

Colorado ASO Expansion Plan

June Monthly CASO Stakeholder Meeting



Agenda

- General updates from Emily Carbone, CASO Planning Team/NW
- Findings from April and May ASO flights in Colorado
- Panel discussion: How do you use ASO data now and what value does it add?
- Project updates from Lynker
- Next steps -- action item to review ASO reports of the Blue and Animas



					Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Task 1. Basin Flight Planning, Data Colelction and Analysis													
★	Reivew of existing products												
★	Basin mapping, equity, and flight optimization												
	Data formats, output options, and costs												
Task 2. Stakeholder Engagement Process													
★	Develop stakeholder feedback approach												
	Solicity stakeholder feedback												
	Reassess flight optimization based on feedback												
	Stakeholder plan review												
	Roundtable checkins												
Task 3. Sustainable Funding Plan													
	Review annual costs and requirements												
	Learn about funding mechanisms												
	Develop multiple funding options												
	Tools to optimize information acquisistion												
Task 4. Sustainable Governance Plan													
	Data management and accessiblity												
	Program placement												
	Annual planning and stakeholder engagement												
	Balancing non-paying beneficiaries												
	Implementation plan												
Plan rollout													
	Roundtable presentations												
	Stakeholder workgroup presentation												

Project Status

- Ongoing Basin Prioritization (Example Flight Coverage)
- Developing Stakeholder Questions
 - Education on ASO
 - Decision Making
 - Existing Snow Products
 - What You Need in an Ideal Tool
 - Level of Involvement in yearly decision making



Basin Prioritization Status

Initial Assessment of Flight Coverage

April 1st requires about 20 flights to cover the state

Timing is key (many groups make a decision BY April 1st)

Example Flight Paths

Working with ASO to develop an efficient set of flight plans to cover 10,000' contour

Stakeholder Engagement

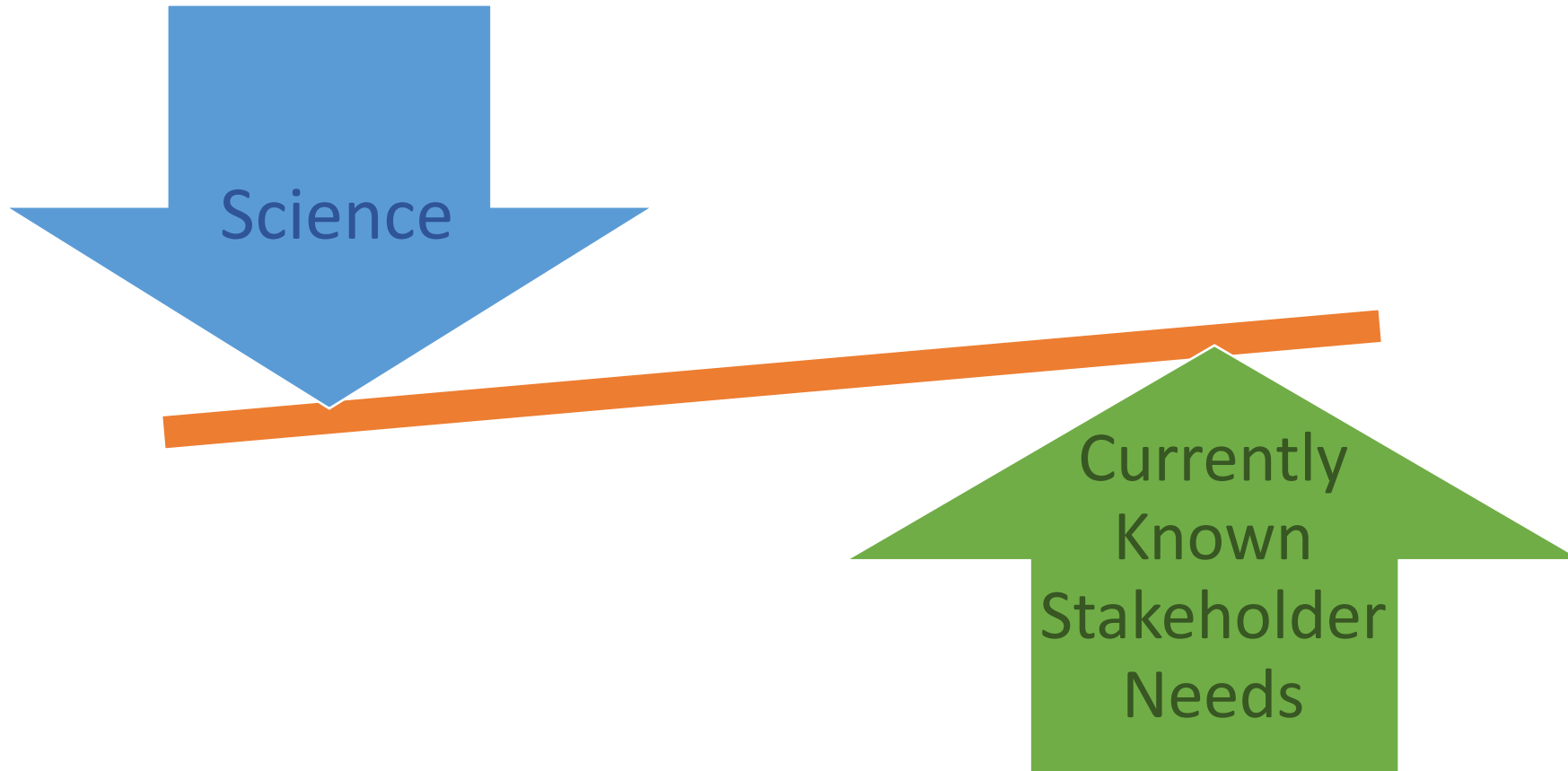
How can ASO improve your decision making?

