

WRF-Hydro/Airborne Snow Observatory Assimilated Hydrologic Forecasts: Colorado

Date of report generation: June 28, 2023

[Updated for all basins each new forecast that becomes available]

Provided by: NCAR WRF-Hydro Modeling Team

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Overview:

This report summarizes WRF-Hydro forecast results for selected major river basin forecast points across the state of Colorado. Included in each report are the following:

- Spatial maps of analyzed ASO-assimilated SWE from WRF-Hydro
- Time-series plots of basin-averaged analyzed and forecasted SWE from the WRF-Hydro OpenLoop model, WRF-Hydro ASO-assimilated model and SNODAS products
- Plots of elevation bin-averaged SWE vs. elevation from WRF-Hydro OpenLoop and ASO-Assimilated analyses and SNODAS
- Tabulations of Apr. 1 – Jul. 31 and/or Apr. 1 – Sep. 30 ensemble seasonal water supply forecasts

WRF-Hydro Forecasts for the Colorado Airborne Snow Measurement (CASM)

The WRF-Hydro modeling system has been employed in various seasonal water supply forecasting activities in the State of Colorado since 2015. Starting first in the Rio Grande/Conejos River basin regions new forecast basins/locations have steadily been added over time as interest in the system has grown. Currently a single model domain has been established over all of the mountain headwater regions of the state to enable snowpack and runoff predictions from key water resource generation areas. While the model integrates over all of these areas, preparation and optimization of *reliable* forecasts at particular locations is limited to areas where funded efforts have been made to engage in data assimilation, model evaluation and model optimization. Prior forecast domains have included the Rio/Conejos system, East/Taylor system, the Dolores basin, Blue River/Dillon Reservoir system and the Upper Colorado/Fraser/Willow Creek/Windy Gap system. The CASM mission has recently (past 2 years) contributed to this data assimilation and model optimization effort by coordinating and support Airborne Snow Observatory, Inc. surveys of snowpack and model forecasting activities. This year new forecast basins include the Roaring Fork/Frying Pan System, the Upper South Platte System and Poudre/ Big Thompson/St. Vrain/Boulder/Clear Creek Front Range systems. Implementation of these new areas along with enhanced optimization of prior domains initiated in April 2023 at the start of the new contract to

fund WRF-Hydro forecasting. As such, forecast development for new basins added this year are still a work in progress and forecast results will be shared as they become available.

This report is organized by river basin which each basin area containing the following information:

- Spatial analyses of ASO-assimilated (where available) snow water equivalent (SWE)
- Basin-averaged analyses and ensemble mean forecast plots of SWE
- Elevation distributions of SWE
- Spatial maps and basin-averaged analyses of modeled soil moisture
- Sub-seasonal (April-July) and seasonal (April-Sept.) values of ensemble accumulated runoff or reservoir inflow

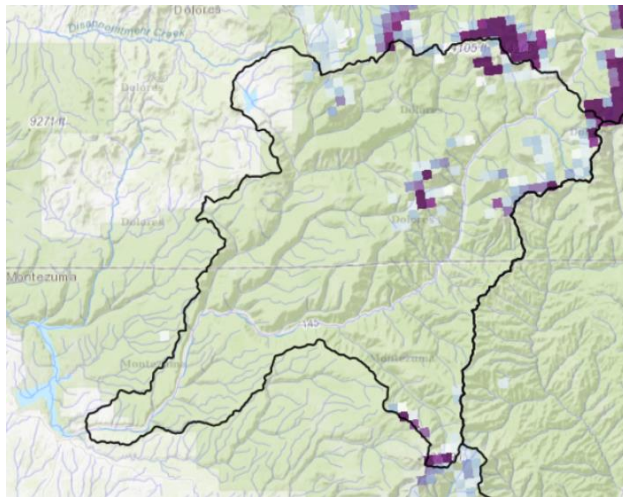
Additional model outputs are being prepared and will be added to future reports as they become available. Additionally, as noted above, several forecast locations are new or are having issues addressed that relate to the availability of timely and quality unregulated flow information for model calibration and forecast preparation. As such, not all locations have forecast information available at this time but will be added as work proceeds.

IMPORTANT: All flow accumulation forecasts from this specific configuration of the WRF-Hydro model are “natural” flow values with no accounting for reservoir storage/release, diversions, transfers or managed return flows. As such, these forecast numbers should be compared against analogous naturalized flow measurements or estimates.

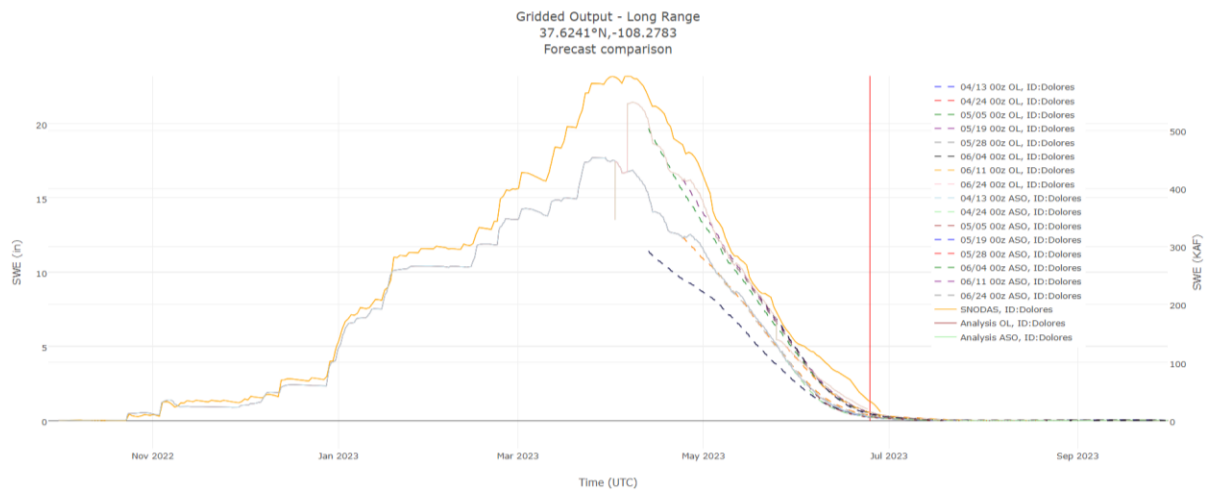
Dolores River Basin:

As of June 23 the ASO-assimilated snowpack from the WRF-Hydro model with ASO survey assimilation was approximately 19.6 (vs. 62.2 kac-ft on June 11) and dropping quickly. Snowpack ablation forecasts have tracked subsequent analyses quite well. Nearly all snowpack resided above 11,500 ft. Basin-averaged soil saturation fraction had decayed to nearly 60%.

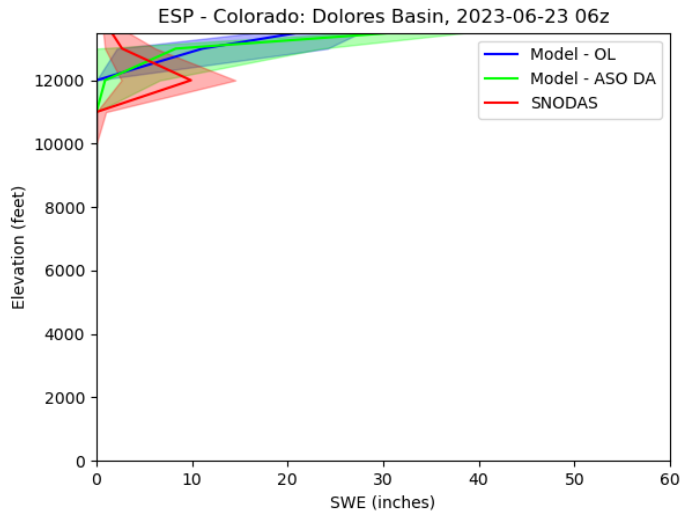
Spatial map of ASO-assimilated SWE:



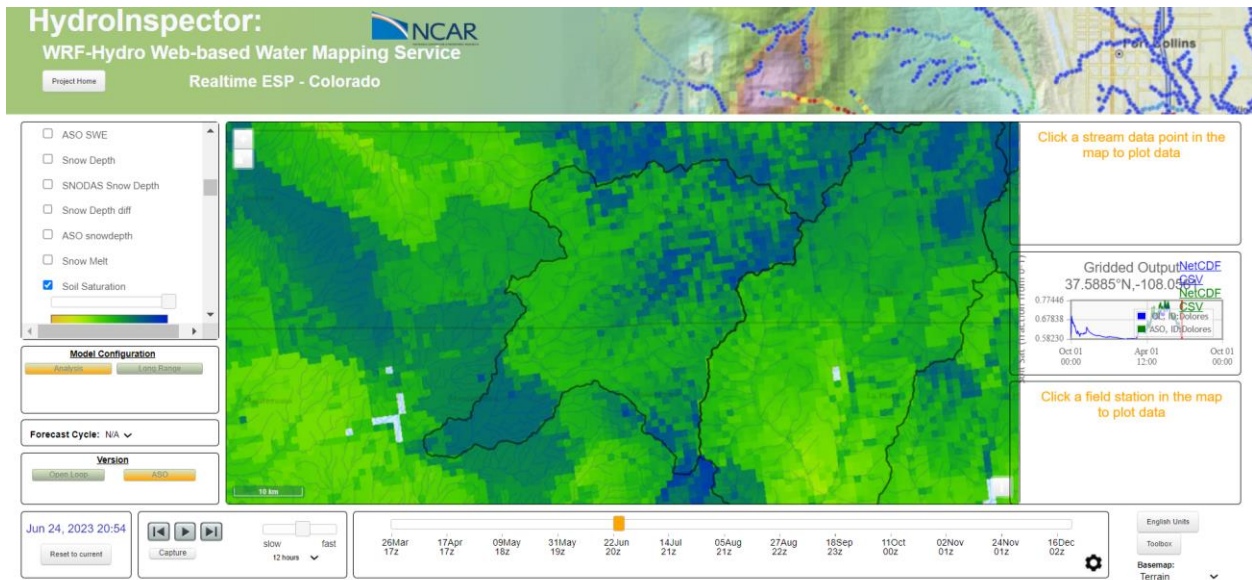
Basin-averaged analyses and forecasts of ASO-assimilated SWE:



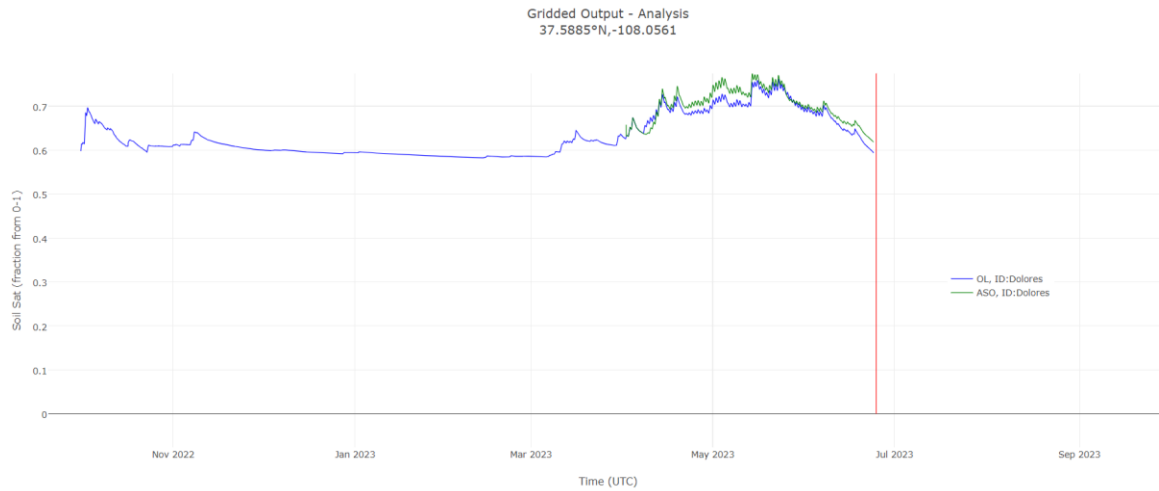
Elevation profile of SWE for SNODAS (red), ASO-assimilated snowpack (green) and WRF-Hydro OpenLoop (blue)



Spatial map of WRF-Hydro modelled soil saturation:



Basin-averaged soil saturation values:



Dolores R. at Dolores, CO, median (Q50) runoff forecast (initialized on 6/23/2023):

Apr-Jul: 438 kac-ft *(Noted major diversion upstream to Groundhog Res.: 22 kac-ft and climbing....adjusted total = 460 kac-ft)

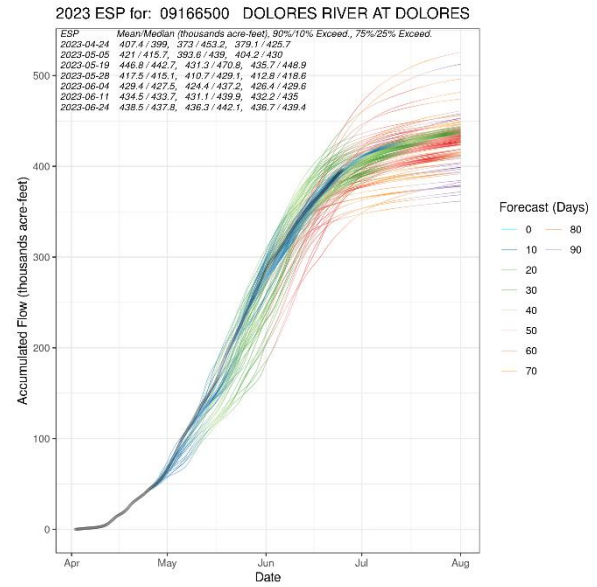
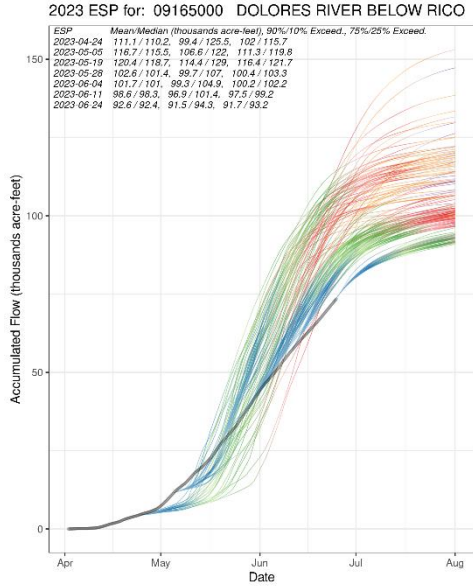
Apr-Sep: 464 kac-ft *(Noted major diversion upstream to Groundhog Res.: 22 kac-ft and climbing....adjusted total = 486 kac-ft)

Dolores R. blw Rico, CO, median (Q50) runoff forecast (initialized on 6/23/2023):

Apr-Jul: 92.4 kac-ft

Apr-Sep: 101.4 kac-ft

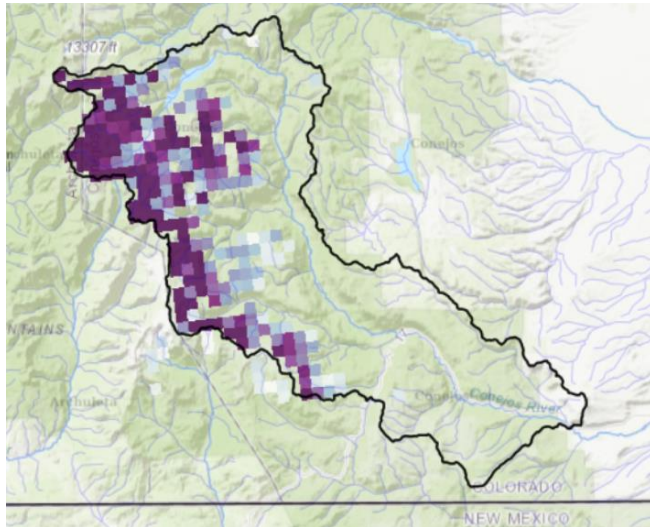
Sample plots for Apr-Jul ESP forecasts (ignore forecasts before 4/24):



