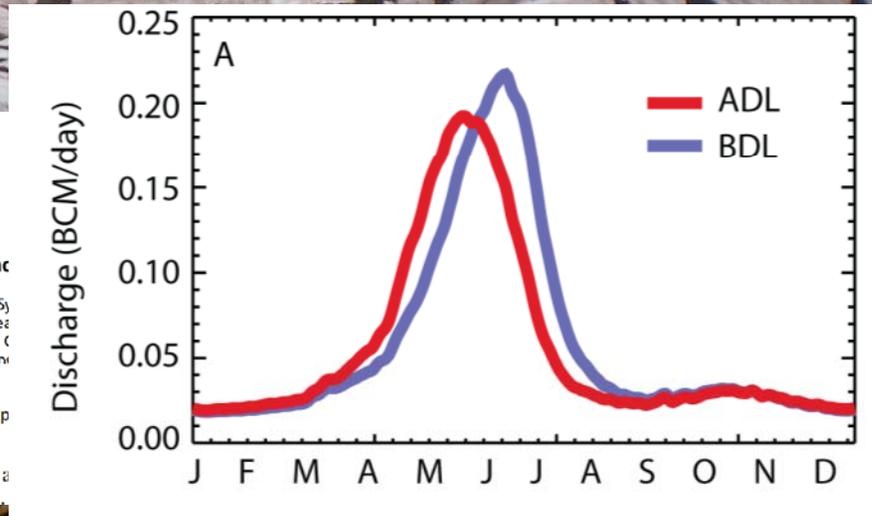
Response of Colorado River runoff to dust radiative forcing in snow

Thomas H. Painter^{a,b,1}, Jeffrey S. Deems^{c,d}, Jayne Belnap^e, Alan F. Hamlet^f, Christopher C. Lang

