Blended observations and models of snow water equivalent for water resources applications

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Water Ed
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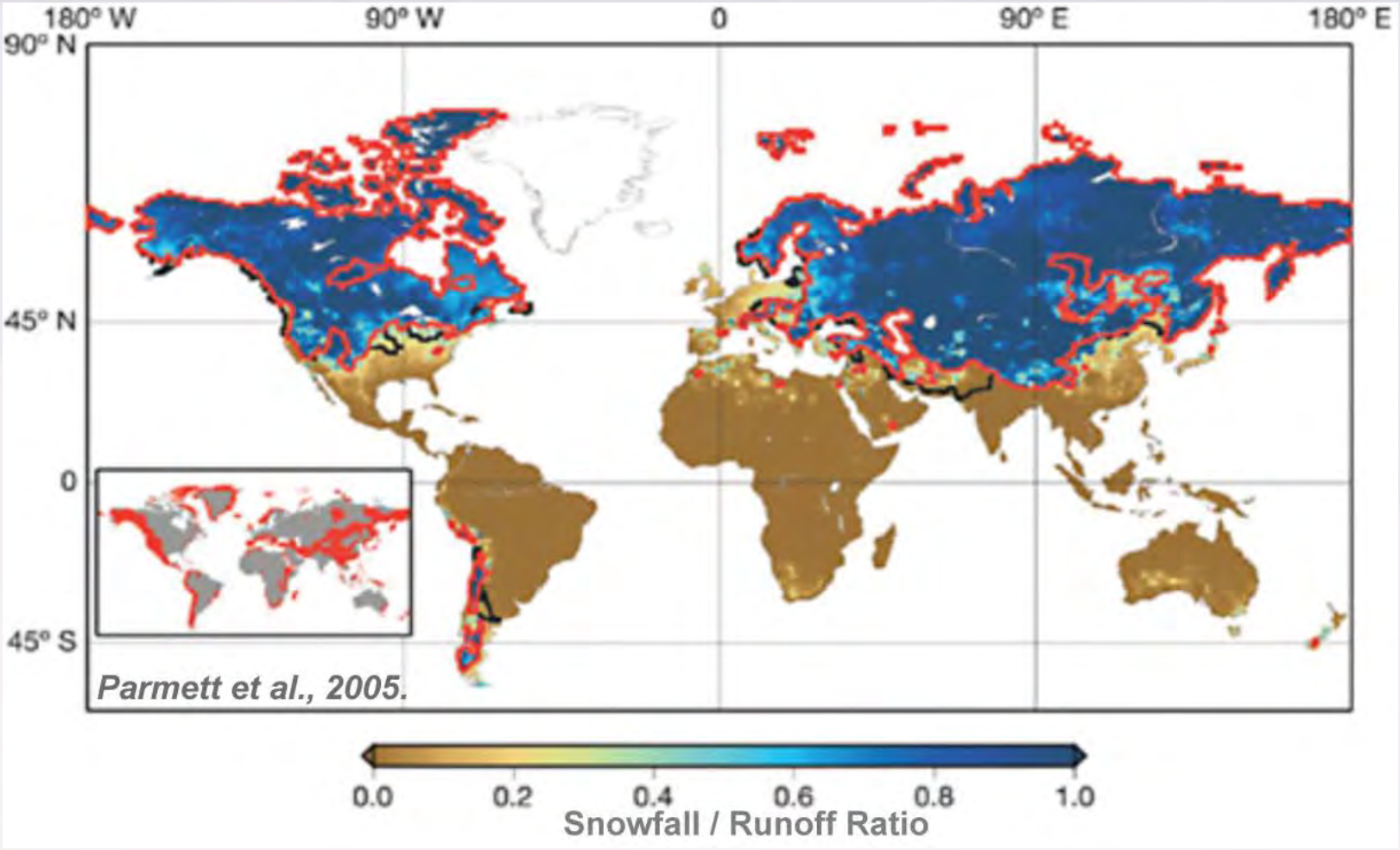
Snow and Water Availability



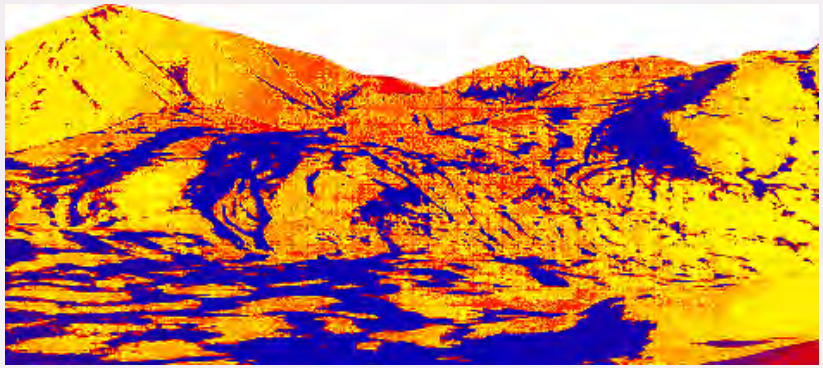
- 60 Million People in US & 1 Billion People Globally
- 1/4th Global GDP

