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CODOS UPDATE FOR SENATOR BECK BASIN STUDY AREA: VISITED APRIL 7-8, 2012

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SUMMARY

Sustained periods of unseasonably warm air temperatures and exposed dust at the snowpack surface during late March and early April have, together, initiated accelerating rates of snowmelt and SWE loss at some, but not all, CODOS Snotel sites. Some CODOS Snotel sites report significant declines in SWE approaching the lowest values in the period of record (for a given date) or even falling outside of the historic range. Those sites *may* have experienced Peak SWE for WY 2012 in early or mid-March. Recent CODOS snowpits near those CODOS sites mirror those losses of SWE.



In contrast, even with comparable reductions in snow albedo from the same exposed dust layers, other CODOS Snotel sites and CODOS snowpits show only small losses of SWE. Energy inputs from warm air and direct absorption of solar energy by dust at the snowpack surface was consumed in warming the snowpack towards an isothermal state at 0° C at those generally higher or cooler (N'ly aspect) sites. Our recent snowpits at Senator Beck Basin, at the Swamp Angel and Senator Beck Study Plots, demonstrate this difference in snowmelt rates driven by differences in elevation (slope and aspect are identical at both sites), as the higher Senator Beck Study Plot is only now approaching isothermal.

The National Weather Service expects warming weather in the western San Juan Mountains through Tuesday, April 10th, with a slight chance for afternoon showers on Tuesday. Another round of strong SW'ly winds will develop on Tuesday afternoon. Somewhat more unsettled and cooler weather will finish the week, including slight chances for rain and/or snow showers each day, with temperatures perhaps even falling below seasonal norms by Friday and the weekend.

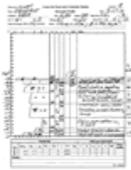
SNOWPACK DISCUSSION

Despite near-constant exposure of dust at the snowpack surface, the Senator Beck Study Plot, at 12,186', has lost essentially no SWE since our [March 28 Update](#), but the mean snowpack temperature has risen from [-3.7° C on March 27](#) to [-1.6° C on April 7](#). Melt at the Senator Beck Study Plot snowpack surface did result in substantial melt water flux into the upper snowpack where that free water encountered cold snow and refroze, as [layers of clear ice](#) up to 2-3 cm thick. Meanwhile, warming from below elevated snow temperatures to near-zero values in the bottom two-thirds of the snowpack.

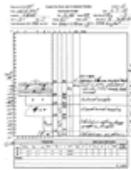
Minor snow squalls associated with dust-on-snow event D8, April 6th, left a [thin layer of dry and dusty new snow](#) scattered over the alpine terrain of Senator Beck Basin. Those patches exhibit a higher albedo than the old snow surface containing D7/6/5/4 dust in between them and will require a day or two of direct sun to melt and merge with the much lower albedo snow underneath.

On [March 26th the snowpack](#) at the lower elevation Swamp Angel Study Plot, at 11,060', was effectively isothermal and contained 21.3" (542 mm) of SWE; depth was 61" (156 cm). By [April 8th](#), SWE and total depth had fallen to 17.0" (433 mm) and 42.5" (108 cm) respectively; temperatures were still isothermal. Dust layer D8 had merged with the D7/6/5/4 dust, at the [snowpack surface](#) (see photo).

Senator Beck Study Plot:



SBSP Pit profile for March 27, 2012



SBSP Pit profile for April 7, 2012

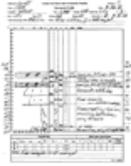


After re-filling the snow pit on April 7, 2012

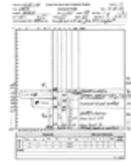


Pit on April 7, 2012

Swamp Angel Study Plot:



SASP Pit profile for March 26, 2012



SASP Pit profile for April 8, 2012



SASP Snow Pit on April 8, 2012



Pit on April 8, 2012

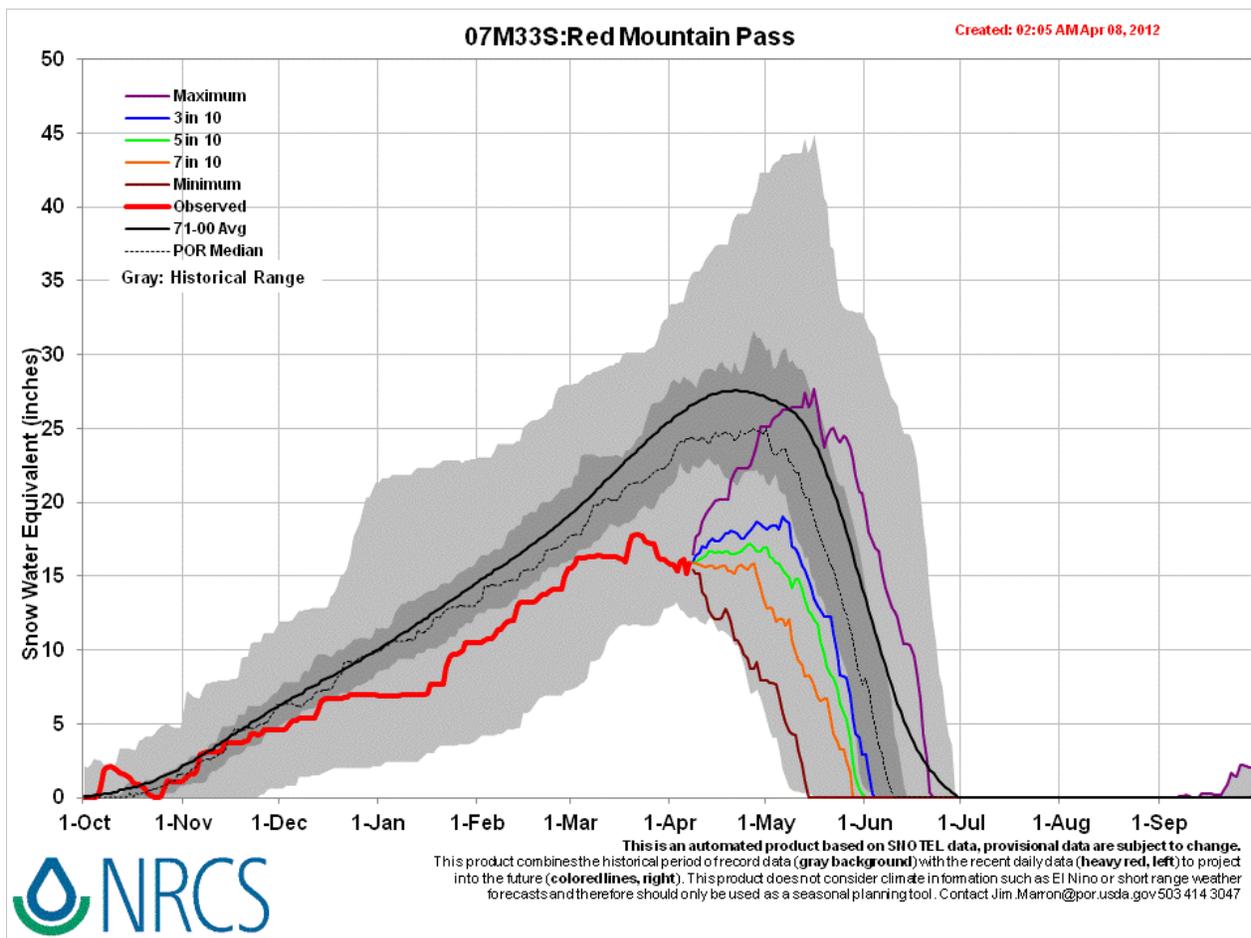
MELT RATE

Between March 27th and April 3rd the Red Mountain Pass Snotel, at 11,200', lost 2" of SWE before a small rebound, much less than the 4.3" (109 mm) loss measured at the Swamp Angel Study Plot from March 26 to April 8. The Red Mountain Pass Snotel site is closely bordered by tall trees to the east, south, and southwest. Farther west, the Lizard Head Pass Snotel (see [snowmelt analysis table](#) and [SNOTEL graph](#)), at 10,200', lost 5" of SWE over the same period and the extremely low SWE levels are barely within the period of record range. Melt rates have approached 1" of SWE loss per day in recent days at the Lizard Head Pass Snotel.

Red Mountain Pass SNOTEL Snowmelt Season Summary Data

	Date	Peak	Days	Post-Peak	Adjusted	Period
	Peak SWE	SWE	to SAG	Added	Daily	Mean
				SWE	Mean Loss	Temp
					SWE	
WY 2006	4/8/2006	24.4	50	1.2	0.51	3.1
WY 2007	5/9/2007	23.7	34	1.7	0.75	4.7
WY 2008	4/14/2008	34.4	66	4.3	0.59	2.9
WY 2009	4/19/2009	27.5	37	1.8	0.79	4.3
WY 2010	4/8/2010	24.2	54	3.7	0.52	1.5
WY 2011	5/22/2011	33.7	33	1.4	1.06	6.8
Max	5/22	34.4	66	4.3	1.06	6.8
Min	4/8	23.7	33	1.2	0.51	1.5
Range	45	10.7	33	3.1	0.55	5.3