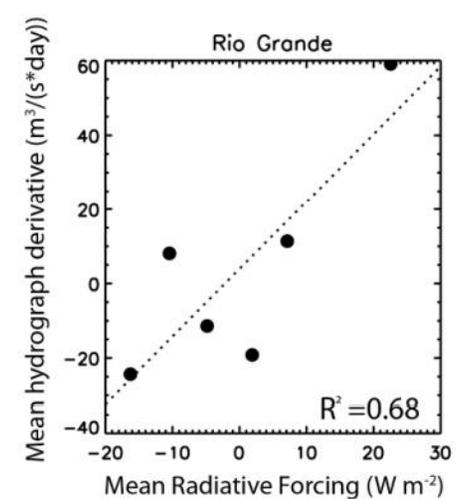
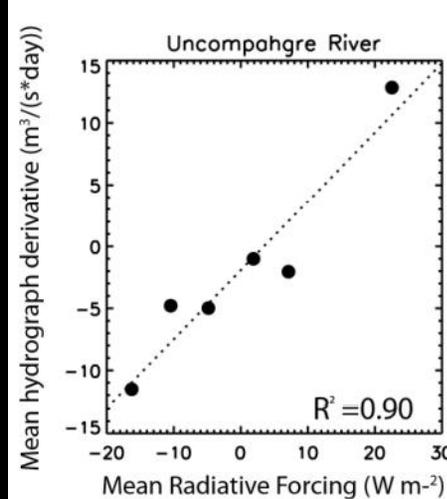
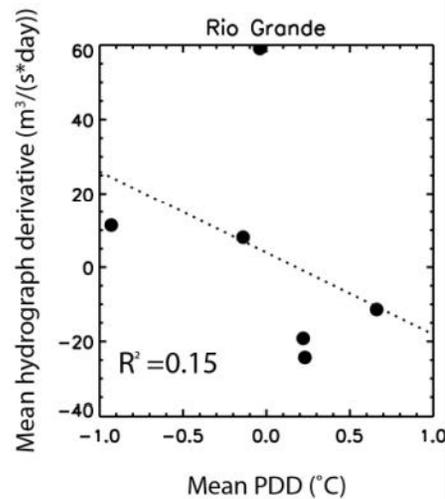
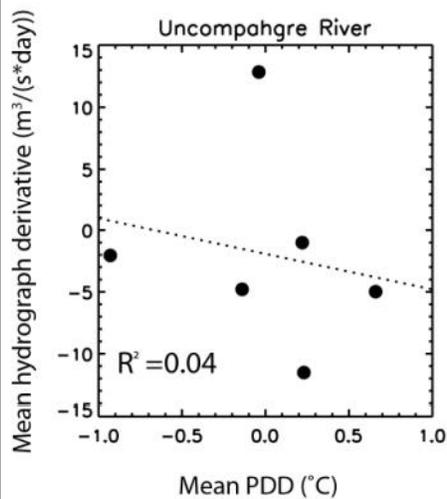
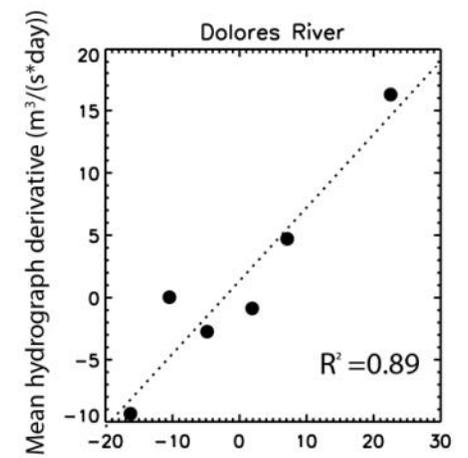
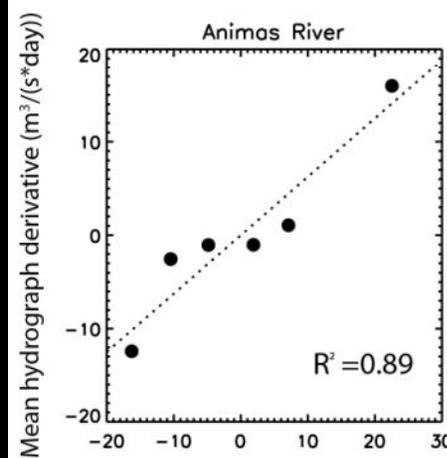
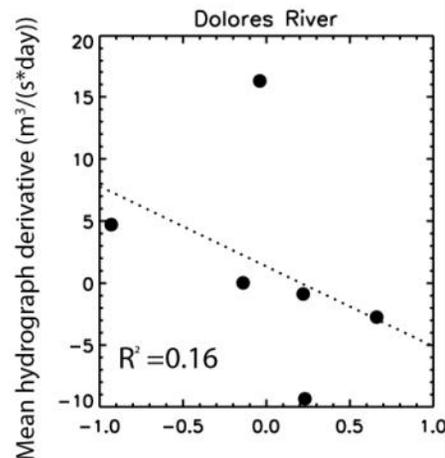