Remotely sensed snowpack reconstruction improves Sierra Nevada water storage estimates

- Snowmelt model runs backwards
- We integrate model snowmelt from time of maximum snow to snow disappearance
- Satellite tells us when snow disappears

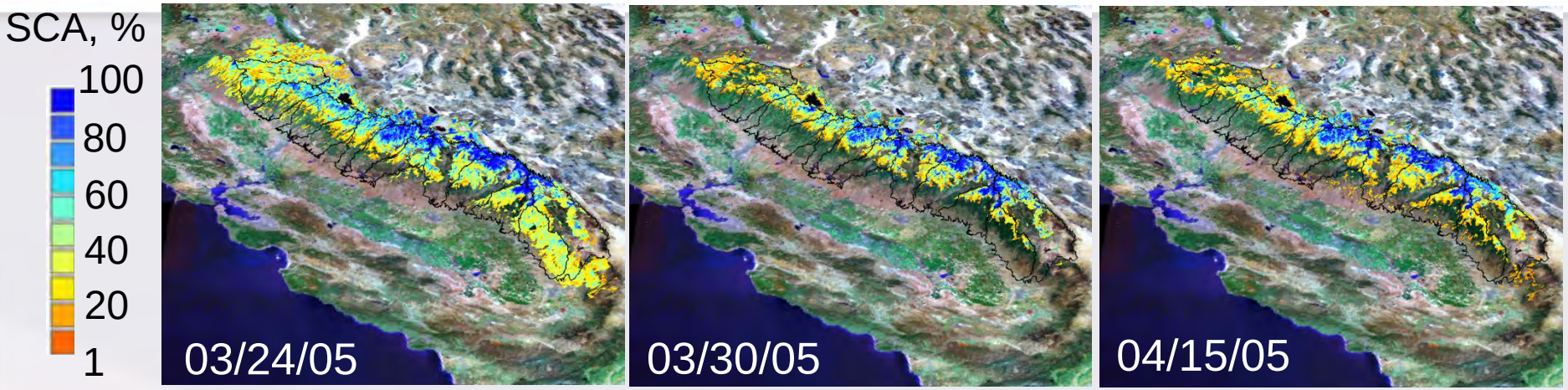
snow covered area

daily snowmelt, cm



Cline et al., 1998a,b; Liston, 1999; Molotch et al., 2004b; Molotch & Bales, 2005;2006; Durand et al., 2007; Molotch, 2008.