What is the ideal timing for you to have high resolution snow data in-hand?

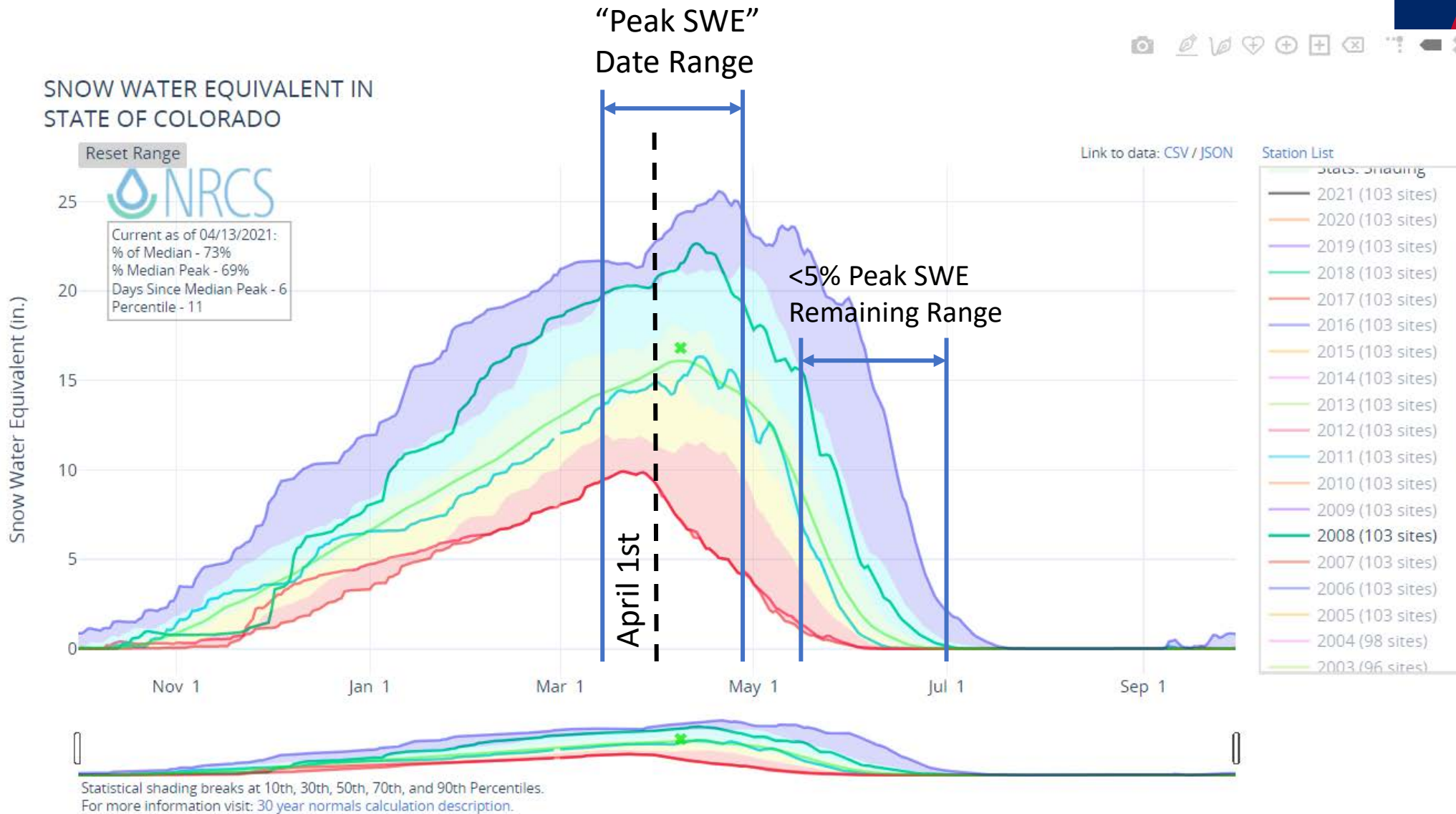


Goals of Basin Prioritization

Top Down (science) \leftrightarrow Bottom Up (stakeholders)