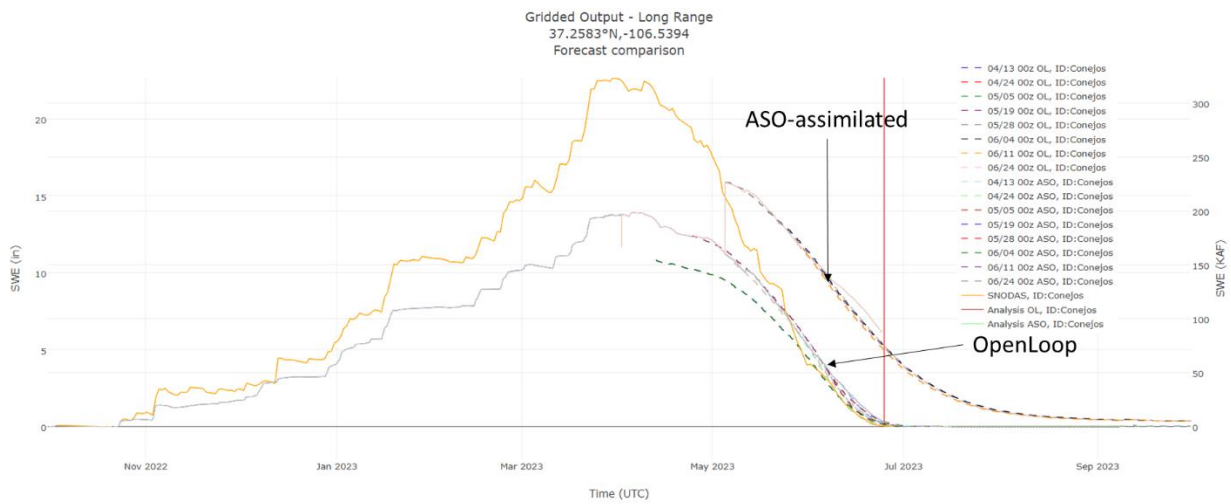
Conejos System:

As of June 23 the ASO-assimilated snowpack from the WRF-Hydro model was approximately 87.3 kac-ft (vs. 129.5 kac-ft on June 11) for the Conejos basin above Mogote. Nearly all snowpack resided largely above 11,000 ft. Basin averaged soil saturation fraction have continued to fall below their seasonal maximum values and currently reside below 60%.

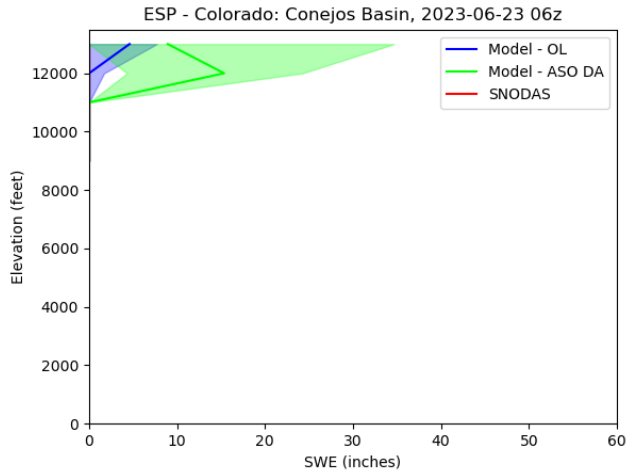
Spatial map of ASO-assimilated SWE:



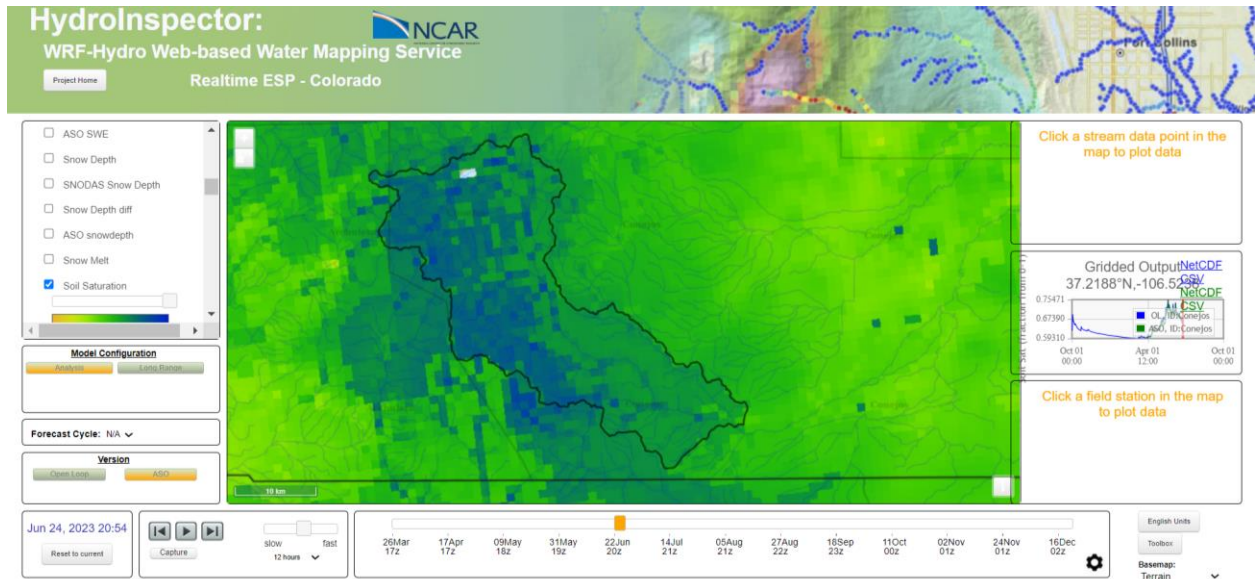
Conejos basin-averaged analyses and forecasts of ASO-assimilated SWE:



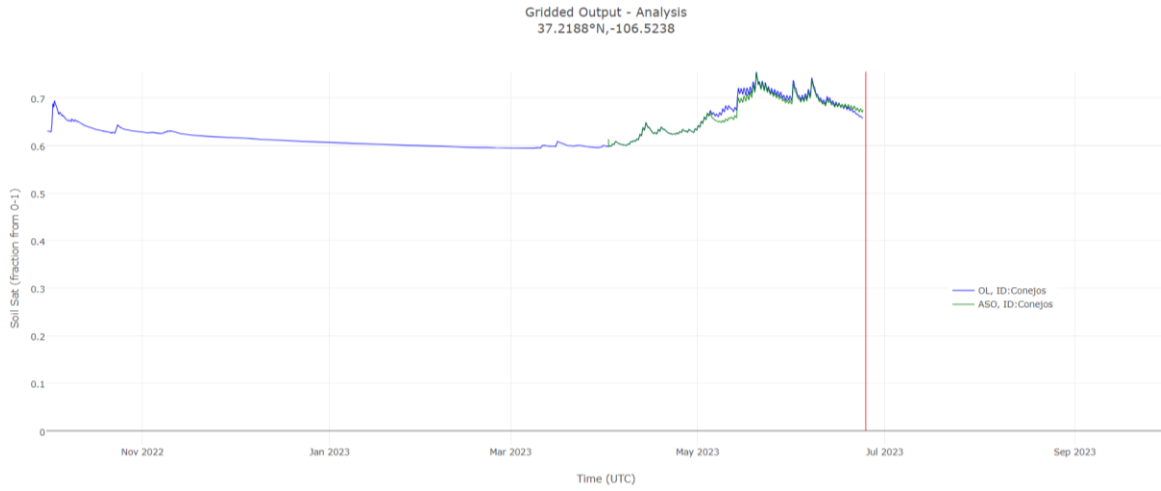
Elevation profile of SWE for SNODAS (red), ASO-assimilated snowpack (green) and WRF-Hydro OpenLoop (blue)



Spatial map of WRF-Hydro modelled soil saturation:



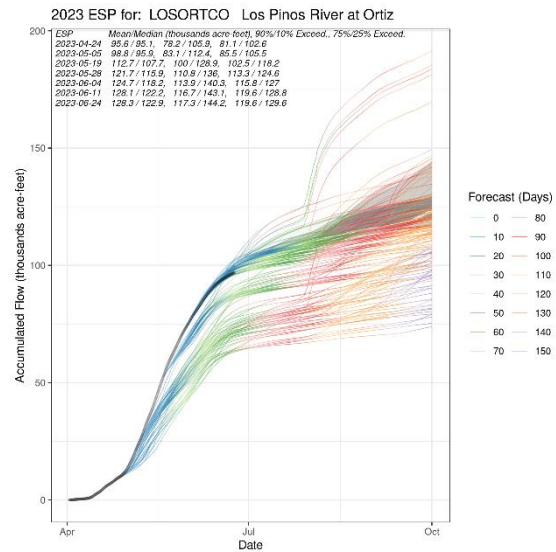
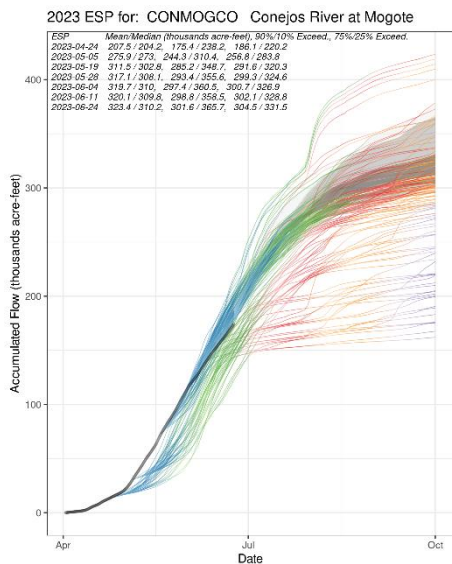
Basin-averaged soil saturation values:



Conejos April-Sep and April-July Median (Q50) Accumulated Runoff/Inflow (initialized on 6/23/2023):

- Conejos System: WRF-Hydro/ASO: 411.6 kac-ft (Apr-Jul): 462.1 kac-ft (Apr-Sep)
- Conejos at Mogote: WRF-Hydro/ASO: 274.3 kac-ft (Apr-Jul): 310.2 kac-ft (Apr-Sep)
- San Antonio @ Ortiz: WRF-Hydro/ASO: 27 kac-ft (Apr-Jul): 29 kac-ft (Apr-Sep)
- Los Pinos @ Ortiz: WRF-Hydro/ASO: 110.3 kac-ft (Apr-Jul): 122.9 kac-ft (Apr-Sep)

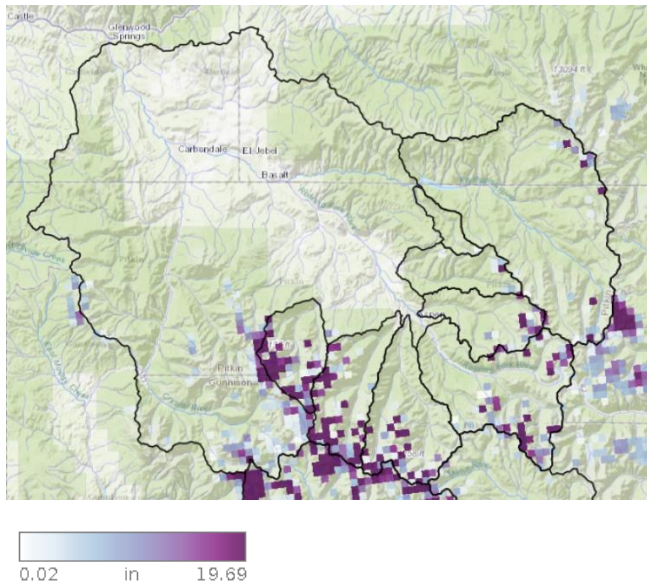
Sample plots for Apr-Sep ESP forecasts (ignore forecasts before 4/24):



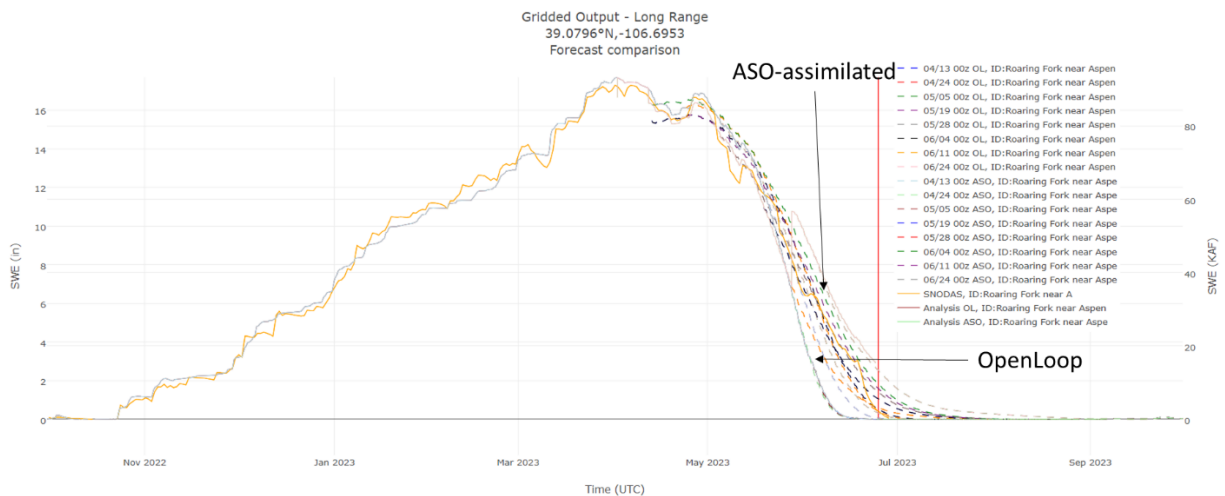
Roaring Fork/Frying Pan System:

As of June 23 the ASO-assimilated snowpack from the WRF-Hydro model was approximately 15.3 kac-ft (vs. 31.5 kac-ft on June 11) for the Roaring Fork River above Aspen and 5.5 kac-ft (vs 30.6 kac-ft on June 11) for the Frying Pan River above Ruedi Reservoir following the latest available ASO survey. The bulk of the remaining snowpack in the combined Roaring Fork/Frying Pan system resided above 11,500 ft. Basin averaged soil saturation fractions for the combined Roaring Fork/Frying Pan system above Glenwood saw consistent decreases.