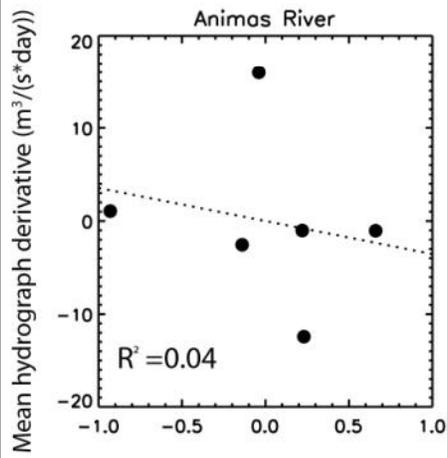
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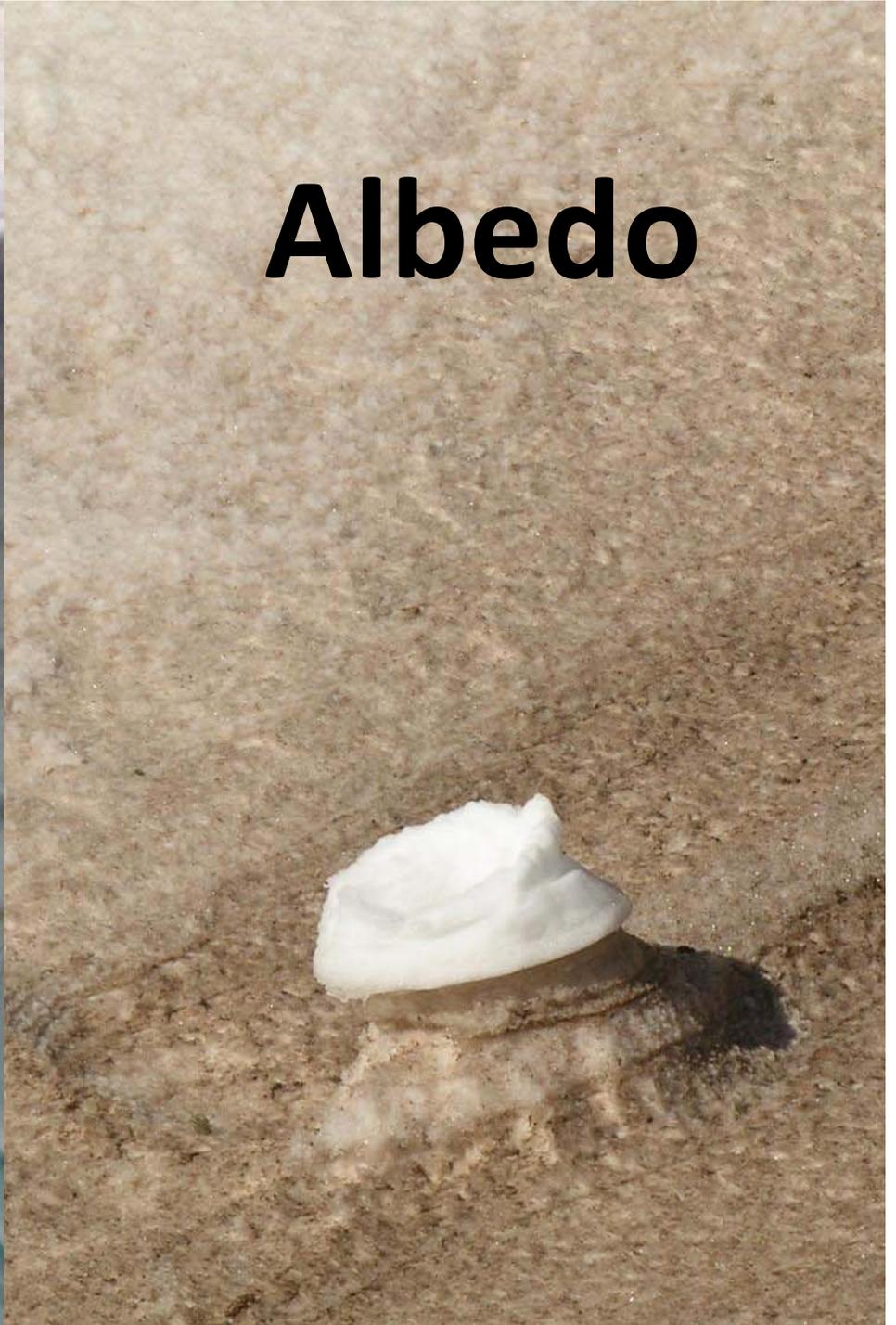
Edited by Peter H. Gleick, Pacific Institute for Studies in Development, Environment, and Security, Oakland, CA, and approved for publication November 12, 2009