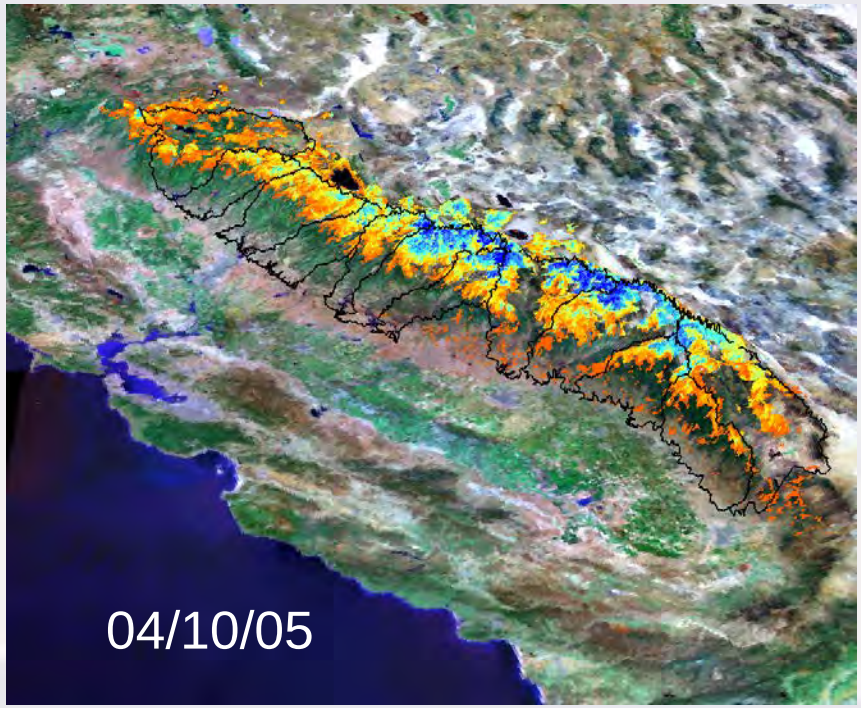
Range-Scale Snow Cover: MODIS



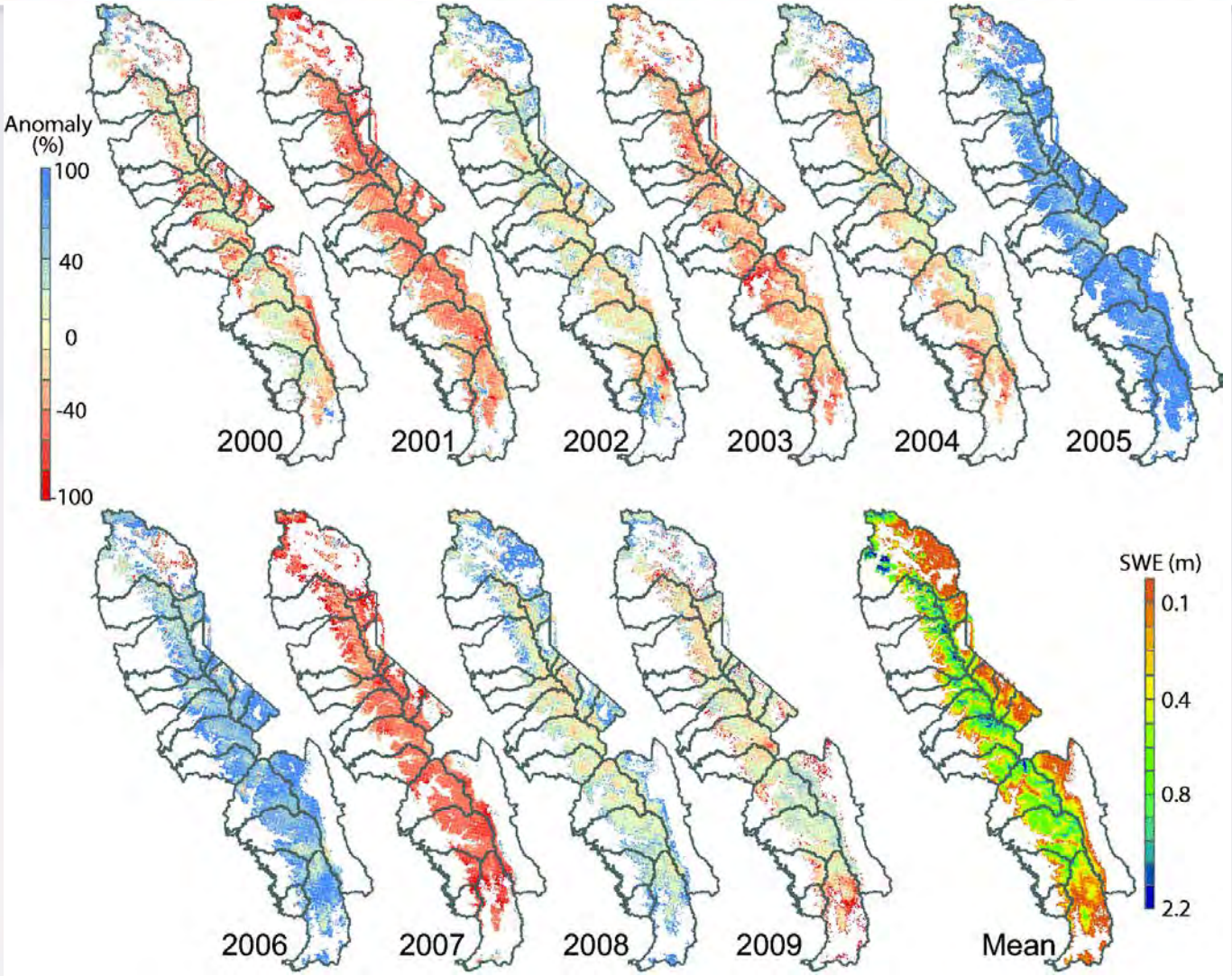
MODSCAG – Dozier et al., 2010

Due to lower initial mass snow disappeared rapidly in N. Sierra.

Areas with persistent snow cover had greatest mass.