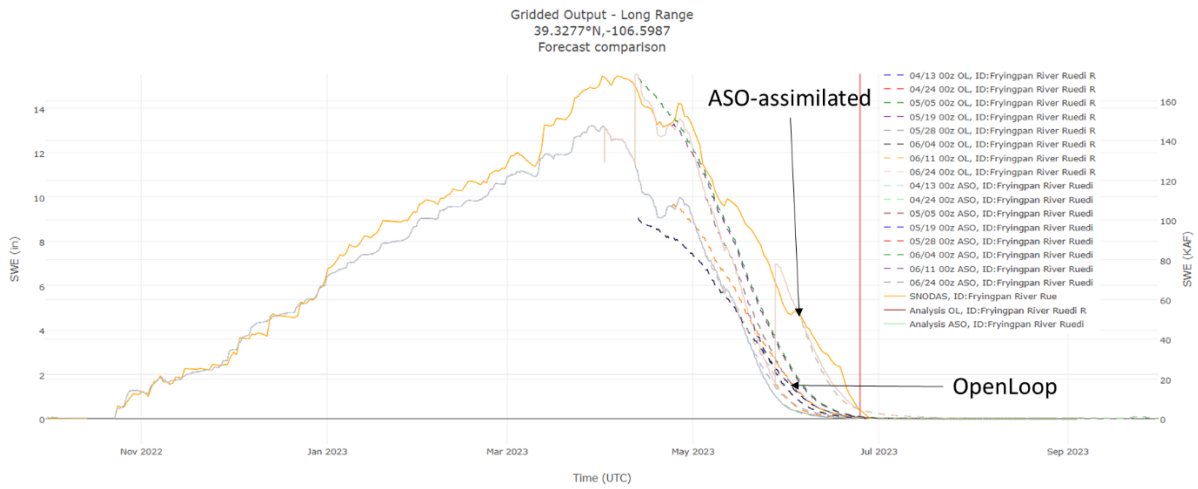
Spatial map of ASO-assimilated SWE:



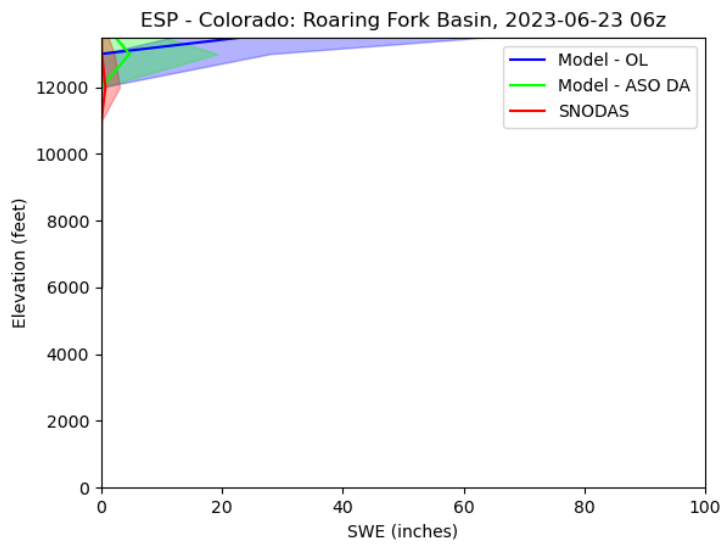
Basin-averaged analyses and forecasts of ASO-assimilated SWE (Roaring Fork River near Aspen):



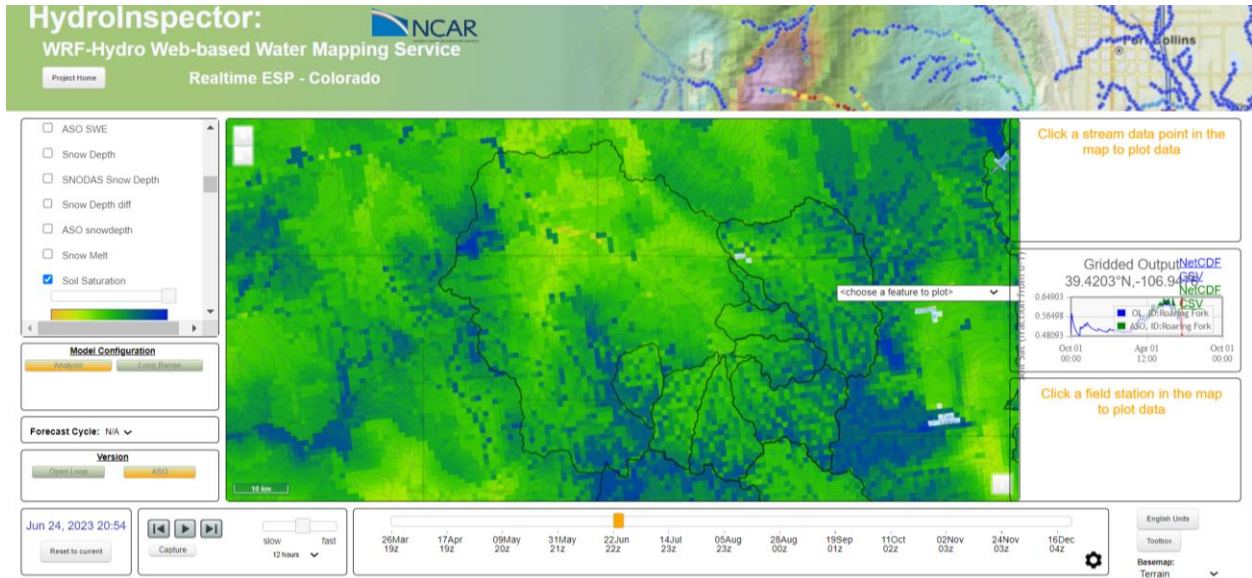
Basin-averaged analyses and forecasts of ASO-assimilated SWE (Frying Pan River above Ruedi Reservoir):



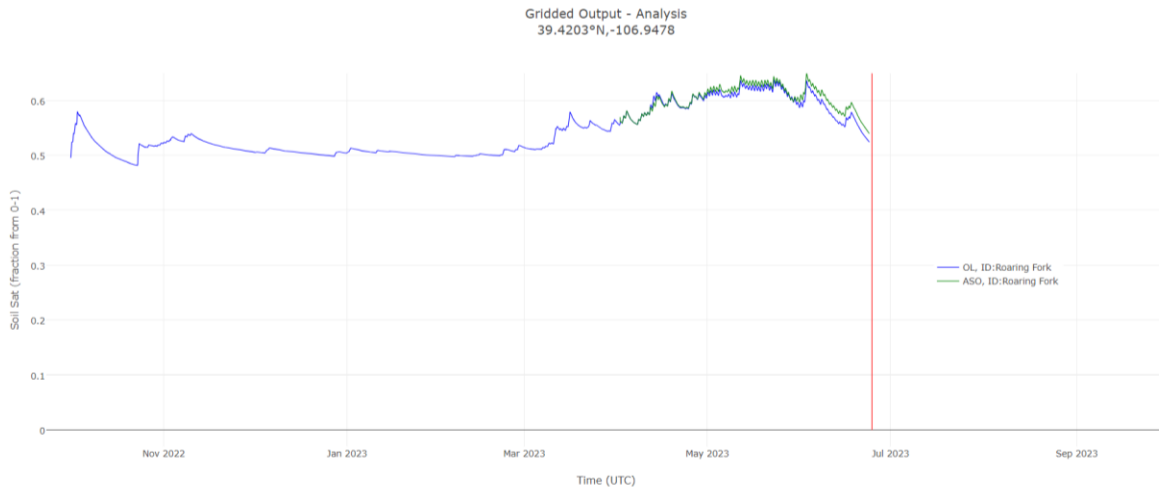
Elevation profile of SWE for SNODAS (red), ASO-assimilated snowpack (green) and WRF-Hydro OpenLoop (blue) for the combined Roaring Fork/Frying Pan System above Glenwood Springs, CO:



Spatial map of WRF-Hydro modelled soil saturation:



Basin-averaged soil saturation values:



Roaring Fork/Frying Pan April-Jul Median (Q50) Accumulated Runoff/Inflow (initialized on 6/23/2023):

Roaring Fork near Aspen: 58.3 kac-ft (New forecast site)

Roaring Fork abv Difficult near Aspen: 39.5 kac-ft (New forecast site)

Roaring Fork at Glenwood Springs: 606 kac-ft (New forecast site, "naturalized" flow forecast, downstream of major anthropogenics, currently based on actual-obs flows...very experimental)

Snowmass Creek: 39.5 kac-ft (CDWR: SNOCRECO...New forecast site)

Ruedi Reservoir Inflow: 139 kac-ft (New forecast site...heavily impacted from upstream diversions...Forecast developed using unregulated flow from USBR API: 104.55 kac-ft from Apr 1 – June 23)

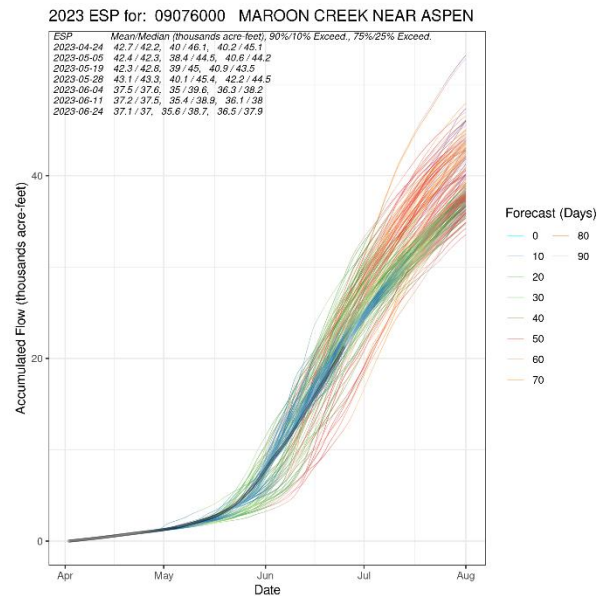
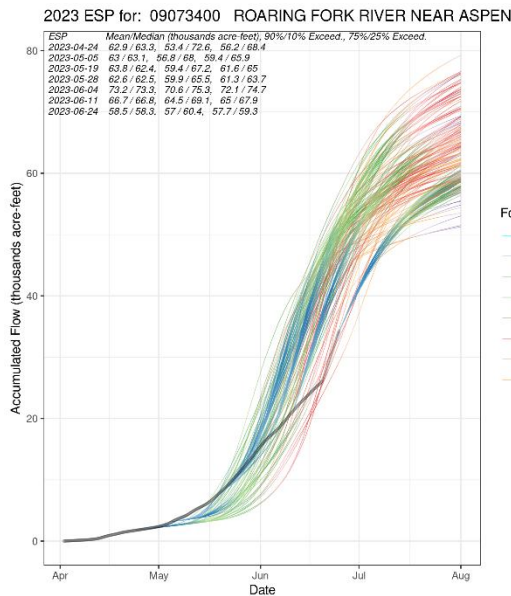
Hunter Cr: 31.8 kac-ft (CDWR: HUNATACO...*based on analyzed past flow, not observed)

Maroon Cr nr Aspen: 37 kac-ft (New forecast site)

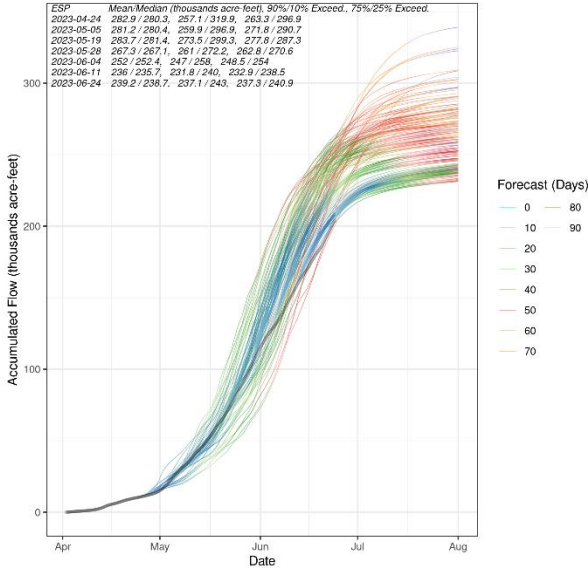
Castle Cr: 52.8 kac-ft (New forecast site)

Crystal River @ Dow Fish Hatchery nr Carbondale: 238.7 kac-ft (CDWR: CRYDOWCO...New forecast site)

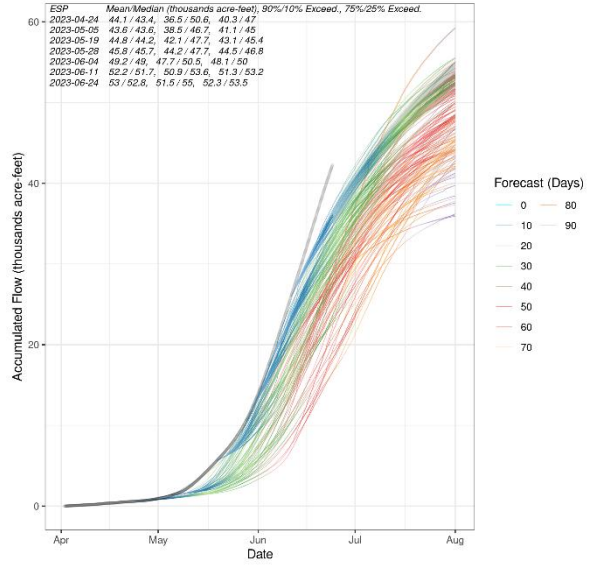
Sample plots for Apr-Oct ESP forecasts (ignore forecasts before 4/24):



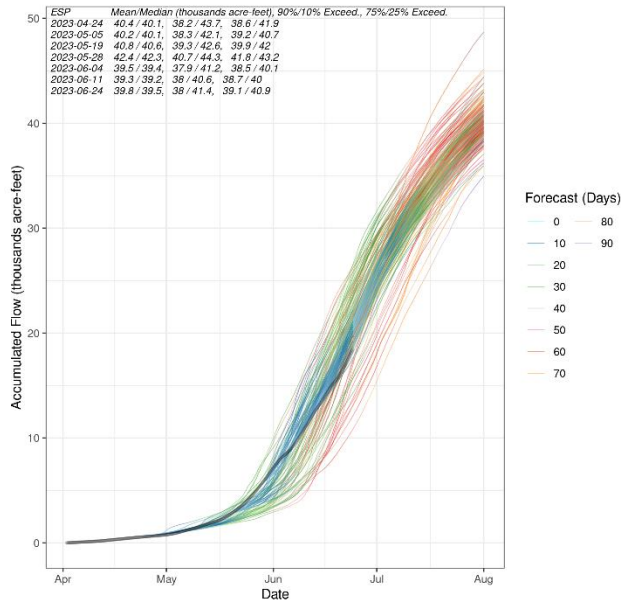
2023 ESP for: CRYDOWCO CRYSTAL AT DOW FISH HATCHERY CARBON



2023 ESP for: 09075000 CASTLE CREEK NEAR ASPEN



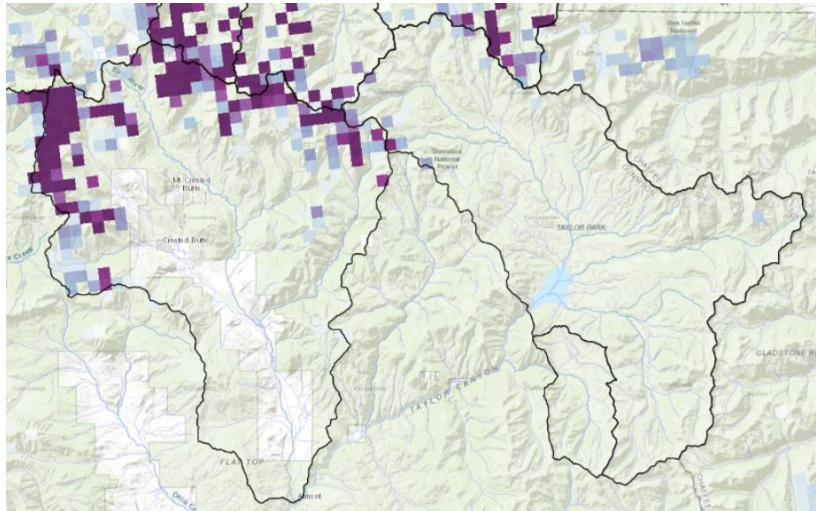
2023 ESP for: SNOCRECO SNOWMASS CREEK



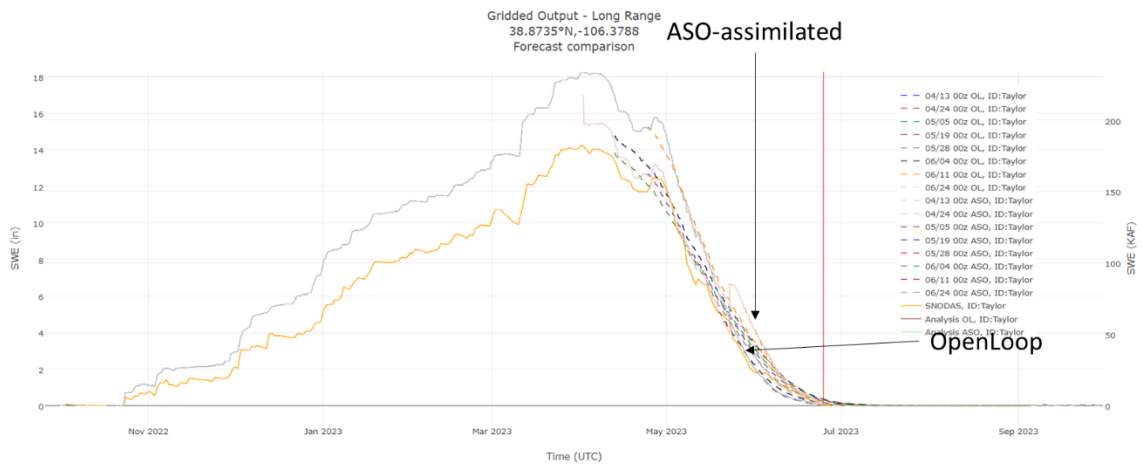
Taylor River/East River System:

As of June 23 the ASO-assimilated snowpack from the WRF-Hydro model was approximately 2.6 kac-ft for the Taylor basin above Taylor Reservoir (vs. 17.8 kac-ft on June 11) and 60.5 (vs. 100.8 kac-ft on June 11) for the East River above Almont. The bulk of the remaining snowpack in the throughout the Upper Taylor and East River basins resided above 11,500 ft. Basin averaged soil saturation fractions for both systems have shown continued declines and have fallen to around 60%.