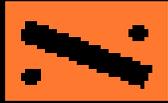
The waters of the Colorado River serve 27 million people in seven states and two countries but are overallocated by more than 10% through dust's direct absorption and accelerated snow metamorphism.



Explain steepness of rising limb







Manual measurement of SWE (snow water equivalent), started in the Sierra Nevada in 1910



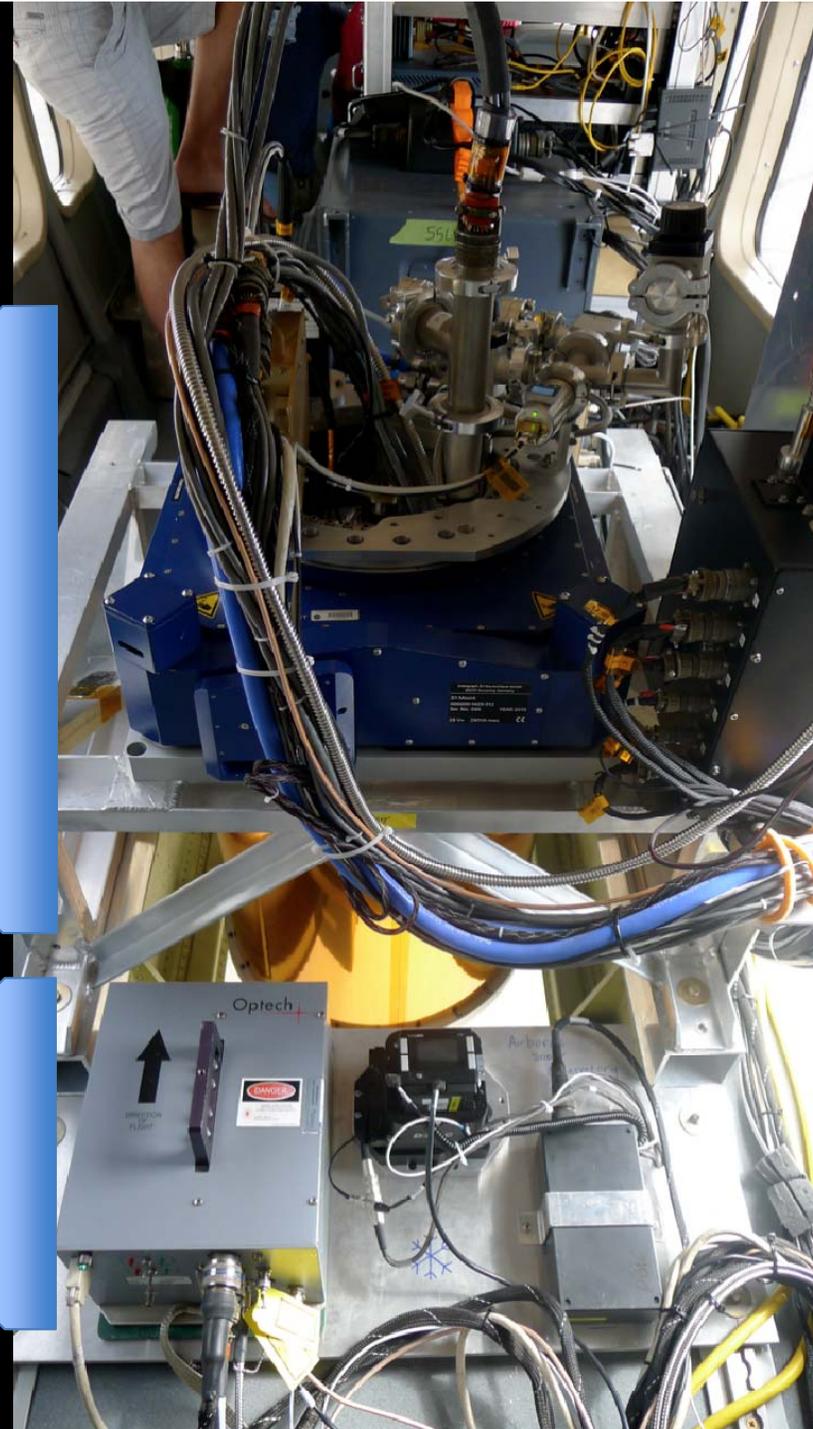


Imaging Spectrometer
0.35-2.50 μm
4 m spatial resolution from 4000 AGL

Albedo
Uncertainty < 2%

3D Scanning LiDAR
1064 nm
1 m spatial resolution

SWE
Uncertainty < 5 cm