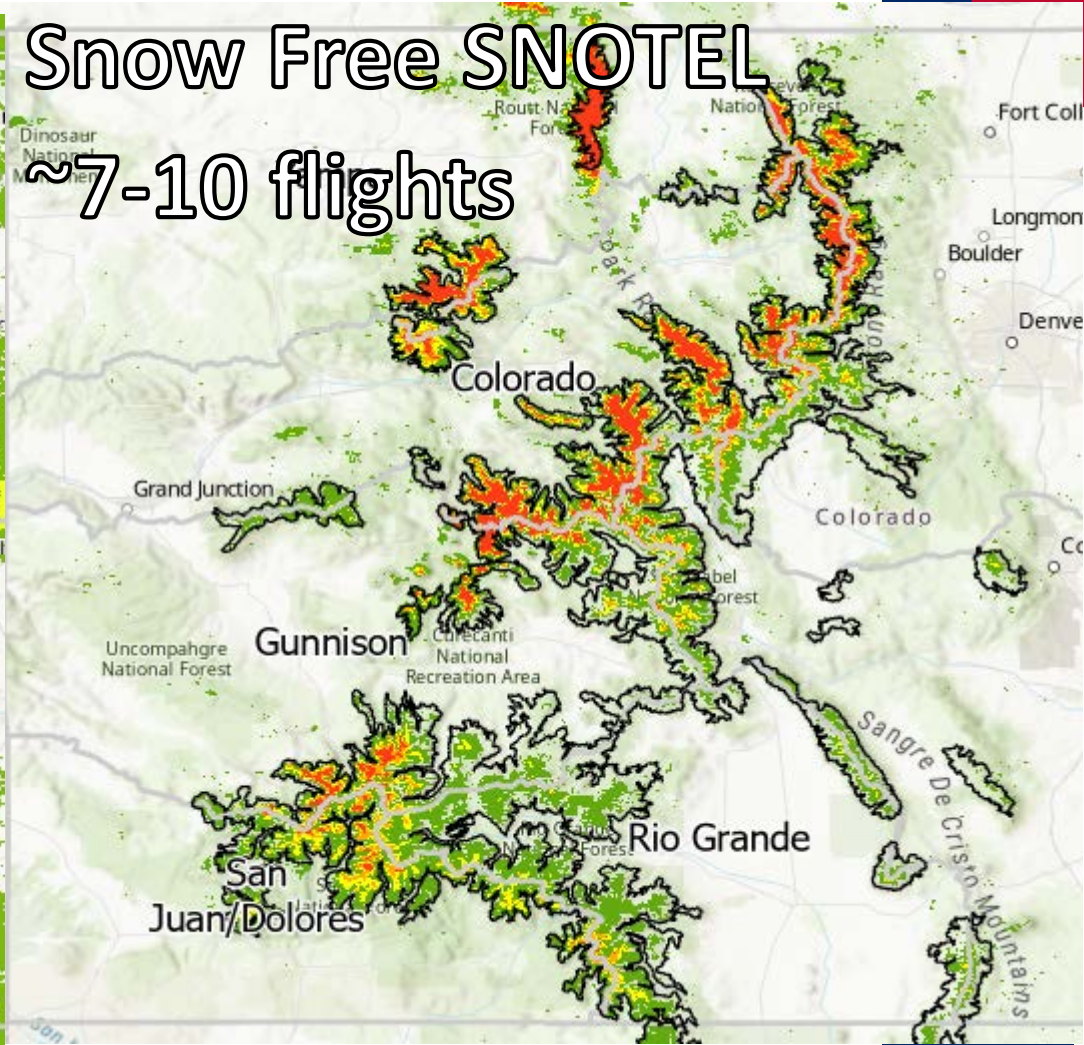
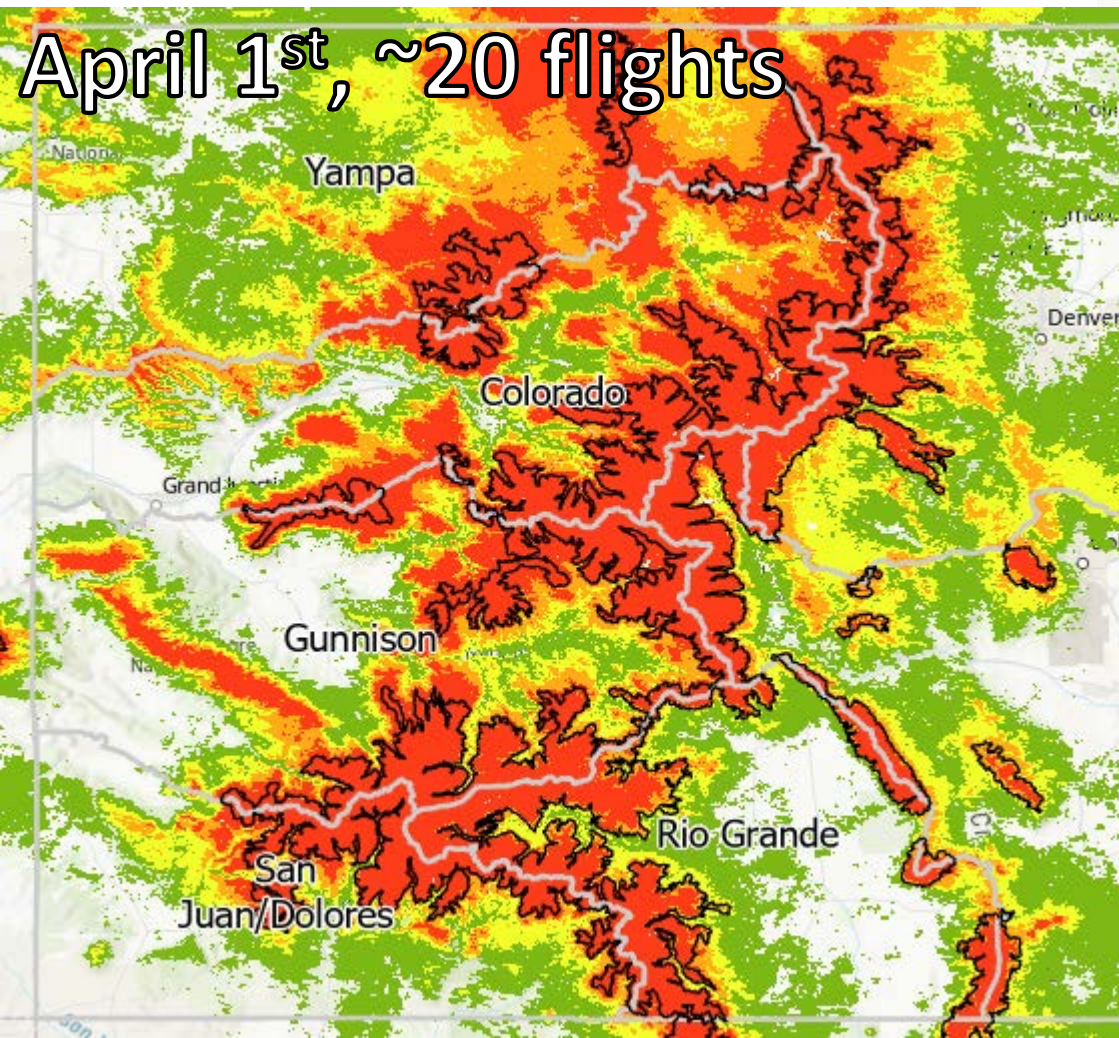
Statewide SNOTEL (2000-2020)



April 1st and “Snow Free SNOTEL “Snow Covered Area

Yellow is the coverage in the median year (Green-yellow-orange-red are 25-50-75-99th %iles)

Black is the 10,000' contour line



Prioritizing areas

- Where have existing stakeholders chosen to fly, and why?
 - How to identify key areas within each major river basin
- What is the finest useful resolution of output?
- Snow covered area is the maximum extent, can we fly less than this?
- Who should be given the responsibility to apportion flights?