East and Taylor River Water Equivalent (SWE) Analysis



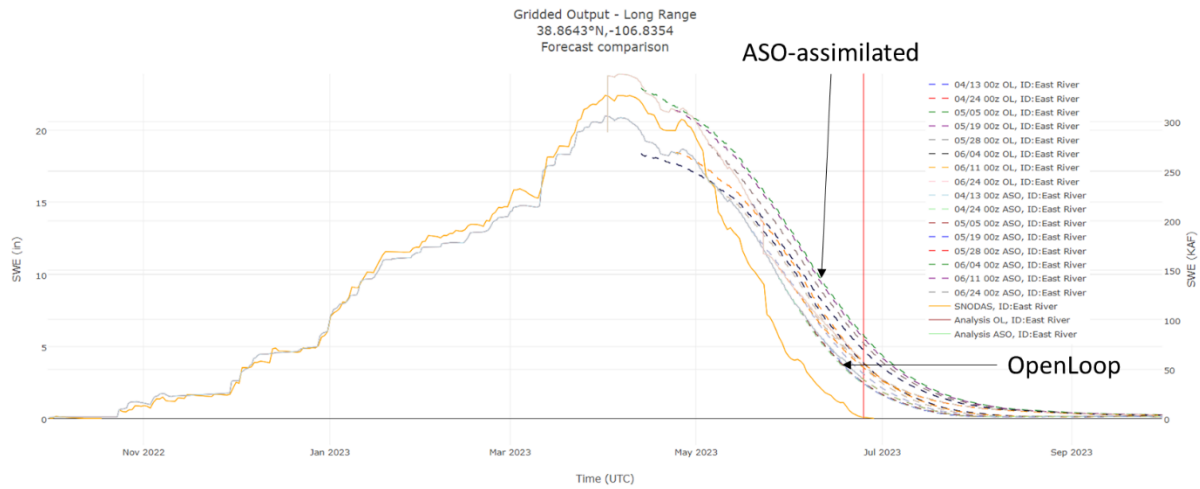
Taylor Basin Basin-averaged Snow Water Equivalent (SWE) Analysis and Forecasts



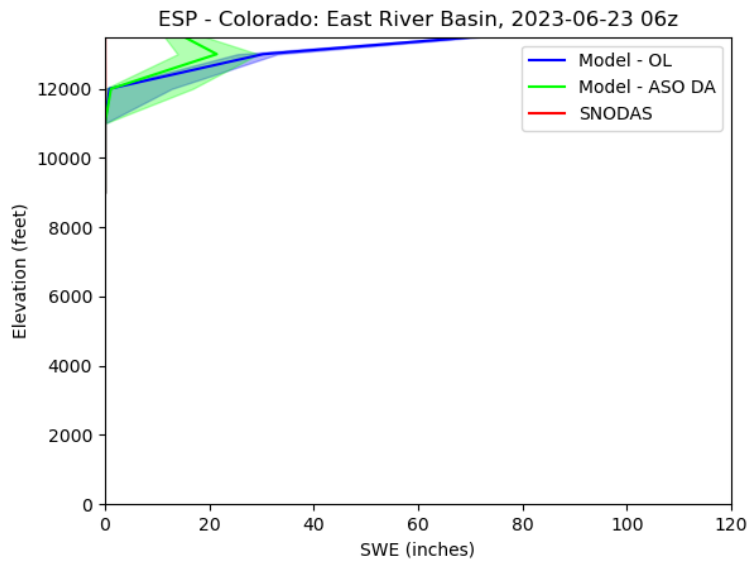
Elevation profile of SWE for SNODAS (red), ASO-assimilated snowpack (green) and WRF-Hydro OpenLoop (blue) for the Taylor basin above Taylor Park Reservoir:

- **With only 2.6 kac-ft of snow left in the Upper Taylor basin we have discontinued the elevation profile of SWE plot.**

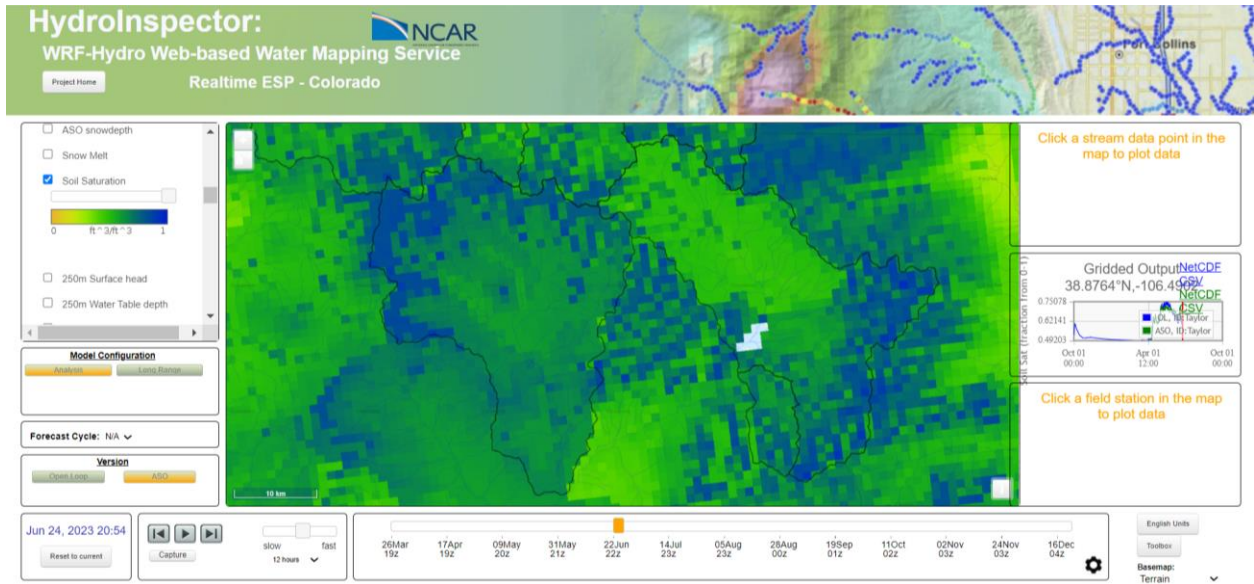
East River Basin-averaged Snow Water Equivalent (SWE) Analysis and Forecasts:



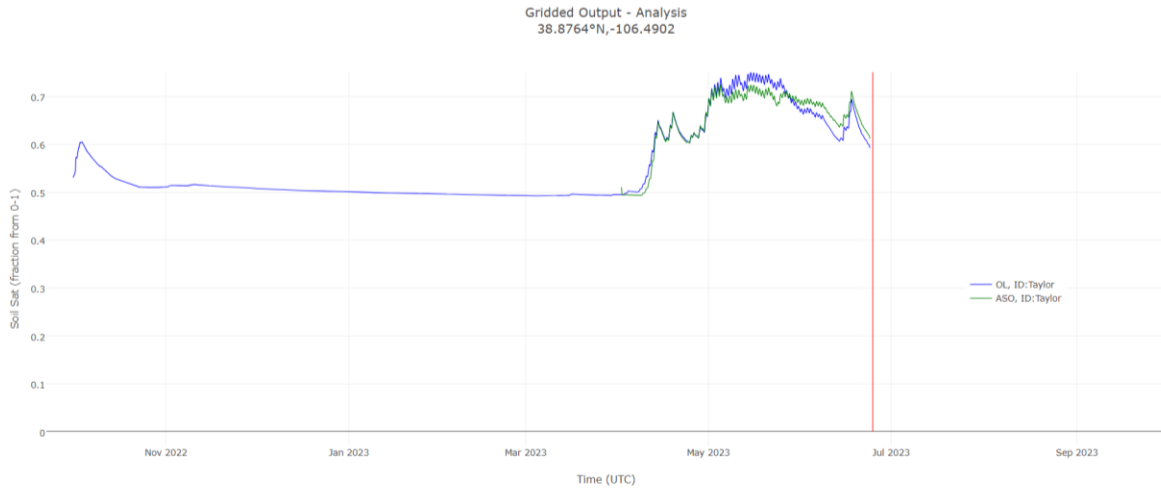
Elevation profile of SWE for SNODAS (red), ASO-assimilated snowpack (green) and WRF-Hydro OpenLoop (blue) for the East River basin above Almont, CO:

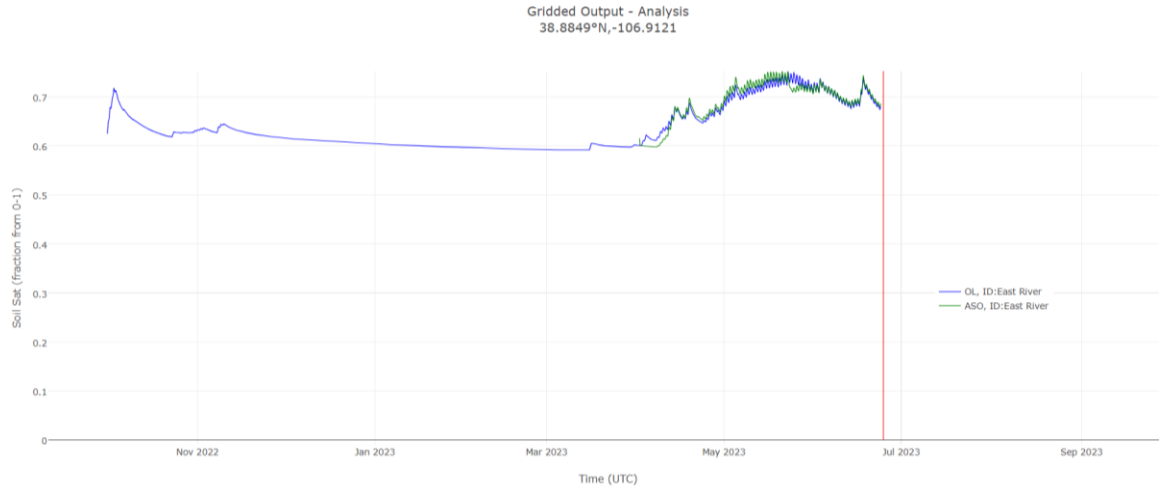


Spatial map of WRF-Hydro modelled soil saturation:



Basin-averaged soil saturation values for the Taylor River basin above Taylor Reservoir and East River above Almont:





Taylor and East Rivers April-Jul Median (Q50) Accumulated Runoff/Inflow (initialized on 6/23/2023):

Taylor Reservoir Inflow: 117 kac-ft

Taylor R. abv Taylor Res: 59.9 kac-ft

Texas Cr. abv Taylor Res: 19.5 kac-ft

Willow Crk abv Taylor Res: 15.9 kac-ft

East River blw Cement Cr: 253.9 kac-ft

East River at Almont: 265.3 kac-ft

Elk Creek abv Crested Butte: 2.6 kac-ft

Ohio Creek @ Baldwin: 73.6 kac-ft

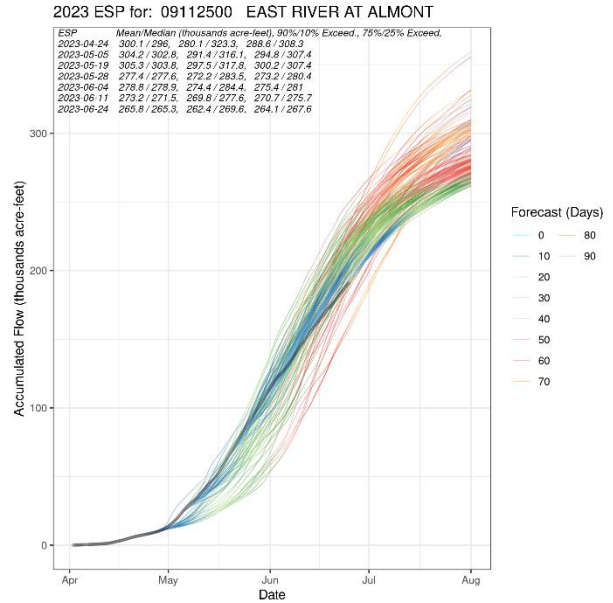
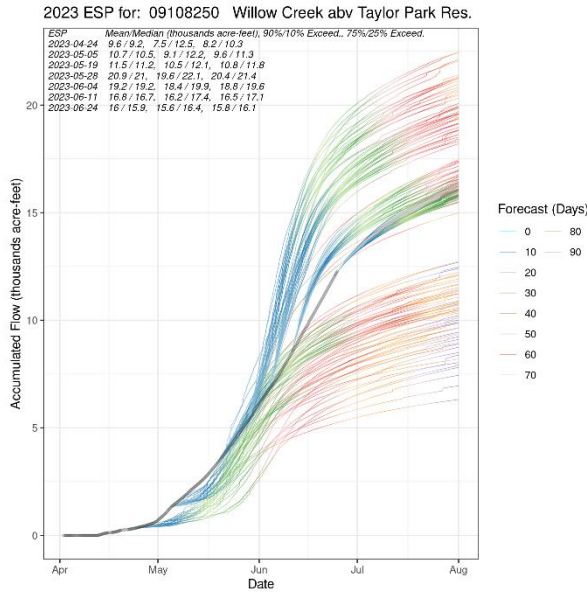
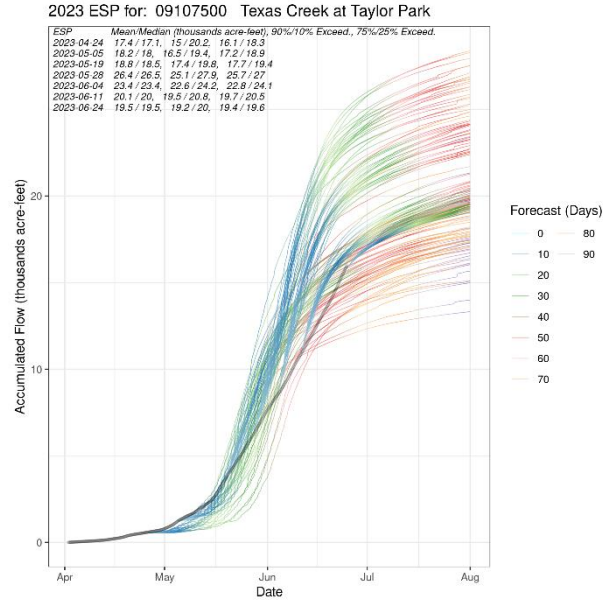
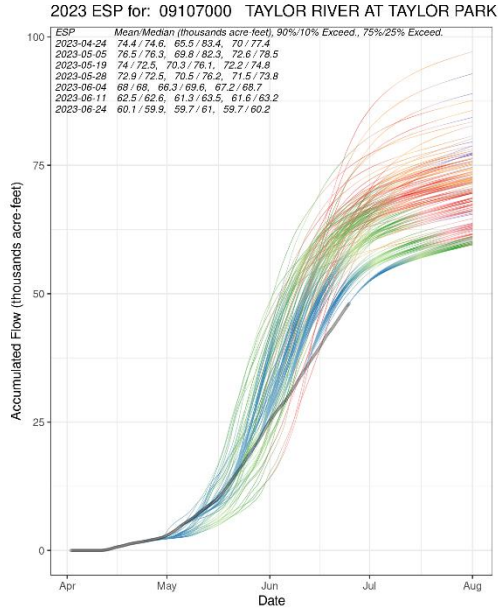
Slate River nr Crested Butte: 130.3 kac-ft