Imaging Spectrometer
0.35-2.50 μm

4 m spatial resolution from 4000 AGL

Albedo

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3D Scanning LiDAR

1064 nm

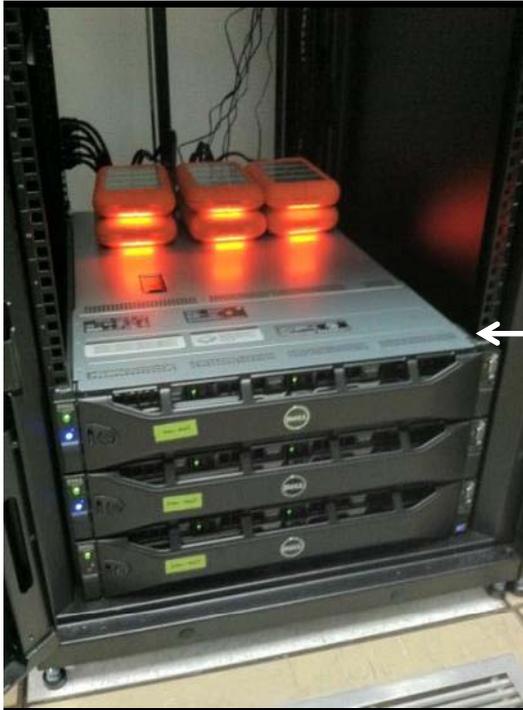
1 m spatial resolution

SWE

Uncertainty < 5 cm



ASO Demonstration Mission

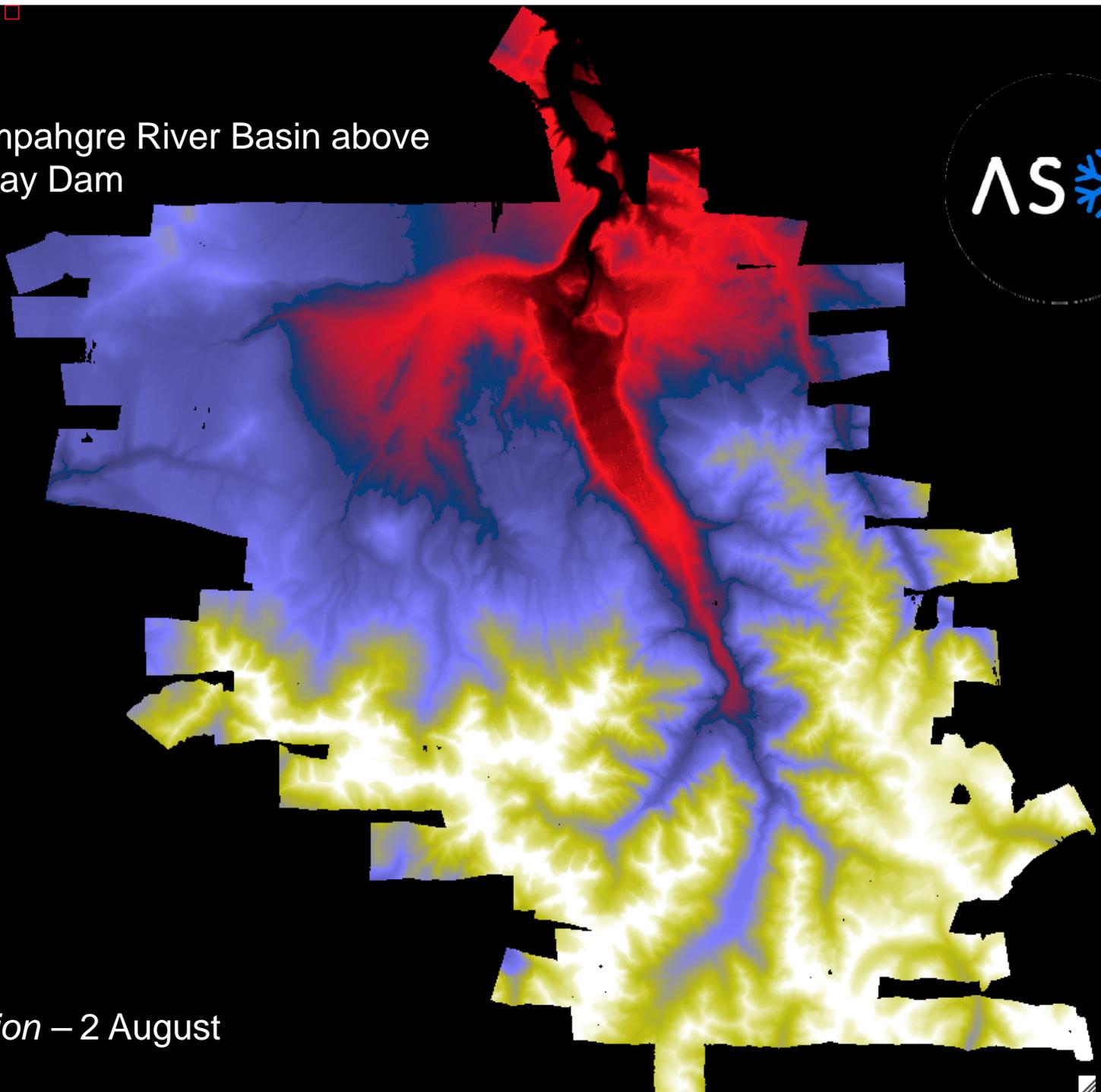


Milestone	Date
Data System Check (NEON data)	Jun 2012
Spectrometer/LiDAR integration/test flights	Jul 23-27 2012
Snow-free acquisitions for LiDAR baseline	Aug 1-10 2012
Snow-on acquisitions of ASO (weekly) * sub-24 hour latency on product delivery	Mar 15-Jul 15 2013