Timing Options for maximum “useful” information

- “What is the marginal value of each additional flight?”
- Wish list:
 - Mid-Winter
 - Peak SWE
 - April 1st
 - Runoff season
 - “Low SWE” SNOTEL
- Variations in required area and # of flights by year type
- Pilot basins where we have multiple flights per year



Working on Components of All-Of-The-Above Approach

- ASO is a snapshot, but its full value is realized by combining it with other tools.
- “High accuracy, Lidar-informed, spatially distributed, temporally continuous SWE estimate”
- Other components
 - Snowfall data
 - SWE Modeling
 - Integrate existing snow products
 - MODIS
 - SNOTEL



Components of Integrated SWE Product

- Stakeholder engagement will inform this
- What needs to be a part of a final decision-making tool?
 - Indication of source data (When was ASO last flown for this particular point)
 - Estimate of Remaining SWE in Snowpack
 - Seasonal Remaining Runoff forecast
- Demonstrated improvement over existing tools
 - Show existing products alongside
 - Quantification of uncertainty
- Resolution
 - Fine spatial resolution
 - Continuous in time (daily/weekly updates)
- Access



Integrated Snow Monitoring Products (CA DWR Dashboard)

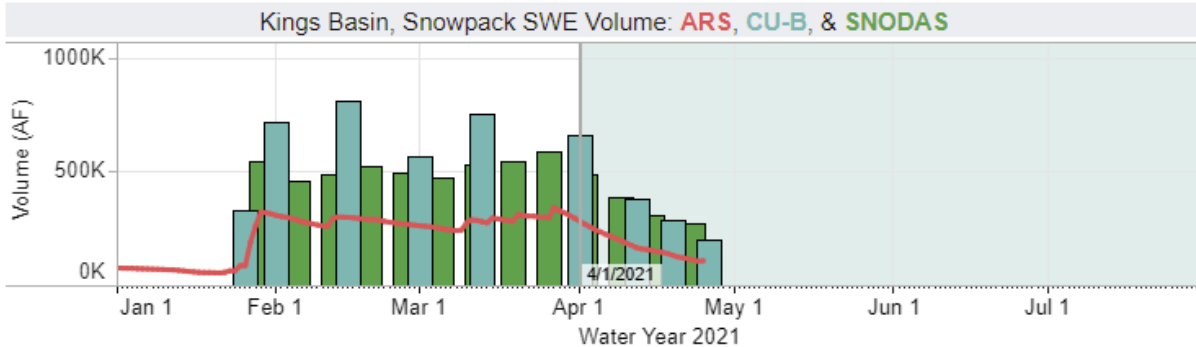
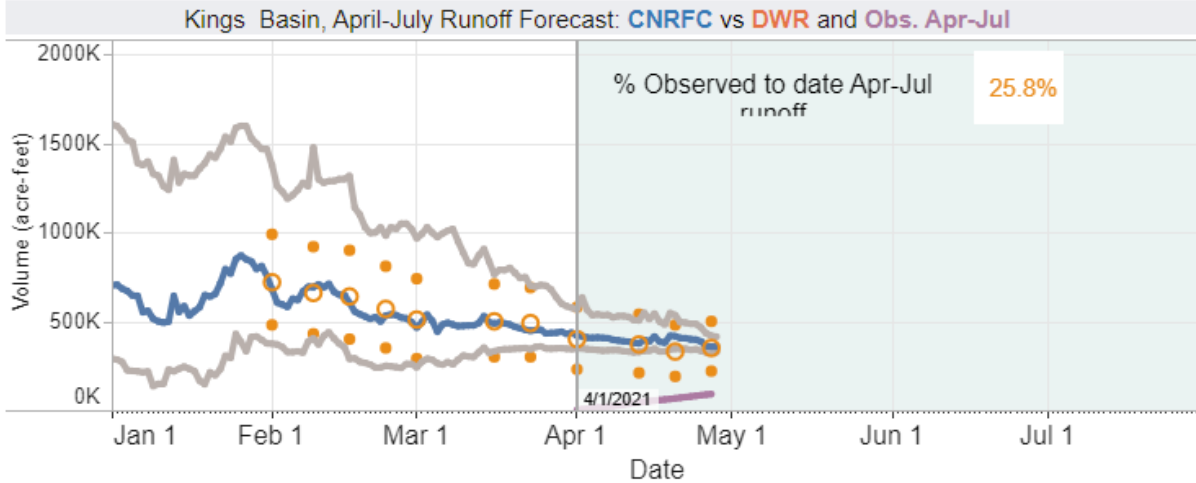