Coal Cr nr Crested Butte: 27.8 kac-ft

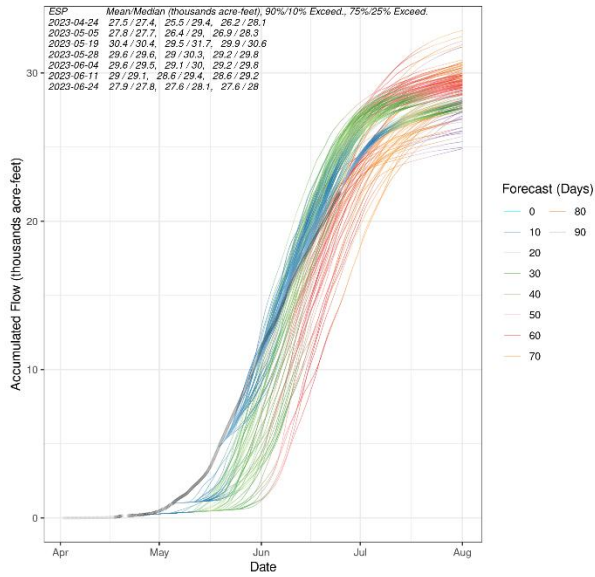
Tomichi Cr @ Sargents: 40.8 kac-ft

Blue Mesa inflow: 896.2 kac-ft (notable upstream diversions/management)

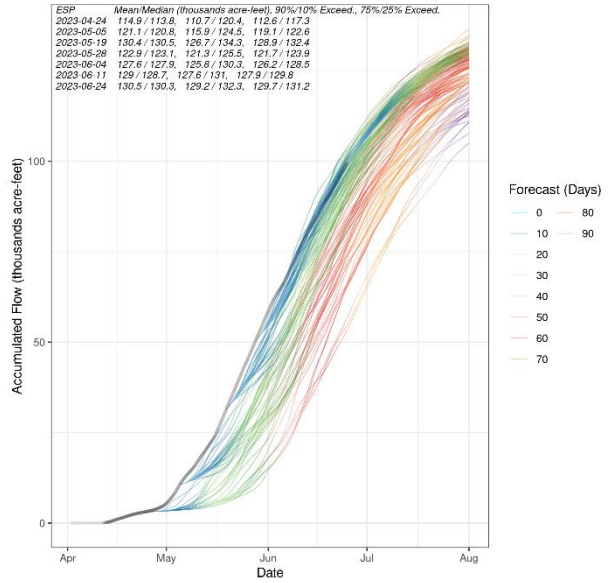
Example ensemble flow accumulation plot for Apr-Jul inflow (initialized 6/4/2023):



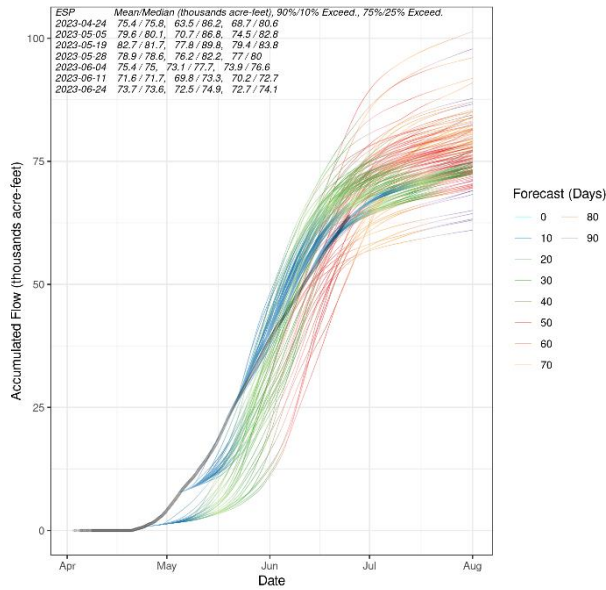
2023 ESP for: 09111250 COAL CREEK abv MCCORMICK CRESTED BUTTE



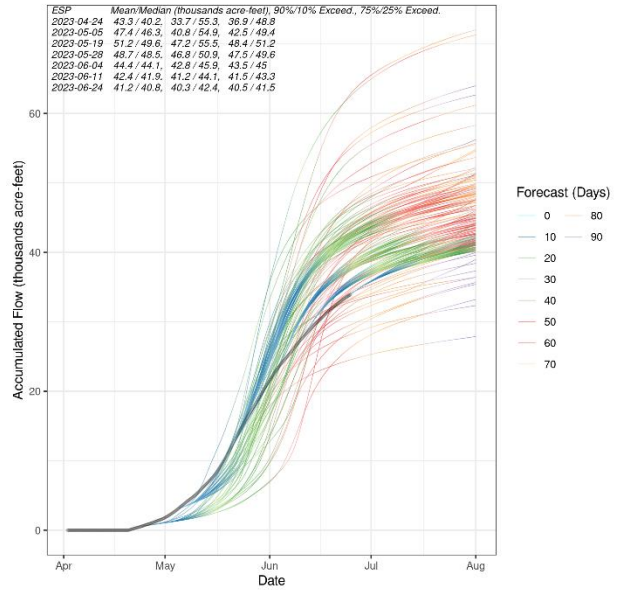
2023 ESP for: 385106106571000 Slate River nr Crested Butte



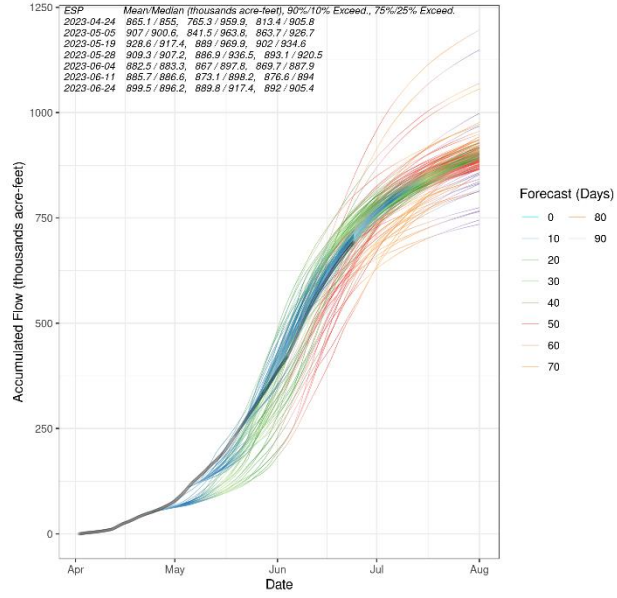
2023 ESP for: 09113500 OHIO CREEK NEAR BALDWIN



2023 ESP for: 09115500 TOMICHI CREEK AT SARGENTS



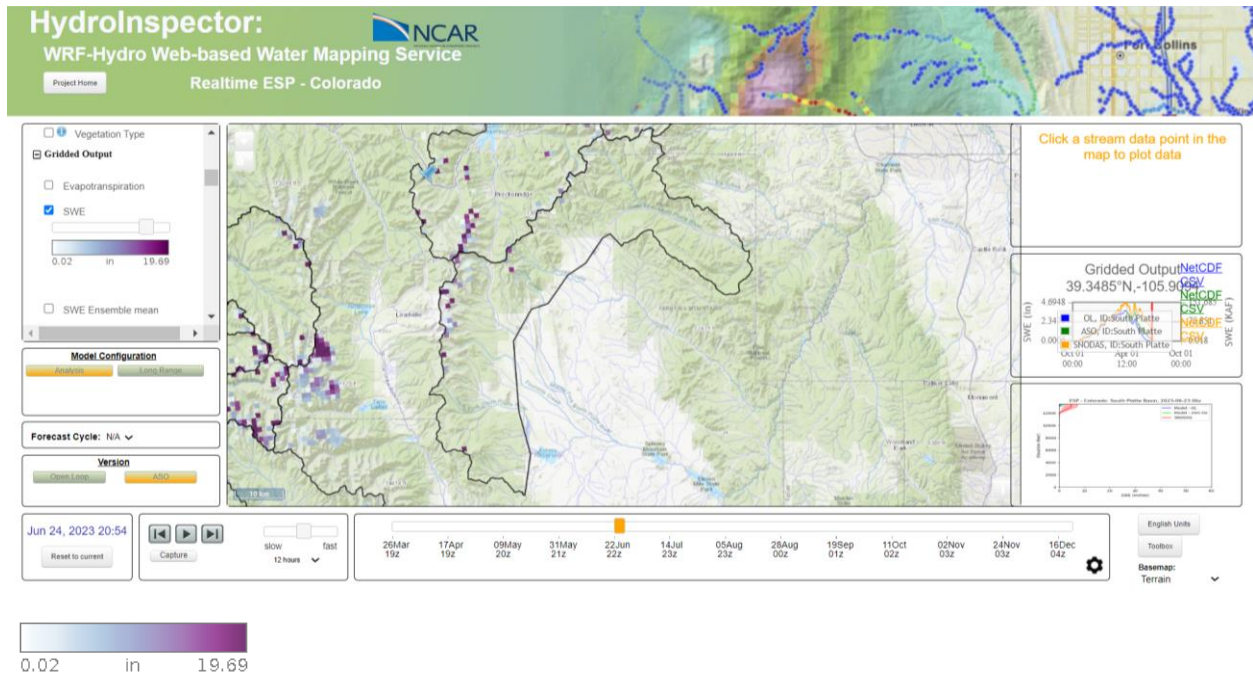
2023 ESP for: 3252975 Blue Mesa Reservoir



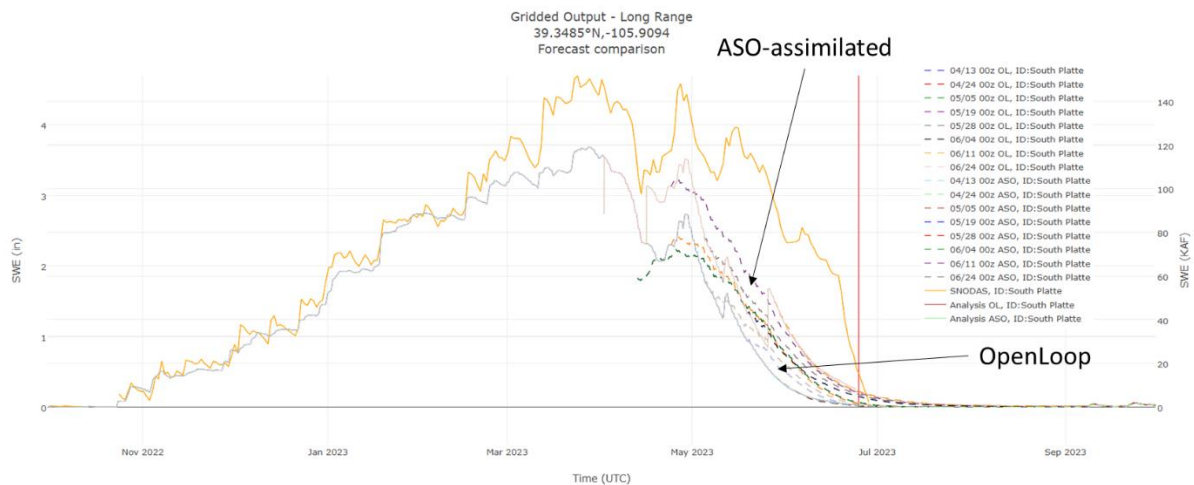
Upper South Platte River System:

As of June 23 the ASO-assimilated snowpack from the WRF-Hydro model was approximately 8.1 kac-ft (vs. 19 kac-ft on June 11) for the Upper South Platte River basin. What minor snowpack remaining in the basin is found above 12,000 ft. Basin averaged soil saturation fractions have fallen to around 60%.

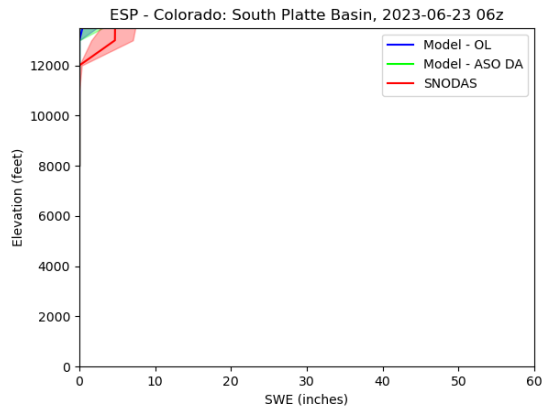
Upper South Platte River Snow Water Equivalent (SWE) Analysis and Forecasts



Upper South Platte River Basin-averaged Snow Water Equivalent (SWE) Analysis and Forecasts:



Elevation profile of SWE for SNODAS (red), ASO-assimilated snowpack (green) and WRF-Hydro OpenLoop (blue) for Upper South Platte River basin:



Spatial map of WRF-Hydro modelled soil saturation:

HydroInspector:
WRF-Hydro Web-based Water Mapping Service
Project Home Realtime ESP - Colorado

NCAR

ASO SWE
 Snow Depth
 SNODAS Snow Depth
 Snow Depth diff
 ASO snowdepth
 Snow Melt
 Soil Saturation

Model Configuration
 Antecedent Long Range

Forecast Cycle: N/A

Version
 Open Loop ASO

Jun 24, 2023 20:54

slow fast
 12 hours

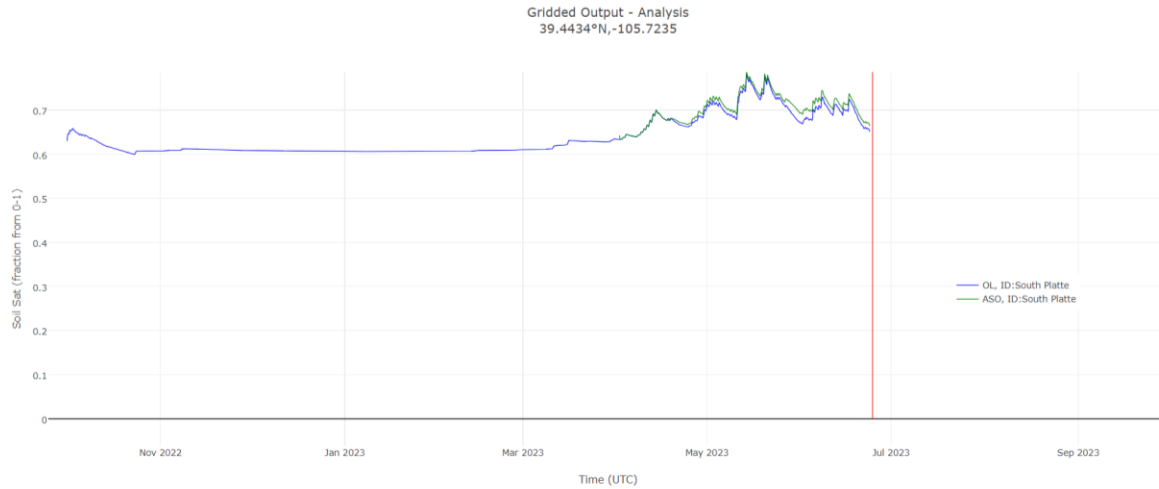
26Mar 19z 17Apr 19z 09May 20z 31May 21z 22Jun 22z 14Jul 23z 05Aug 23z 26Aug 00z 19Sep 01z 11Oct 02z 02Nov 03z 24Nov 03z 10Dec 04z