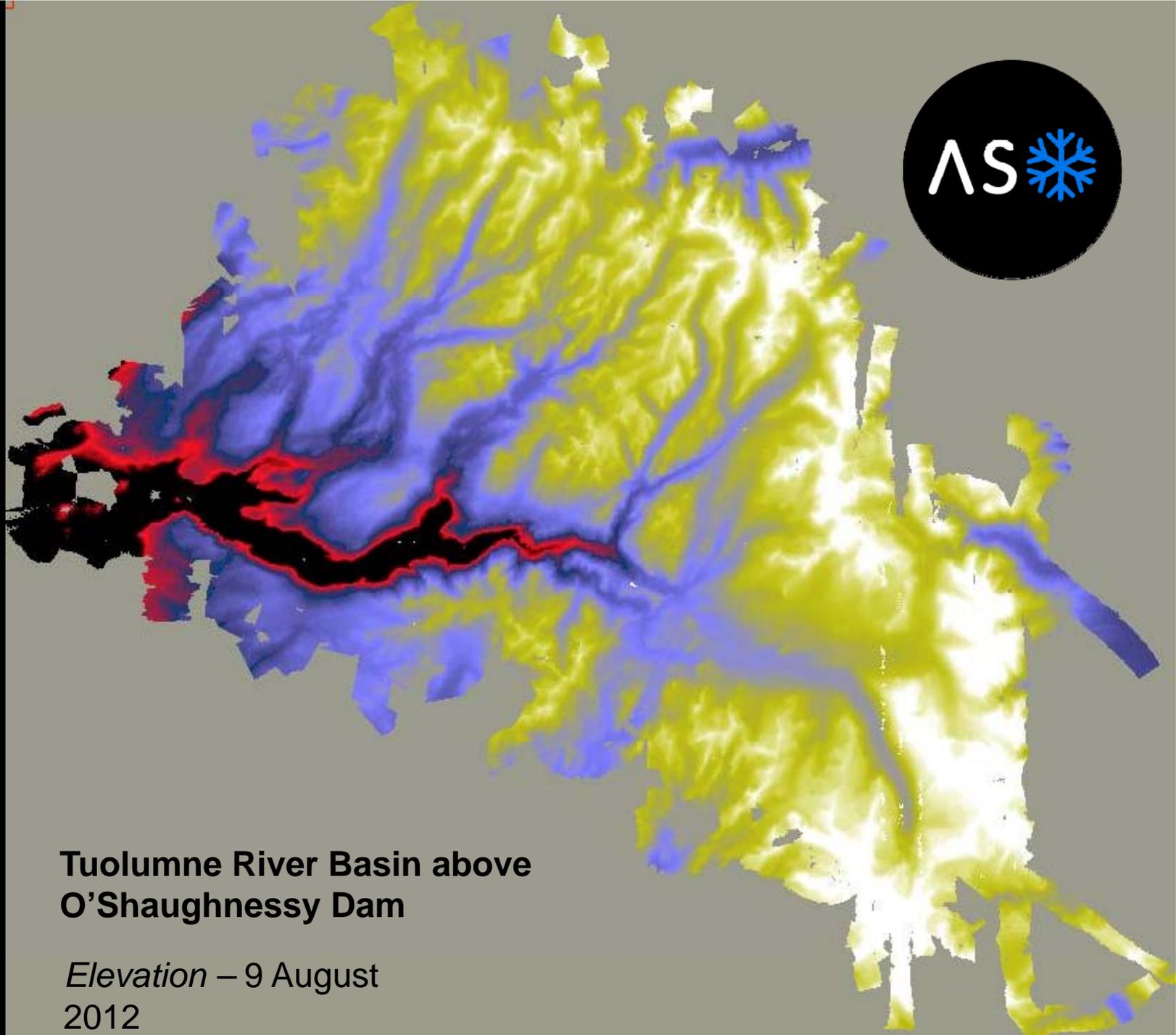


View from Below: Instrument Apertures

Uncompahgre River Basin above
Ridgway Dam



*Elevation – 2 August
2012*



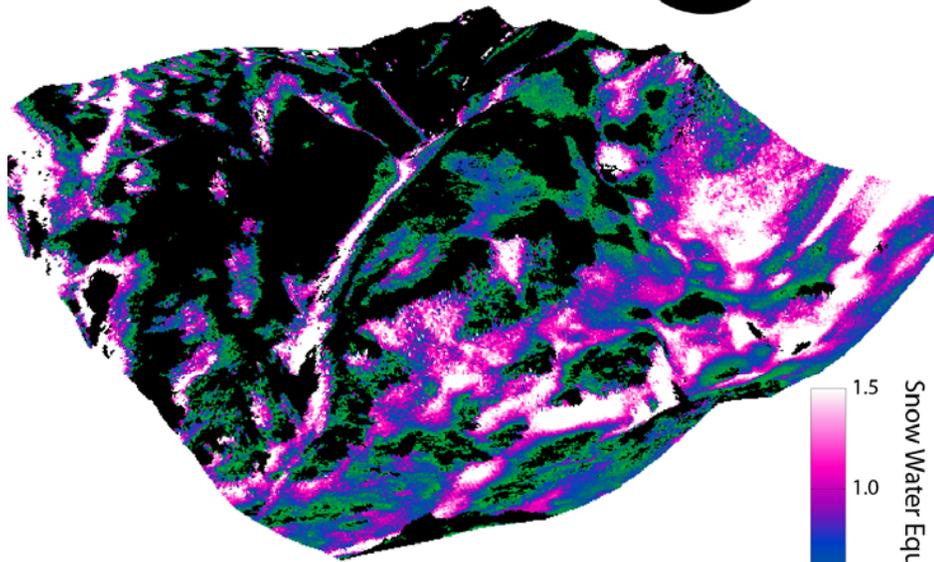
**Tuolumne River Basin above
O'Shaughnessy Dam**

