Recent rain event, streamflow effects

June Greetings from Silverton -

Last Friday, Saturday, and Sunday June 5-7, we logged a total of 39 mm of precipitation (15 mm 6/5. 23 mm 6/6, and 1 mm 6/7) at the Swamp Angel Study Plot (SASP) at Senator Beck Basin. Given steadily rising streams in the days prior to this event, including our own Senator Beck Basin runoff, there was concern that additional snowmelt from rain-on-snow could result.

At the SASP elevation, 11,060', almost all of this fell as rain or mixed rain/sleet and we gained no additional depth of snowcover at SASP. At the higher Senator Beck Study Plot (SBSP at 12,180') some fraction of this precipitation fell as snow and we did gain 10 cm (4") of snow depth there.

Snowline in the Red Mountain Pass locale was at about 11,000' prior to this storm so the Senator Beck Stream Gauge, at 11,040', was well positioned to assess the impact of this rain on snowmelt runoff, and the contribution of snowmelt to any change in Uncompahgre River flows as measured at the USGS Uncompahgre River Near Ridgway gauge.

During this rain event, streamflow measured at our Senator Beck Stream Gauge actually declined, from a 24-hour mean of 12.82 cfs for June 4, the peak flow for the season to-date, down to 9.23 cfs for June 7. 24-hour mean air temperatures remained above freezing throughout the rain event, at both SASP and SBSP.

Also during this event, 24-hour mean incoming solar (shortwave) radiation plunged from averaging near 400 w/m2 on June 2,3 and 4 to 119 w/m2 on June 5 and 173 w/m2 on June 6. This is the straightforward impact of heavy cloud cover. Those same clouds, however, were emitting thermal (longwave) radiation that did contribute energy to the snow surface energy budget throughout the event, especially at night. Overall, though, the loss of solar radiation resulted in a net reduction in radiative forcing of snowmelt.

At the USGS Uncompahgre gauge, streamflow was slightly declining on June 3-4 following a peak of near 640 cfs on June 3, as the most vulnerable

snowpack was being rapidly depleted. Then, flows rose again to the season-to-date peak of near 700 cfs on June 6. (All this behavior was at flow levels that exceeded the median discharge levels for those dates and followed a very steep surge in flows in late May.)

Despite almost entirely above-freezing air temperatures throughout the rain event period, and the additional thermal energy contained in the rain falling on snow (even the sleet was at 0 C and did not significantly cool the snow surface), the loss of energy from direct solar radiation was too much for the other factors in the snow surface energy budget to overcome, and snowmelt rates declined. It seems, then, that even with significant amounts of rain-on-snow, at most elevations of snowcover, the uptick in Uncompahgre River flows was rain driven, and that the additional flows produced by rain on the non-snowcovered terrain below 11,000' offset the decline in flows from snowmelt.

That's enough on this for now ... the somewhat counterintuitive outcome of this rain-on-snow event deserves more thought and you may have seen somewhat diifferent outcomes in your locale. Now it looks like we're in for a repeat rain event, so we'll see how this plays out.

More soon,
Chris