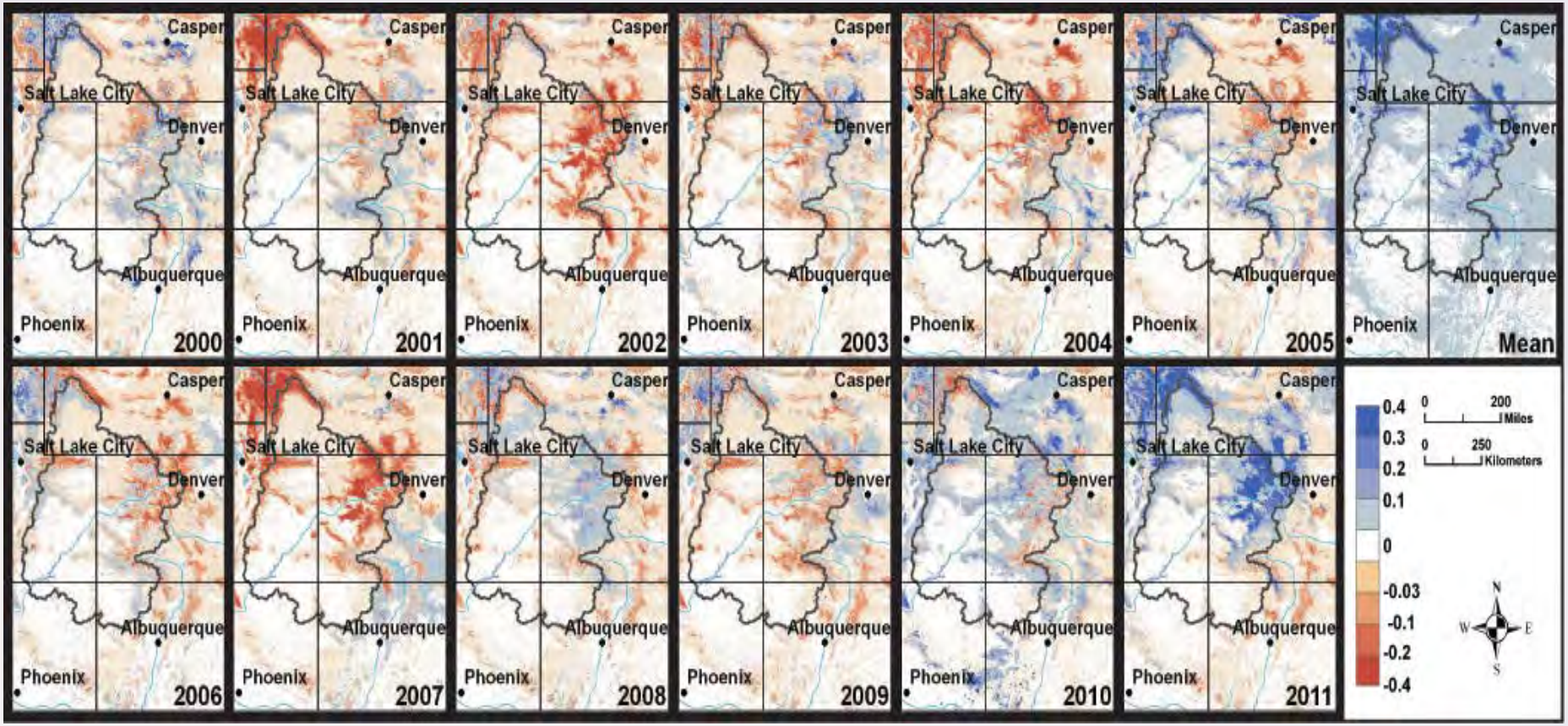
Snow Water Equivalent Anomalies



Max Accumulation = April 1

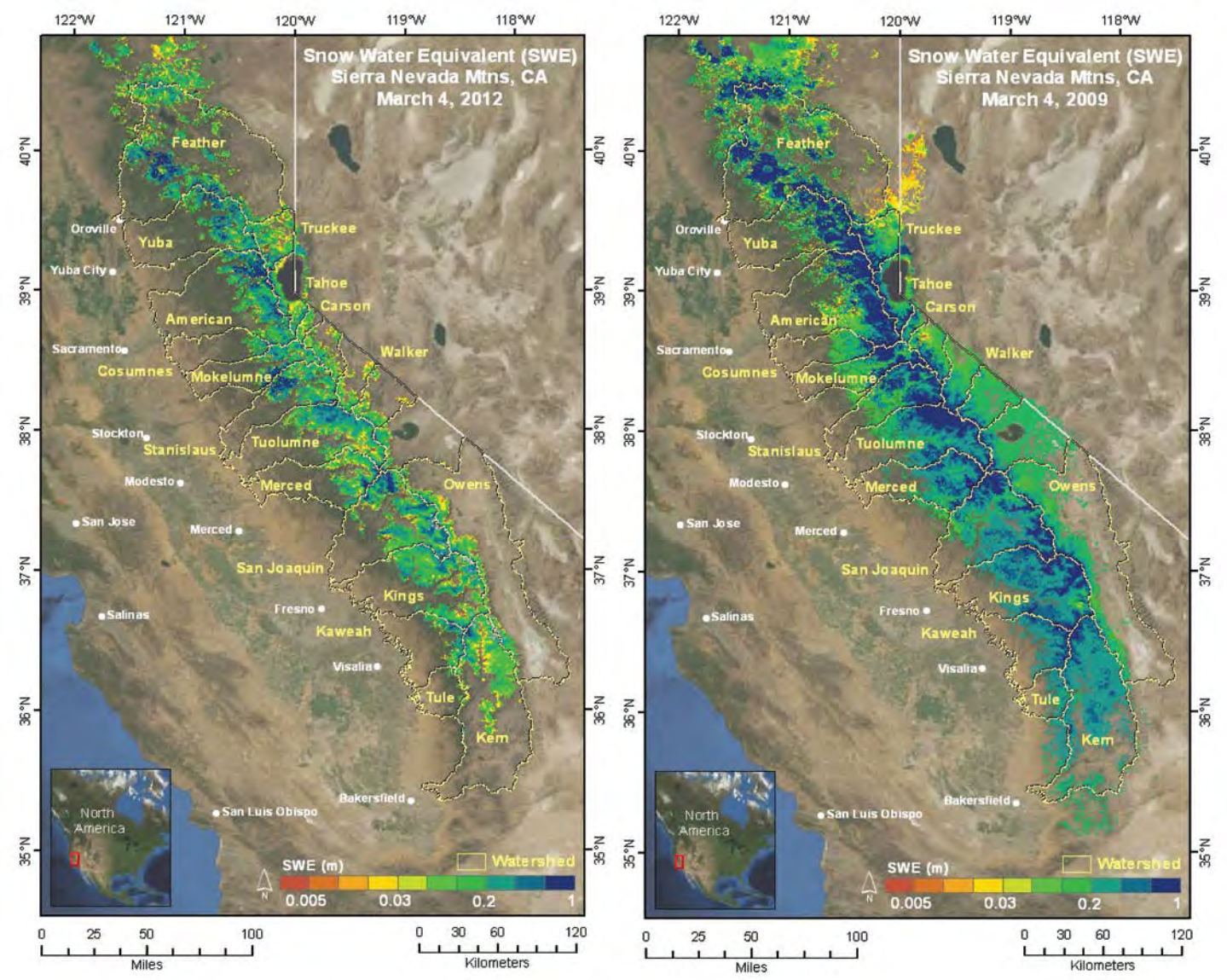
Guan et al., in review

Snow Water Equivalent Anomalies



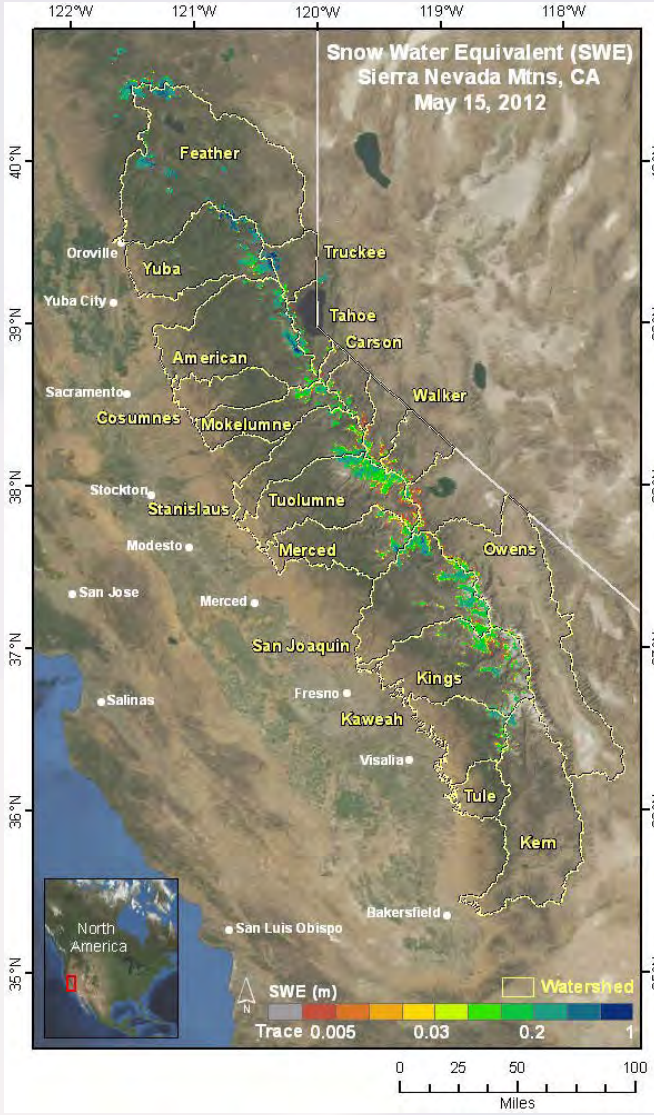
Schneider et al., in preparation

Real Time SWE Product