Elevation – 9 August
2012

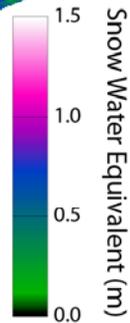
Telluride, CO
2 August 2012



First ASO SWE and albedo retrievals



Snow water equivalent
San Juan Mountains
11 May 2012



AVIRISng color composite
San Juan Mountains
11 May 2012

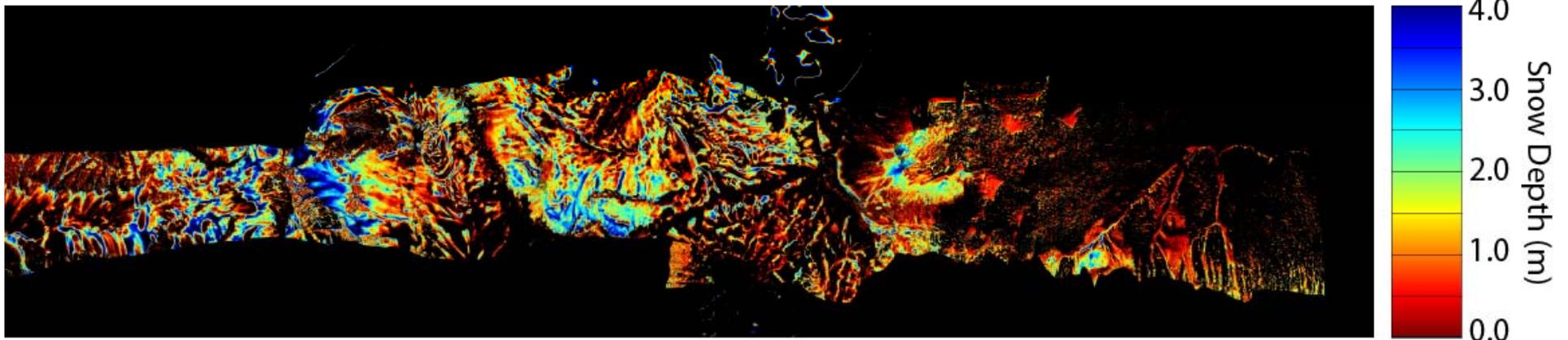
Color Composite from Spectrometer



San Juan Mountains, CO
11 May 2012



Snow Water Equivalent



San Juan Mountains, CO
11 May 2012





Lyell Fork of Tuolumne River