Click a stream data point in the map to plot data
 Gridded Output NetCDF
 39.4434°N, -105.75°W
 NetCDF
 OL - South Platte ASO - South Platte
 Oct 01 00:00 Apr 01 12:00 Oct 01 00:00

Click a field station in the map to plot data

English Units
 Toolbox
 Basemap: Terrain

Basin-averaged soil saturation values for the Upper South Platte River basin:



Upper South Platte April-Jul Median (Q50) Accumulated Runoff/Inflow (initialized on 6/23/2023):

N. Fork, S. Platte at Bailey (CDWR PLABAICO): 27.1 kac-ft (New forecast site, considerable anthropogenics upstream, no naturalized observed flow data yet available)

Jefferson Cr. near Jefferson (CDWR JEFJEFCO): 3.6 kac-ft (New forecast site, clear evidence of managed flow in observations)

Michigan Cr. near Jefferson (CDWR MCHJEFCO): 5.4 kac-ft (New forecast site)

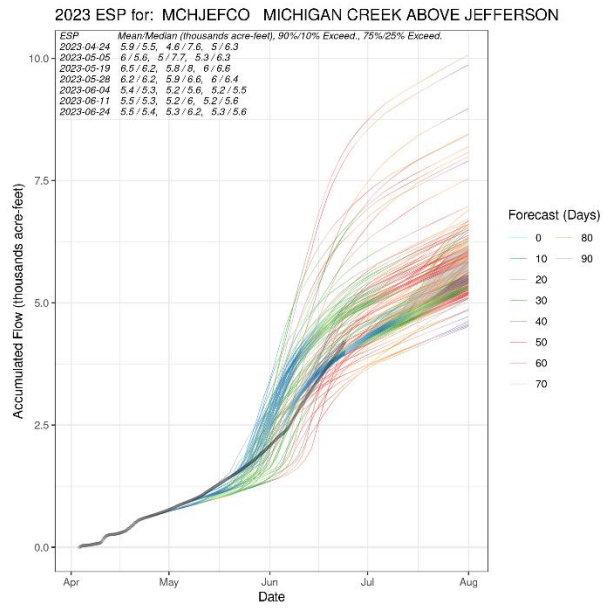
Tarryall Cr at Upper Station (CDWR TARRUPCO): 9.8 kac-ft (New forecast site, no actual observations yet integrated)

Middle Frk S. Platte abv Montgomery Res (CDWR MFKABMCO): 3 kac-ft (New forecast site)

S. Fork of S. Platte abv Antero Res (CDWR SFKANTCO): 8.3 kac-ft (New forecast site...suspect observational data before 4/15)

Antero Res. Inflow: Lacking proper usable observed inflow data...

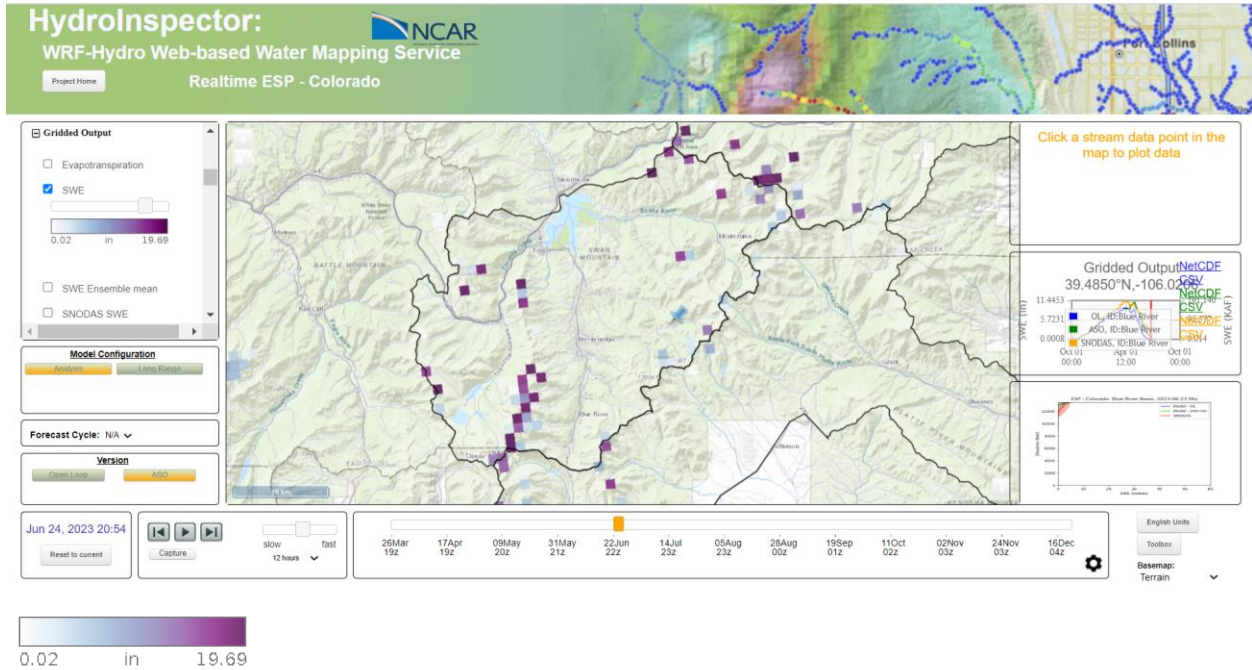
Example ensemble flow accumulation plot for Apr-Oct inflow:



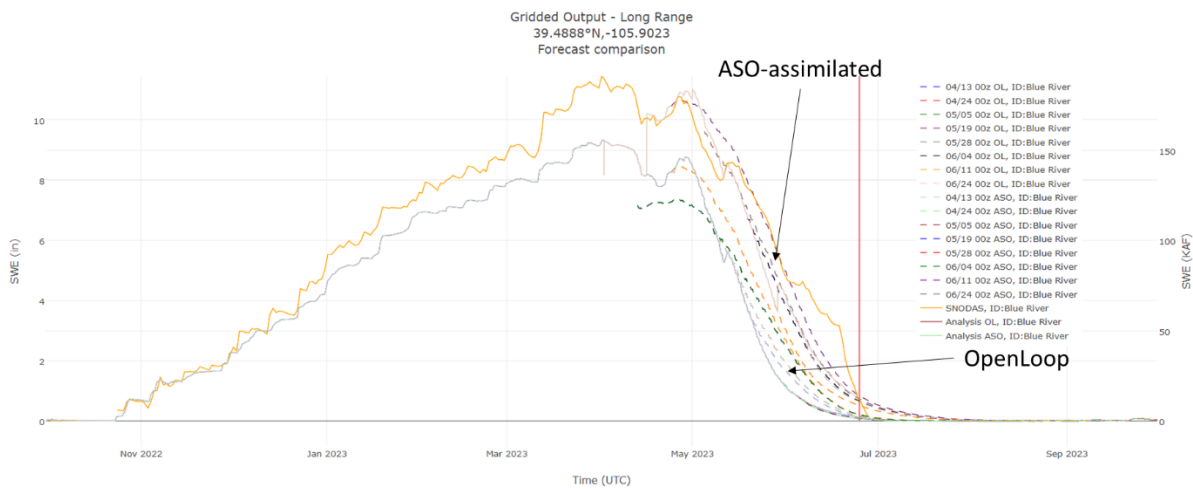
Blue River/Dillon Reservoir System:

As of June 23 the ASO-assimilated snowpack from the WRF-Hydro model was approximately 13.4 kac-ft (vs. 33.4 kac-ft on June 11) for the Blue River/Dillon Reservoir basin. The bulk of the remaining snowpack in the throughout the region resided above 12,000 ft. Basin averaged soil saturation fractions for the basin have continued to decrease modestly and are around 60%.

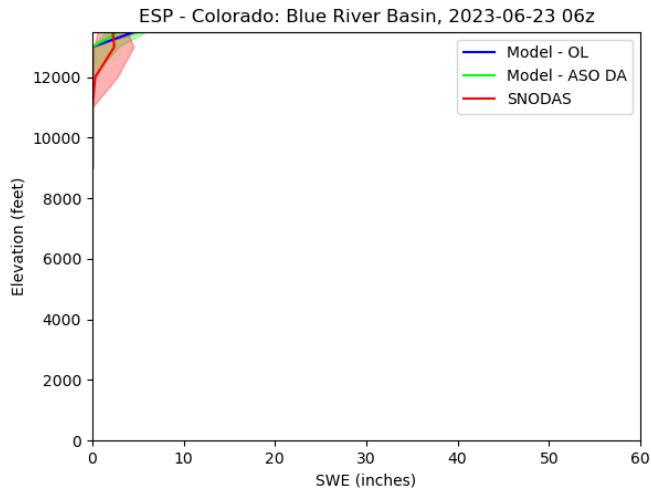
Blue River/Dillon Reservoir Snow Water Equivalent (SWE) Analysis



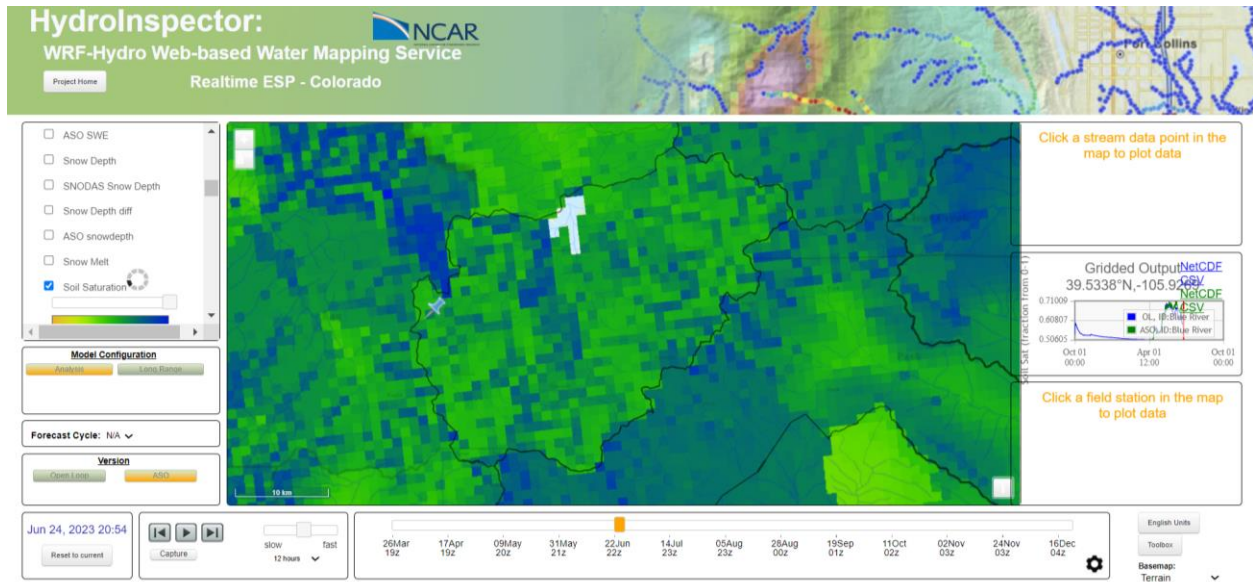
Blue River/Dillon Reservoir basin-averaged Snow Water Equivalent (SWE) Analysis and Forecasts:



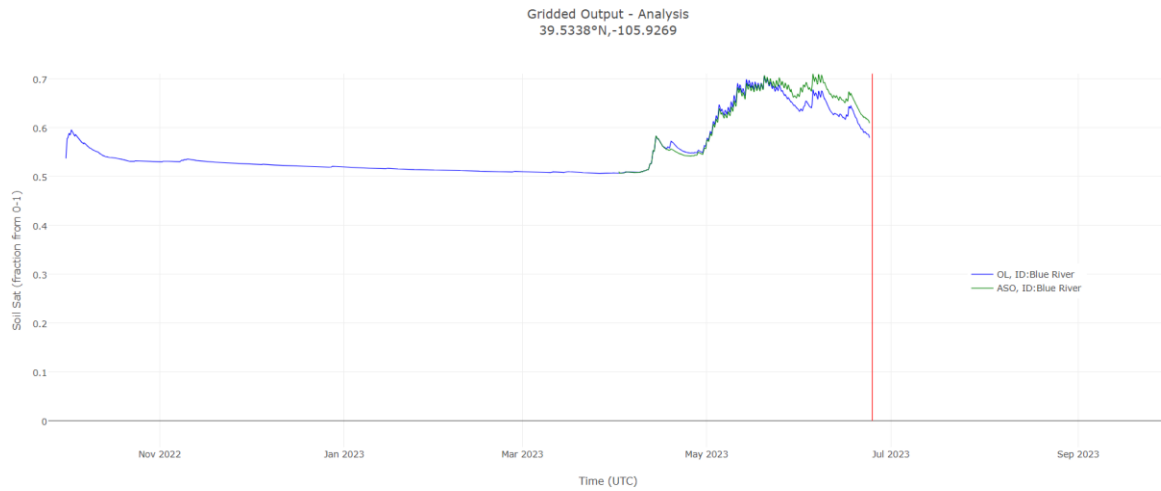
Elevation profile of SWE for SNODAS (red), ASO-assimilated snowpack (green) and WRF-Hydro OpenLoop (blue) for the Blue River/Dillon Reservoir basin:



Spatial map of WRF-Hydro modelled soil saturation:



Basin-averaged soil saturation values for the Upper South Platte River basin:



Blue River/Dillon Reservoir April-Jul Median (Q50) Accumulated Runoff/Inflow (initialized on 6/23/2023):

Dillon Reservoir: 132 kac-ft

Blue River abv Dillon: 42.2 kac-ft

Snake River nr Montezuma: 28.5 kac-ft

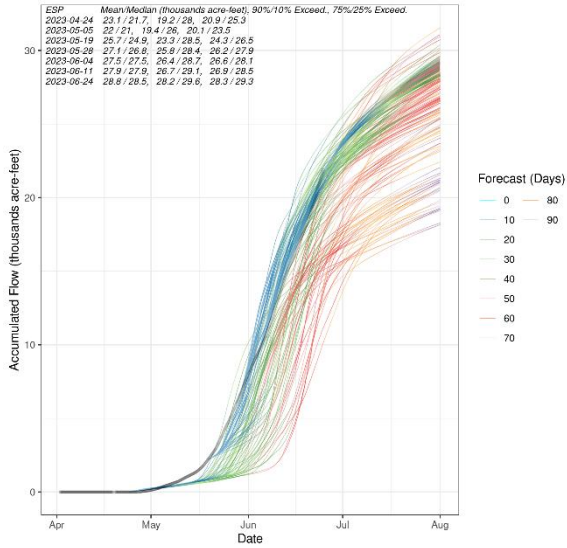
Tenmile Creek nr Frisco: 46.4 kac-ft

Keystone Gulch nr Keystone: 2.4 kac-ft

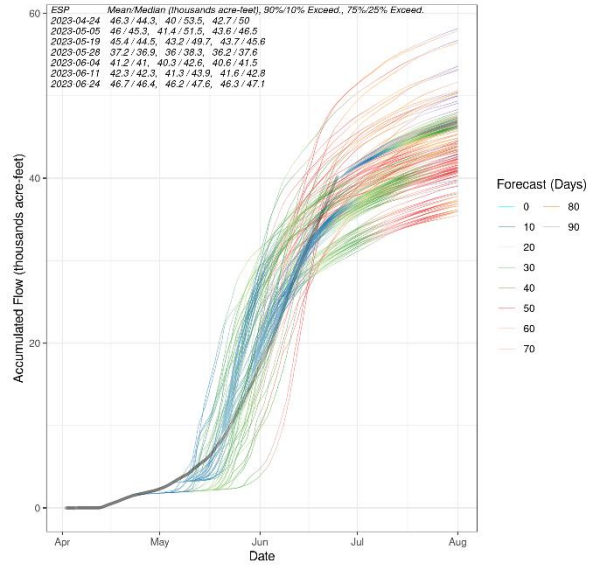
Straight Cr. nr Dillon: 6.5 kac-ft

Example ensemble flow accumulation plot for Apr-Oct inflow:

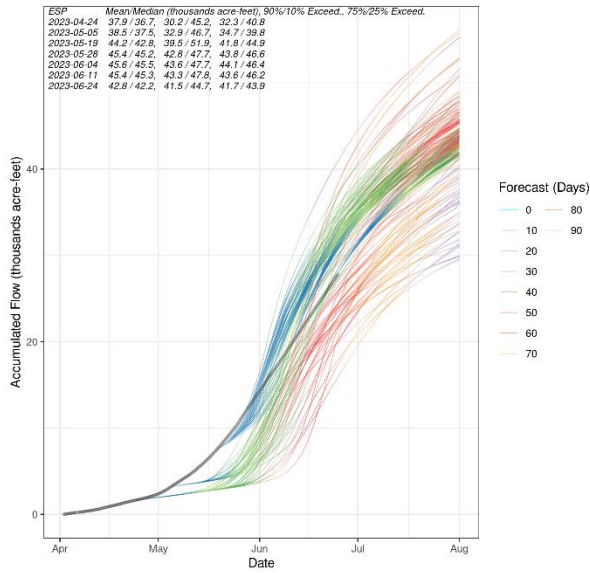
2023 ESP for: 09047500 SNAKE RIVER NEAR MONTEZUMA



2023 ESP for: 09050100 TENMILE CREEK blw NORTH TENMILE



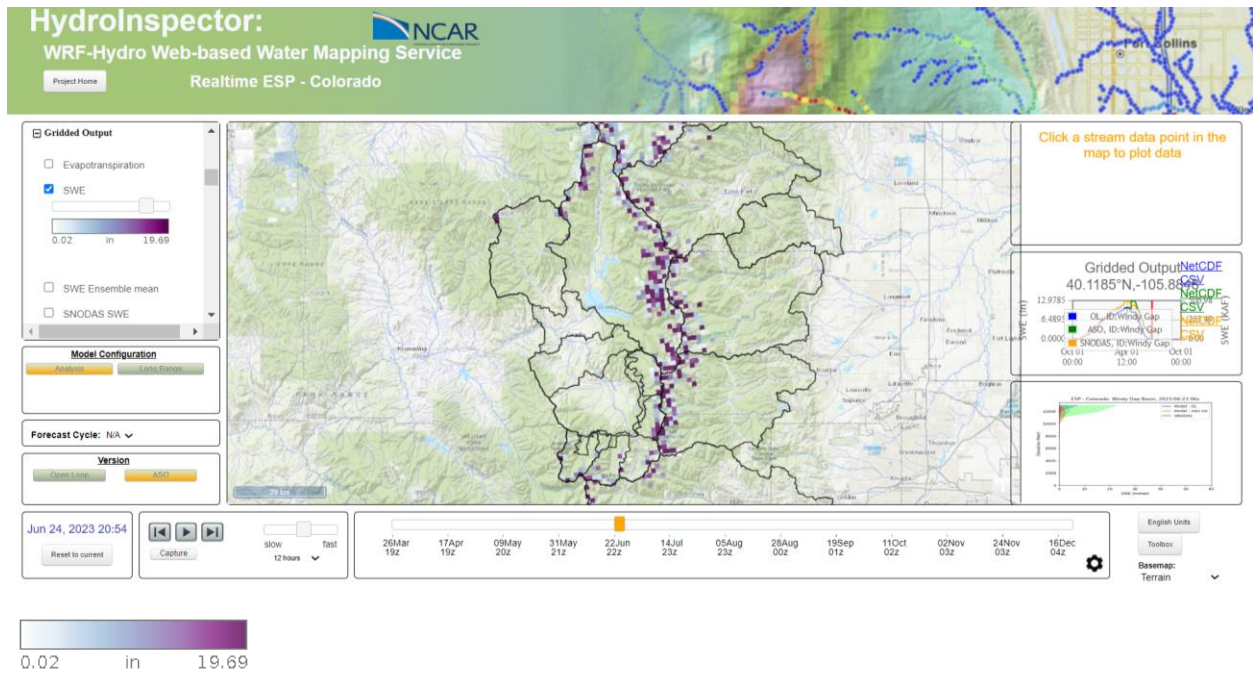
2023 ESP for: 09046600 BLUE RIVER NEAR DILLON



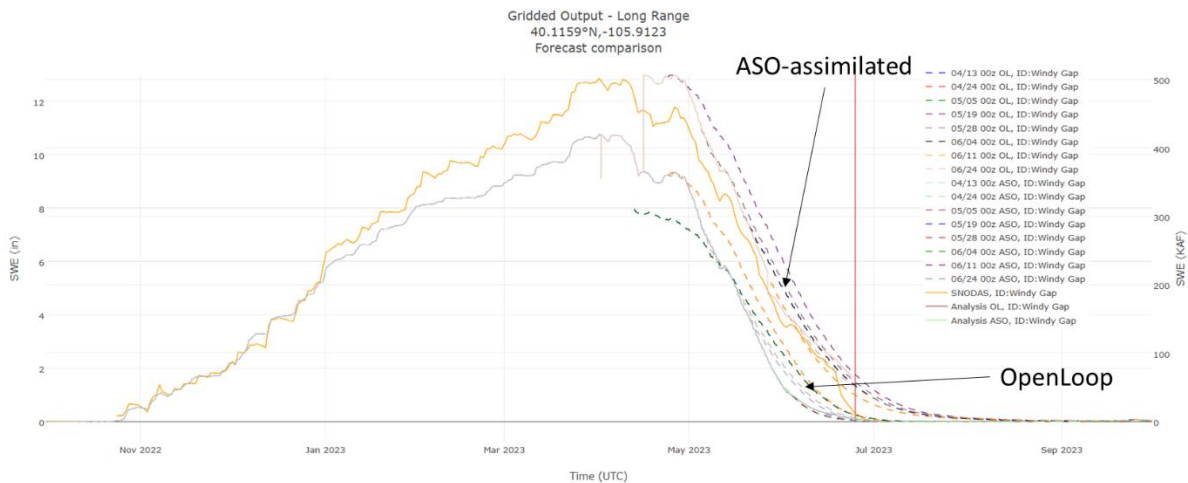
Upper Colorado River/Windy Gap System:

As of June 23 the ASO-assimilated snowpack from the WRF-Hydro model was approximately 65 kac-ft compared to the June 11 value of 117.5 kac-ft for the Upper Colorado Windy Gap basin. The bulk of the remaining snowpack in the throughout the region largely resided above 11,500 ft. Basin averaged soil saturation fractions for the basin have continued their decline over the last few weeks.

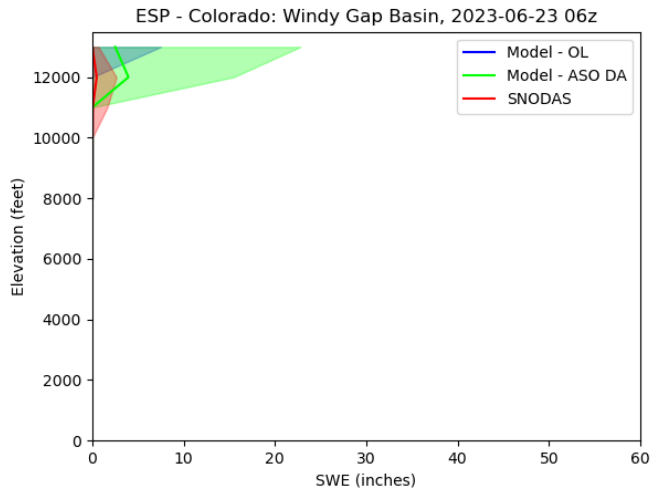
Upper Colorado/Windy Gap Snow Water Equivalent (SWE) Analysis



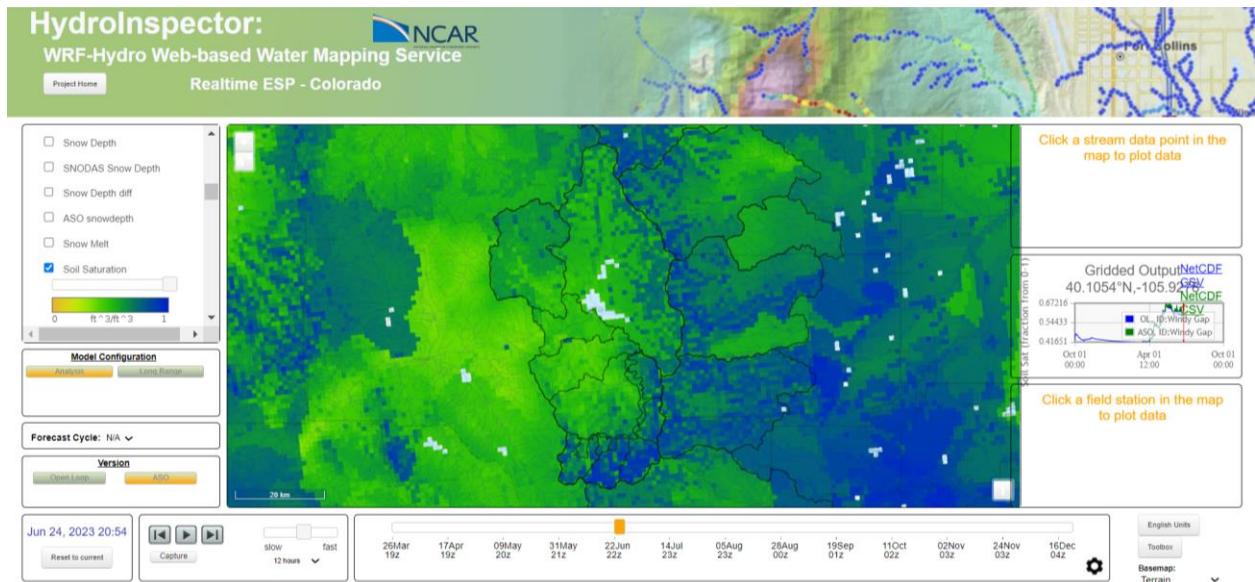
Upper Colorado/Windy Gap basin-averaged Snow Water Equivalent (SWE) Analysis and Forecasts:



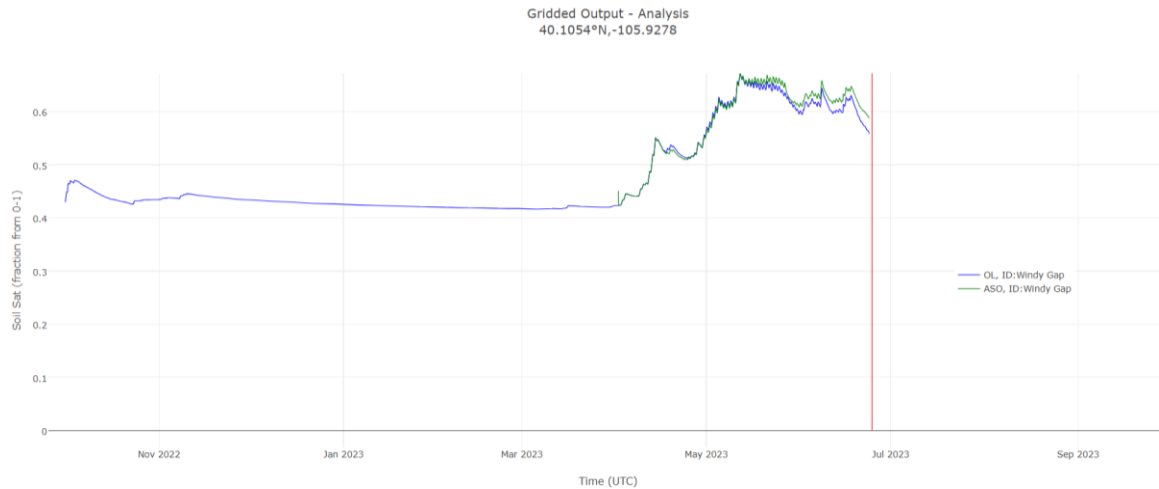
Elevation profile of SWE for SNODAS (red), ASO-assimilated snowpack (green) and WRF-Hydro OpenLoop (blue) for the Upper Colorado/Windy Gap basin:



Spatial map of WRF-Hydro modelled soil saturation:



Basin-averaged soil saturation values for the Upper Colorado/Windy Gap basin:



Upper Colorado/Fraser to Windy Gap April-Jul Median (Q50) Accumulated Runoff/Inflow (initialized on 6/23/2023):

Col. R. blw Baker Gulch: 51.7 kac-ft

North Inlet Cr.: 32 kac-ft (CDWR NORINLET: using analyzed observed flow for period without actual observations)

East Inlet Cr.: 26 kac-ft (CDWR EASINLET: using analyzed observed flow for period without actual observations)

Fraser R @ Upper Sta: 8.7 kac-ft (uses actual observed flows, naturalized flow record needed)

Fraser R @ Winter Park: 21.2 kac-ft (uses actual observed flows, naturalized flow record needed)

Vazquez Cr. nr Winter Park: 16.6 kac-ft (uses actual observed flows)

Ranch Cr. nr Fraser: 15.4 kac-ft (uses actual observed flows)

Cabin Cr nr Fraser: 5.8 kac-ft (uses actual observed flows)

St. Louis Cr. nr Fraser: 15.3 kac-ft (uses actual observed flows, naturalized flow record needed)

Fraser R @ Tabernash: 63.7 kac-ft (uses actual observed flows, naturalized flow record needed)

Fraser R @ Granby: 129.1 kac-ft (CDWR FRAGRACO: using naturalized flow at gauge location provided by Northern WCD of 94.9 kac-ft)

Willow Cr. Reservoir inflow: 82.2 kac-ft (using naturalized Willow Cr. Reservoir inflow provided by Northern WCD of 77.8 kac-ft)

Grand Lake inflow: 105.3 kac-ft (no observed inflows available...used model analysis)

Lake Granby inflow: 279.5 kac-ft (using naturalized Lake Granby inflow provided by Northern WCD of 200.1 kac-ft)