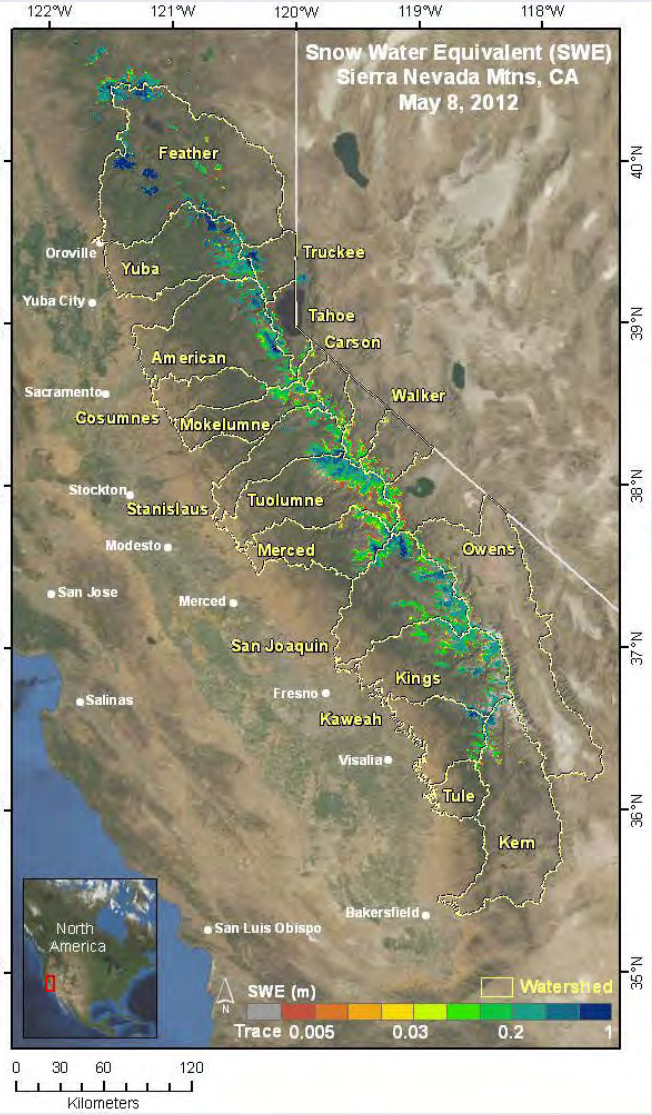


Real-Time SWE Product Beta Version

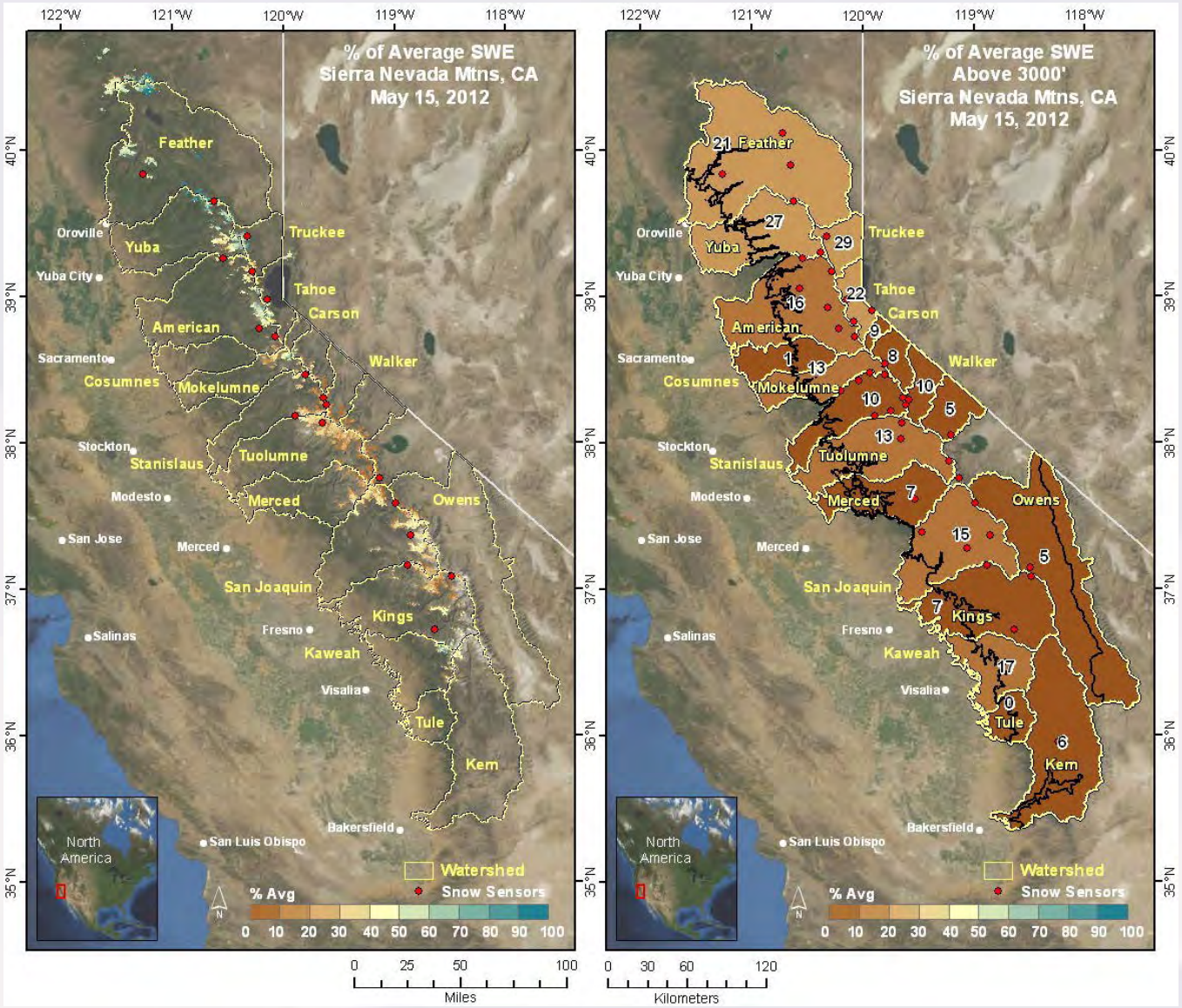
May 15, 2012



May 8, 2012



Real-Time SWE Product Beta Version



Real Time SWE Reports by Watershed

Watershed	5/15/12 SWE (in)	5/15/12 % Avg to Date	5/8/12 SWE (in)	5/8 thru 5/15 Change in SWE (in)
AMERICAN	1.17	16.28	2.75	-1.58
FEATHER	0.86	21.05	2.02	-1.17
KAWEAH	0.82	16.87	2.20	-1.38
KERN	0.13	5.63	0.44	-0.30
KINGS	0.75	7.46	2.64	-1.89
TAHOE	2.09	21.78	4.15	-2.06
MERCED	0.57	7.29	1.67	-1.10
OWENS	0.15	5.42	0.46	-0.31
SAN JOAQUIN	1.66	14.85	4.02	-2.36
STANISLAUS	1.01	9.58	2.42	-1.41
TRUCKEE	1.84	28.80	3.28	-1.44
TUOLUMNE	1.46	13.36	3.29	-1.83
YUBA	2.30	27.39	4.80	-2.50
COSUMNES	0.01	0.50	0.17	-0.16
MOKELUMNE	1.11	12.73	2.29	-1.18
TULE	0.00	0.29	0.07	-0.07
WEST WALKER RIVER	0.75	9.73	1.65	-0.90
EAST WALKER RIVER	0.30	5.46	0.73	-0.43
WEST FORK CARSON RIVER	0.57	8.68	1.26	-0.69
EAST FORK CARSON RIVER	0.48	7.59	1.23	-0.75