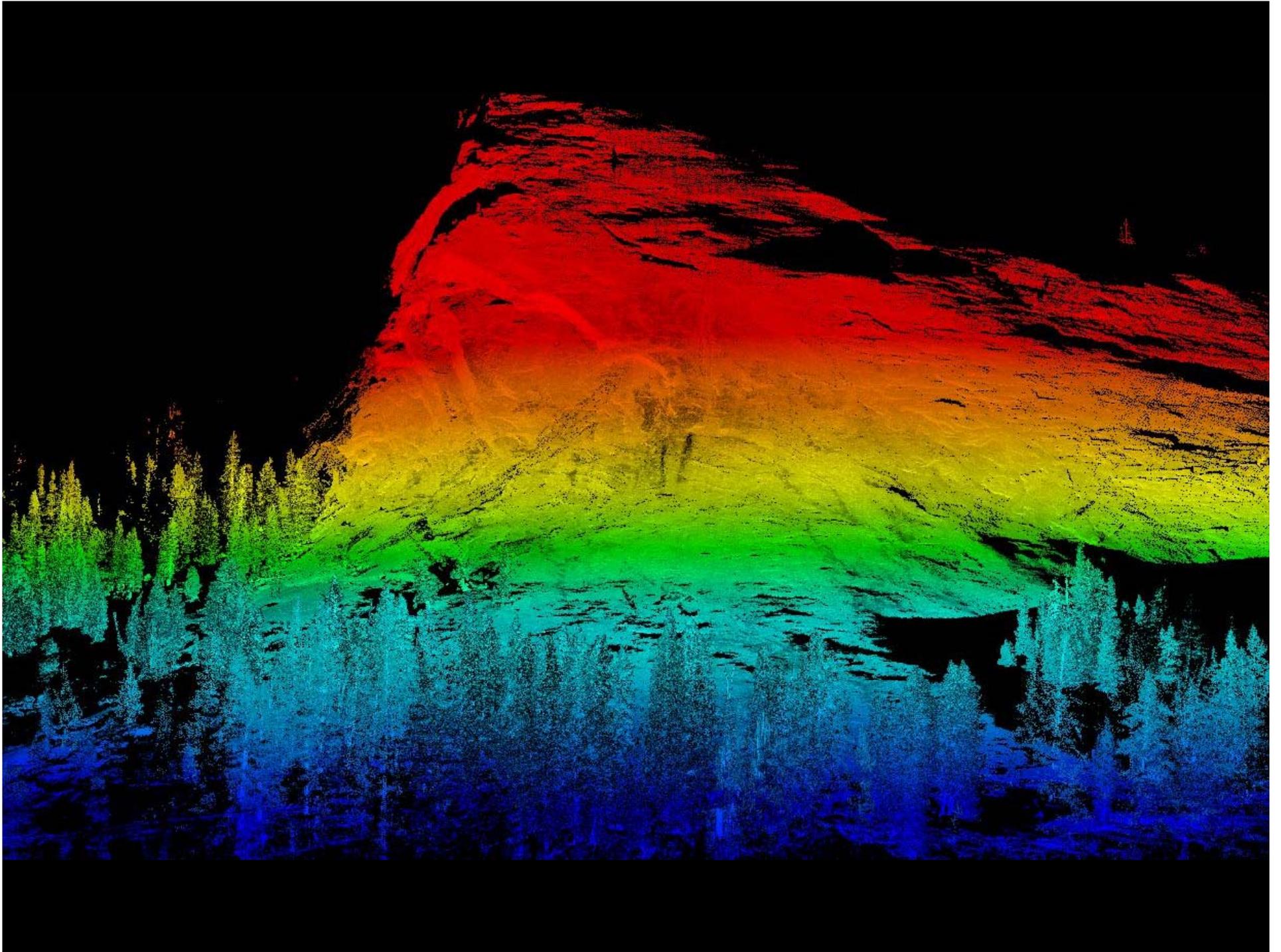
Tuolumne River Basin

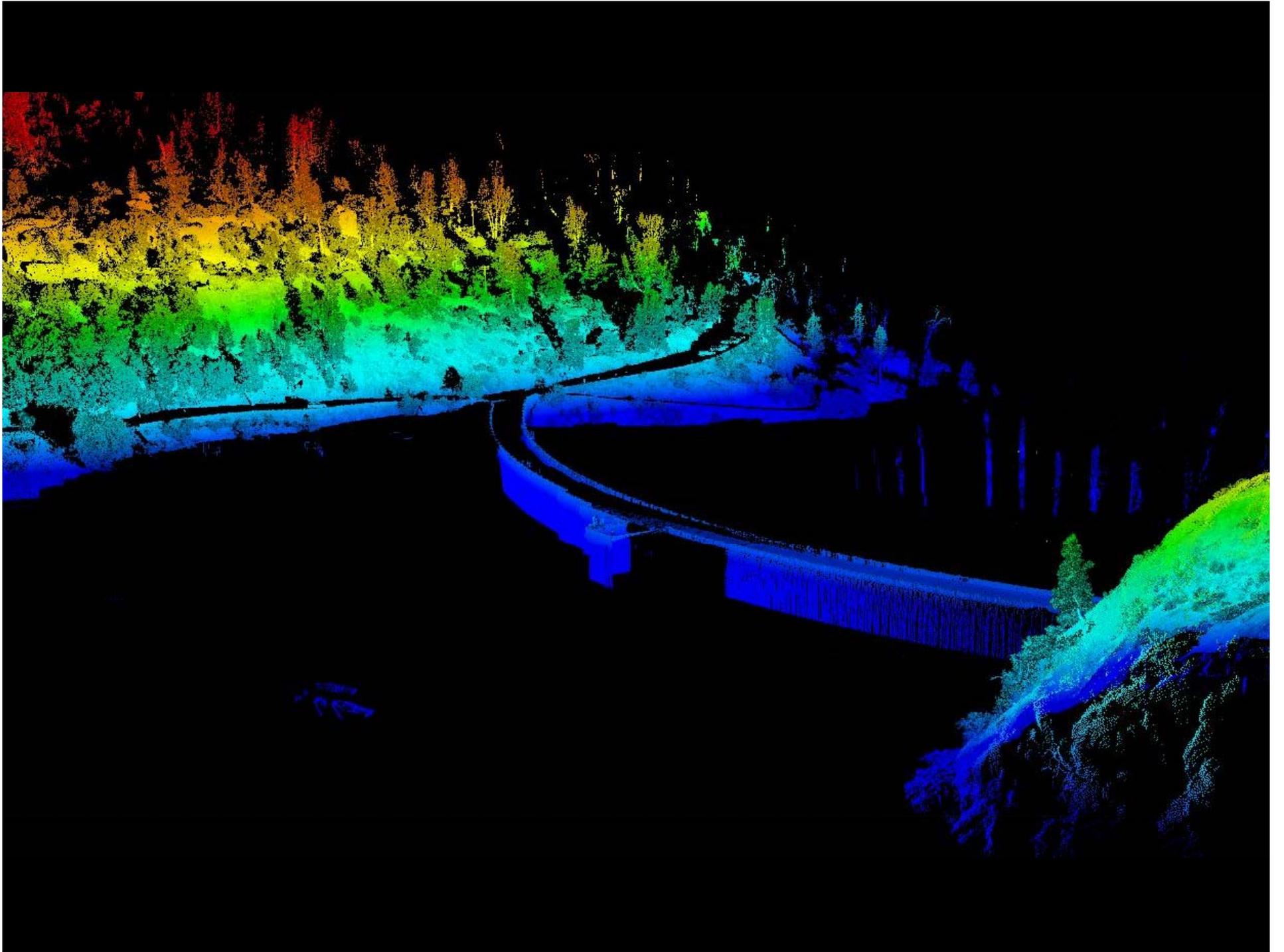
O'Shaughnessy Dam/Hetch Hetchy



August 7, 2012

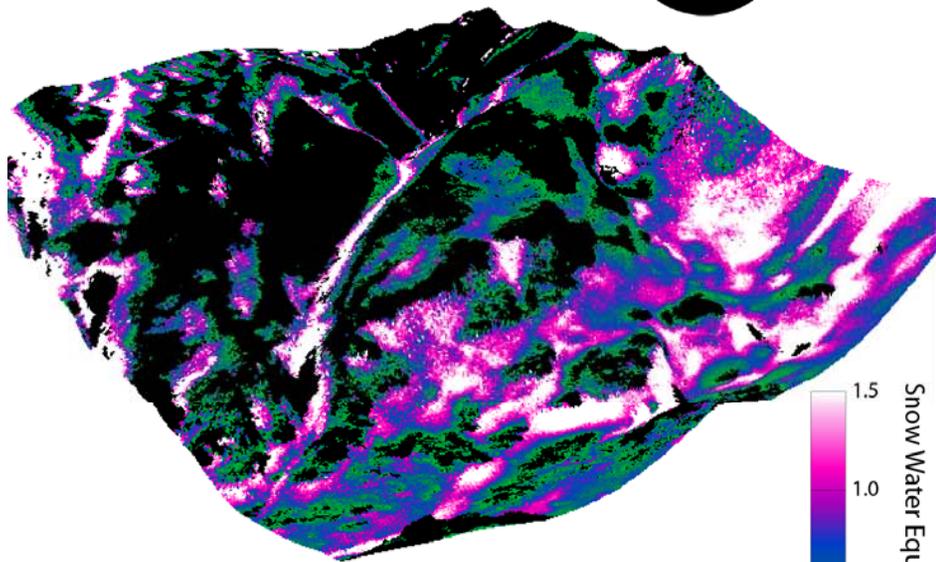




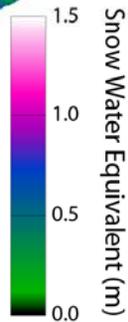




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Snow water equivalent
San Juan Mountains
11 May 2012



AVIRISng color composite
San Juan Mountains
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What we will do with these products