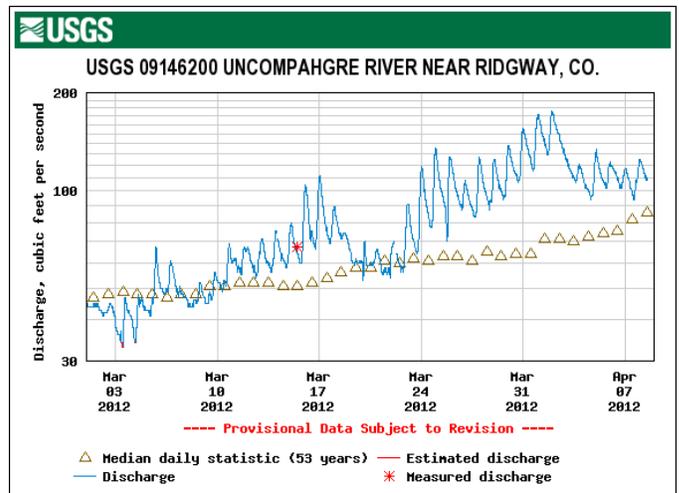
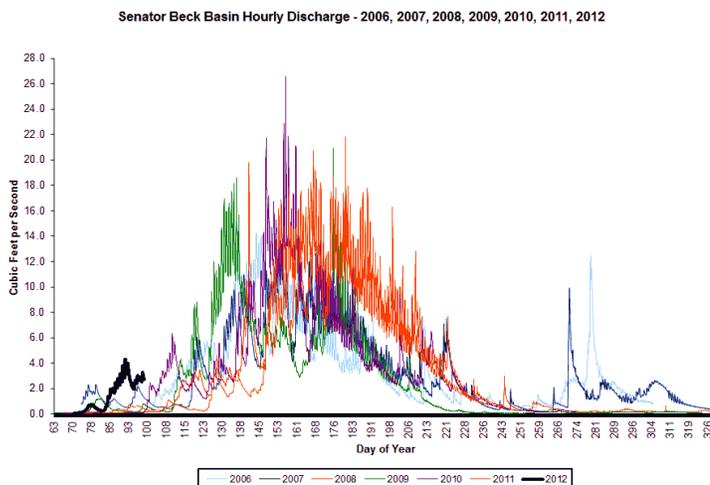
Adjusted Daily Mean Loss SWE rates include additional SWE received after date of Peak SWE



STREAM FLOWS

Streamflow behavior at the CSAS's Senator Beck stream gauge and the [USGS Uncompahgre at Ridgway gauge](#) show similar declines in early April, after significant surges in late March. Unsettled weather on April 2, with snow flurries, ushered in cooler air and cloudier skies for the following several days, with another weak weather system following on the 5th. The combination of cooler temperatures, small amounts of new snow briefly increasing snow albedo, and frequently cloudy skies dampened the preceding surge in streamflows. On April 8, surface flows from the rapidly melting sunny slopes at the bottom end of Senator Beck Basin were once again increasing, as was the flow at the stream gauge, as seen in the video link below. Senator Beck Basin total discharge remains quite small, to-date, as much of the upper Basin snowpack is only now approaching isothermal snow temperatures, at 0° C

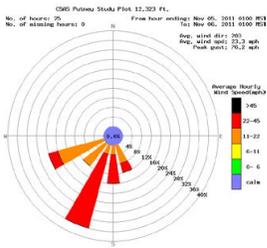
The effects of early April weather are also seen in the USGS gauge data from the [Animas River at Durango](#), [Dolores River at Dolores](#), and [San Miguel River near Placerville](#).



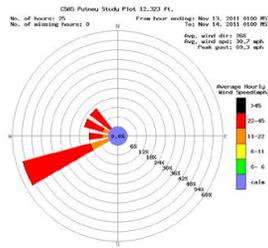
WIND BEHAVIOR

The following graphs show wind behavior during the Water Year 2012 dust-on-snow events at our Putney Study Plot (best wind data for Senator Beck Basin Study Area and Red Mountain Pass). We have estimated beginning and end times of each event based on observations from Silverton, CO. For more on this wind analysis, see the [CODOS dust log and wind rose table](#).

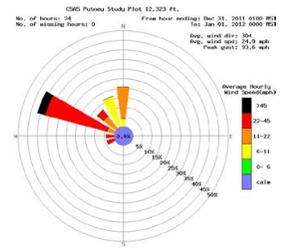
D1: Nov 5, 2011



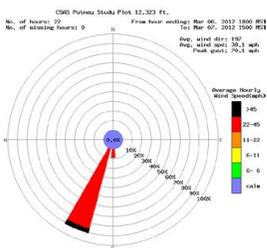
D2: Nov 13, 2011



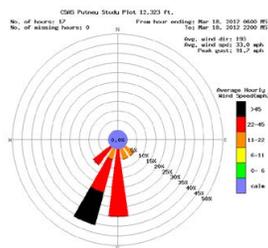
D3: Dec 3, 2011



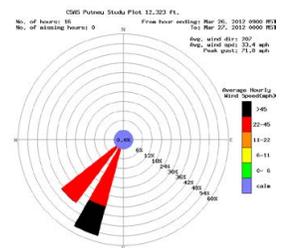
D4: March 6, 2012



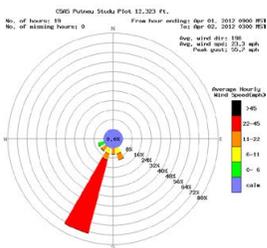
D5: March 18, 2012



D6: March 26, 2012



D7: April 1, 2012



D8: April 6, 2012