Real Time SWE Report by Elevation Band

Watershed	Elevation	5/15/12 SWE (in)	5/15/12 % Avg to Date	5/8/12 SWE (in)	5/8 thru 5/15 Change SWE (in)	Area Sq Mi
AMERICAN	3000-4000'	0.00	0.00	0.00	0.00	191.9
	4000-5000'	0.00	0.00	0.01	-0.01	249.3
	5000-6000'	0.00	0.19	0.09	-0.09	294.8
	6000-7000'	0.49	5.26	2.45	-1.96	296.4
	7000-8000'	3.58	18.63	8.97	-5.39	175.7
	8000-9000'	8.65	31.35	14.84	-6.19	74.2
	9000-10,000'	13.15	37.87	19.80	-6.65	8.9
COSUMNES	3000-4000'	0.00	0.00	0.00	0.00	77.8
	4000-5000'	0.00	0.00	0.00	0.00	84.7
	5000-6000'	0.00	0.00	0.00	0.00	63.6
	6000-7000'	0.00	0.00	0.20	-0.20	28.1
	7000-8000'	0.32	1.93	4.71	-4.39	8.6
E CARSON	5000-6000'	0.00	0.00	0.00	0.00	32.7
	6000-7000'	0.00	0.01	0.00	0.00	77.7
	7000-8000'	0.02	0.67	0.16	-0.14	102.6
	8000-9000'	1.01	9.58	2.54	-1.53	96.5
	9000-10,000'	1.87	10.66	4.17	-2.30	29.7
	10,000-11,000'	1.02	5.12	3.56	-2.53	13.5
	> 11,000'	1.60	5.86	9.16	-7.56	0.3
E WALKER	6000-7000'	0.00	0.00	0.00	0.00	73.6
	7000-8000'	0.00	0.00	0.00	0.00	157.4
	8000-9000'	0.00	0.10	0.05	-0.04	154.9
	9000-10,000'	0.55	4.78	1.55	-0.99	63.1
	10,000-11,000'	2.11	10.75	4.71	-2.59	48.8
	> 11,000'	1.74	8.54	4.63	-2.88	7.8
FEATHER	3000-4000'	0.00	0.00	0.02	-0.02	286.2
	4000-5000'	0.00	0.08	0.03	-0.03	735.8
	5000-6000'	0.12	3.93	0.82	-0.70	1305.1
	6000-7000'	2.19	33.32	5.09	-2.90	871.3

More Information

- Identify other users / interested parties:
- Water Resources
- Forest Management
- Weather Research
- Regional Climate Modelers
- Hydrologic Modelers (CADWR-PRMS)

- instaar.colorado.edu/research/labs-groups/mountain-hydrology-group/

- Noah.molotch@colorado.edu
- Noah.P.Molotch@jpl.nasa.gov

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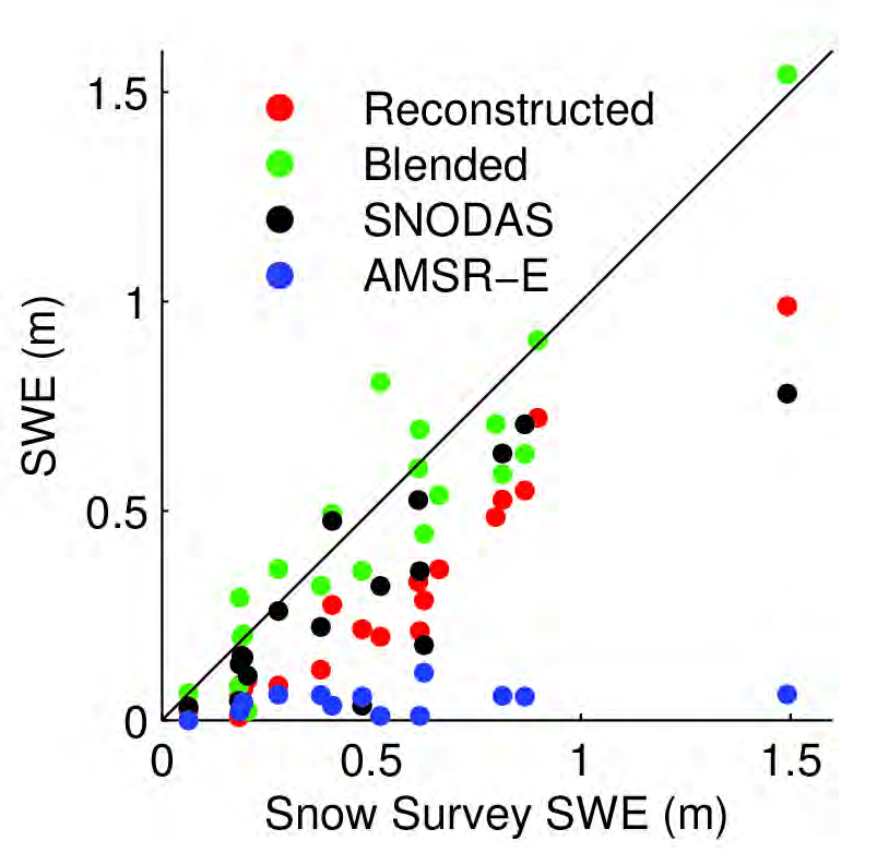
Model Performance

Sierra Nevada



Upper Colorado River Basin