Snow Product (April-July Runoff Forecasts and Snowpack SWE Volume) Comparisons



Kings Basin, DWR B120 Summary Table

Historical Avg. AJ 1966-2015	DWR B120 10% AJ Forecast	DWR B120 50% AJ Forecast	DWR B120 90% AJ Forecast	% of Historical Avg. AJ
1,210,000	500,000	350,000	220,000	29%



B-120 (50% exce.) Apr-Jul runoff as % of avg.



% Avg. Apr-Jul runoff
0% 200%

Date
April 27, 2021

Data Last Updated On: 4/28/2021 1:44:05 PM



CA DWR integrates a range of tools:

Forecasts

CNRFC

DWR

Snowpack estimates:

ASO-derived

CU-Boulder Satellite Product

SNODAS

Stakeholder Engagement

- Question Themes

- Education on Lidar Snow Data
- Current Use of Snow Data for Operational Decision Making
- Utility of Existing Snow Products
- Importance of Validation and Uncertainty Estimates
- Level of Involvement in flight Planning
- Ideal Toolkit for your Decision Making

- Approaches

- Small Focus Groups and Interviews to do a deep dive on specific issues.
- Broader survey to larger group to understand how widespread those issues are



California Example on Timing (Wet vs Dry yr)

- California has a very different water management regime (flood control vs water supply)



ARSS Resources Needed – 6 Flights vs 8 Flights ...or more

Ideal Dry Year Program (6 flights)	Feb		March		April		May		June	
	1st	Mid	1st	Mid	1st	Mid	1st	Mid	1st	Mid
Tuolumne	X		X	X	X	X	X			
Merced	X		X	X	X	X	X			
San Joaquin	X		X	X	X	X	X			
Kings	X		X	X	X	X	X			
Kaweah	X		X	X	X	X	X			
Lakes/Mono	X		X	X	X	X	X			

FLEXIBILITY IS KEY!

- 10 Flights Program – Adds in a January 1 flight (early look) and Mid-Feb or Mid-March.
- Bank unused flights from one year to use in another year or snow-free if needed.

6 vs. 8 Flights Idealized Program

Ideal Wet Year Program (8 Flights)	Feb		March		April		May		June	
	1st	Mid	1st	Mid	1st	Mid	1st	Mid	1st	Mid
Tuolumne	X		X		X	X	X	X	X	X
Merced	X		X		X	X	X	X	X	X
San Joaquin	X		X		X	X	X	X	X	X
Kings	X		X		X	X	X	X	X	X
Kaweah	X		X		X	X	X	X	X	X
Lakes/Mono	X		X		X	X	X	X	X	X



Colorado Flight Planning Example for Average Year



Colorado Flight Planning Example (Avg year)											
Watershed	Feb		March		April		May		June		Total
	1st	Mid	1st	Mid	1st (Peak SWE-ish)	Mid	1st	Mid	1st (5% swe-ish)	Mid	
South Platte			2		3		1		1		7
Arkansas			2		2		1		1		6
Colorado			2		5		1		1		9
Yampa			2		4		1		1		8
Rio Grande			2		2		1		1		6
Gunnison			2		2		1		1		6
San Juan/Dolores			2		2		1		1		6
"Scientific Pilot Basin 1"	1	1	1	1	1	1	1	1	1	1	10
"Scientific Pilot Basin 2"	1	1	1	1	1	1	1	1	1	1	10
Total Flights at Snapshot	2	2	16	2	22	2	9	2	9	2	68

Chat questions

- MENTIMETER LINK
- <https://www.menti.com/2cs3zqk38h>



Next Steps

- Note that the July meeting has been moved to July 14th to accommodate the holiday week