Col. R. nr Granby: needs naturalized flow timeseries

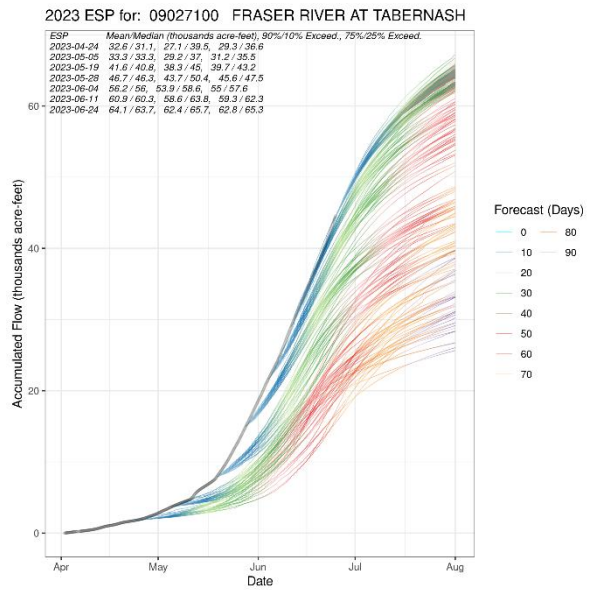
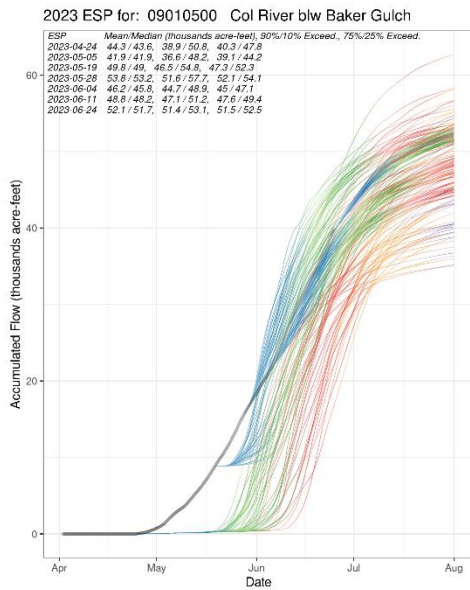
Williams Frk nr Leal: 49.3 kac-ft

S. Frk Williams Crk nr Leal: 17.1 kac-ft

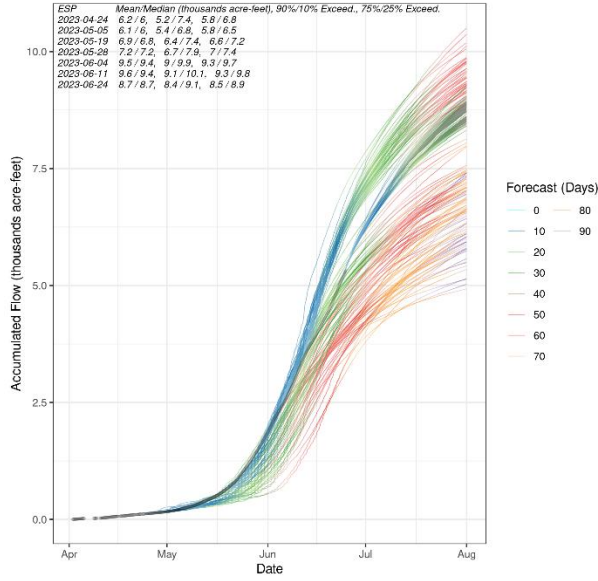
Bobtail Cr. Nr Jones Pass: 5 kac-ft

Williams Frk Res. Inflow: 43.5 (no observed inflows available...used model analysis)

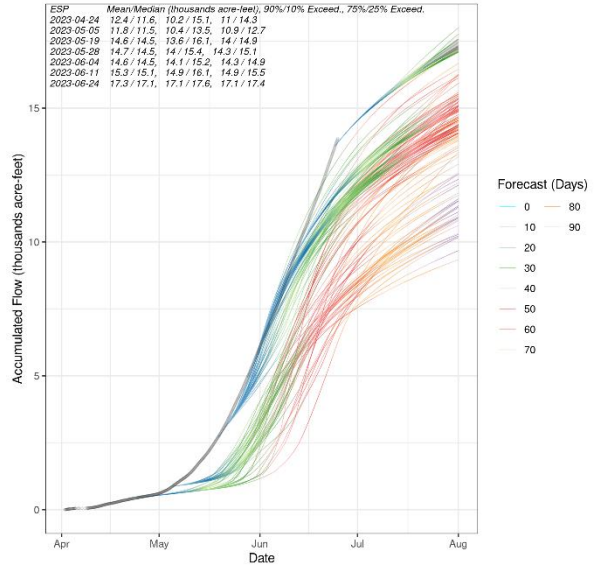
Example ensemble flow accumulation plot for Apr-Oct inflow (initialized on 6/24/2023):



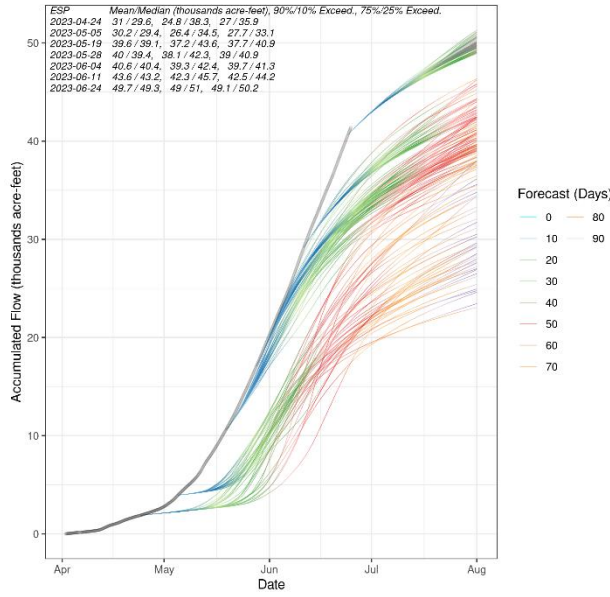
2023 ESP for: 09022000 FRASER RIVER AT UPPER STA



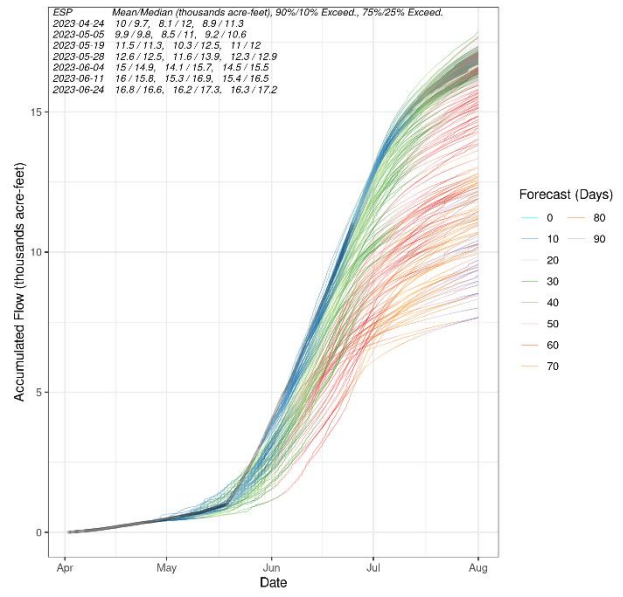
2023 ESP for: 09035900 S Frk Williams Crk nr Leal



2023 ESP for: 09036000 Williams Frk nr Leal



2023 ESP for: 09025000 VASQUEZ CREEK AT WINTER PARK



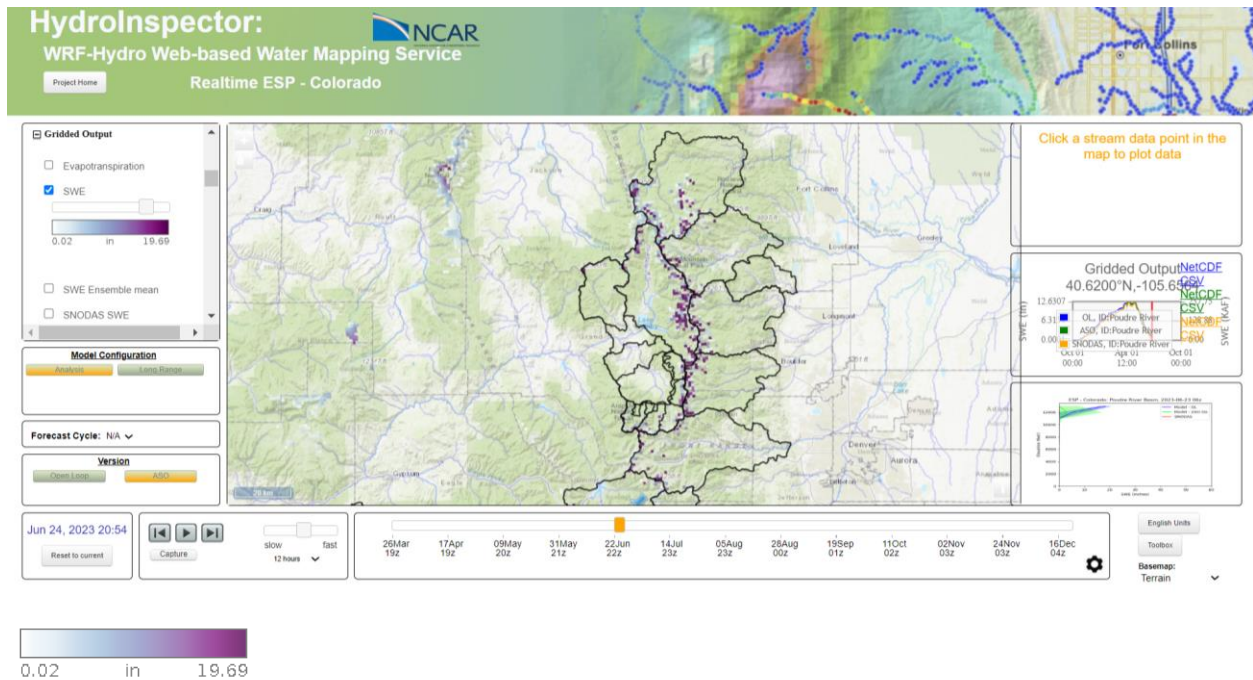
Front Range System:

As of June 23 the ASO-assimilated snowpack from the WRF-Hydro model for the 5 Front Range basins was: [ASO survey data for all Front Range basins has now been assimilated into the WRF-Hydro model]

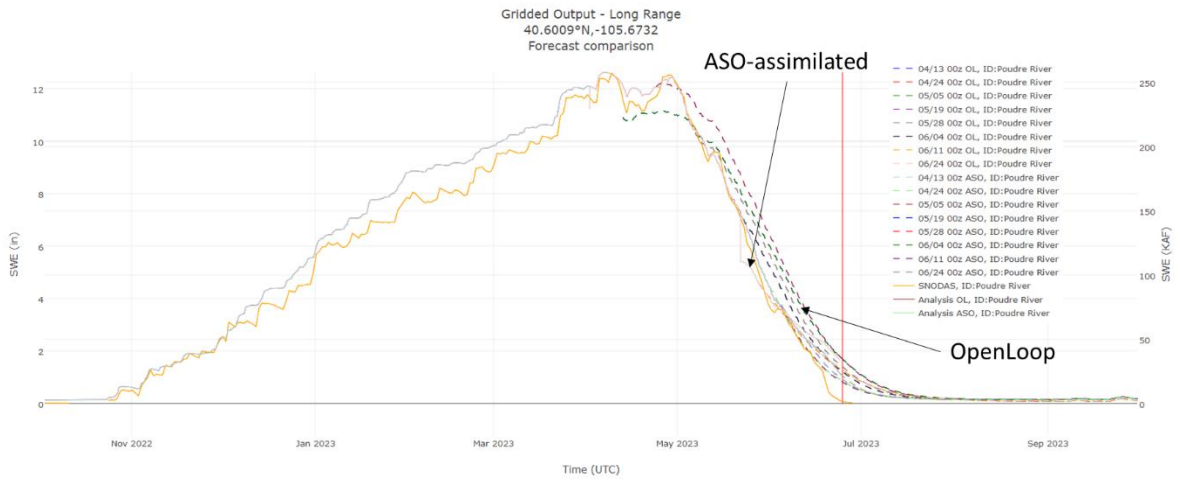
Poudre River Basin:	33.5 kac-ft (vs. 59 kac-ft on 6/11)
Big Thompson River Basin:	13.6 kac-ft (vs. 25 kac-ft on 6/11)
Little Thompson River Basin:	0.0 kac-ft
St. Vrain River Basin:	14.1 kac-ft (vs. 25 kac-ft on 6/11)
Boulder Creek Basin:	26.0 kac-ft (vs. 35 kac-ft on 6/11)
Clear Creek Basin:	11.9 kac-ft (vs. 20 kac-ft on 6/11)

Nearly all remaining snowpack in the throughout the region resided above 11,500 ft.

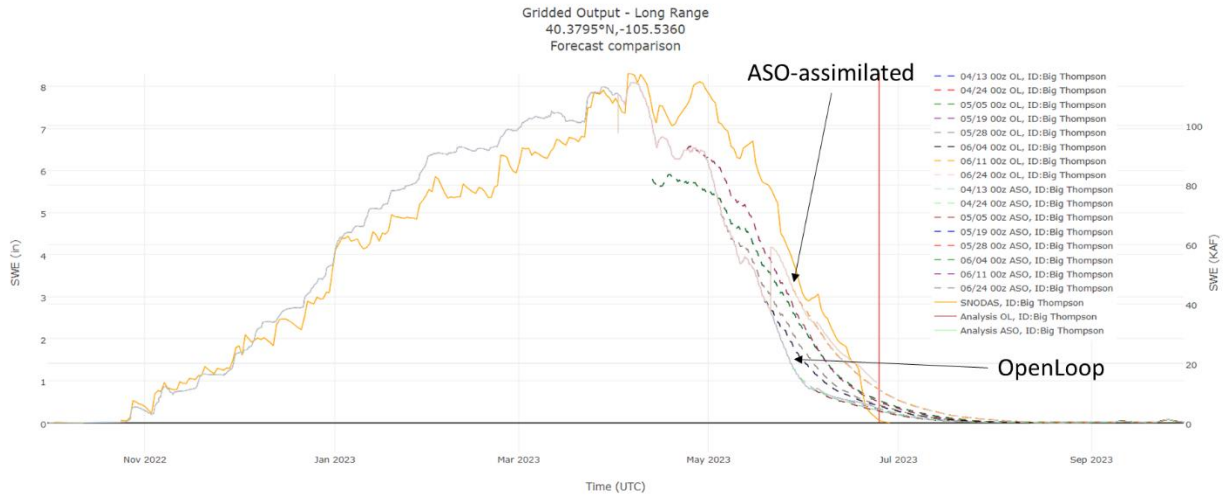
Front Range System Snow Water Equivalent (SWE) Analysis



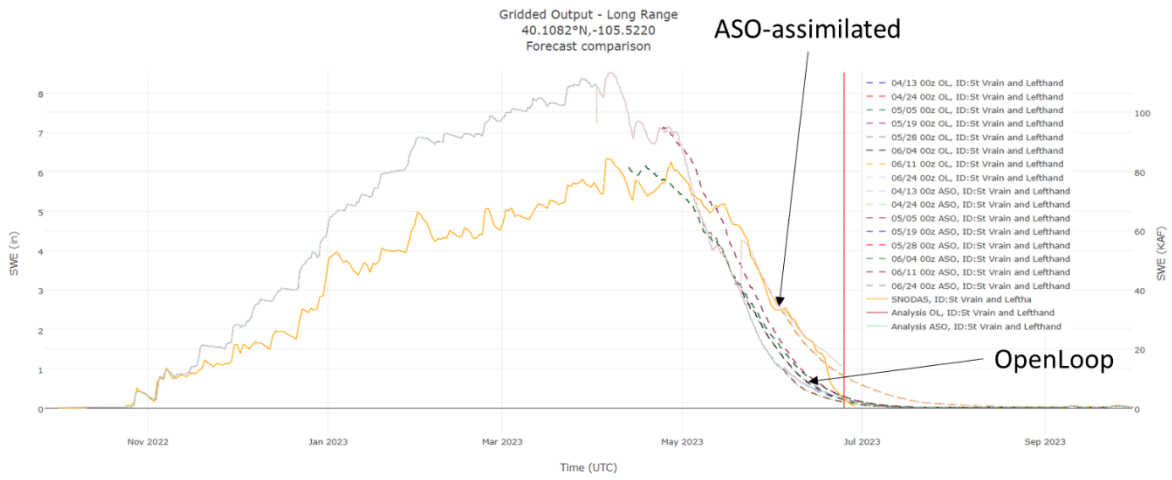
Poudre River basin-averaged SWE:



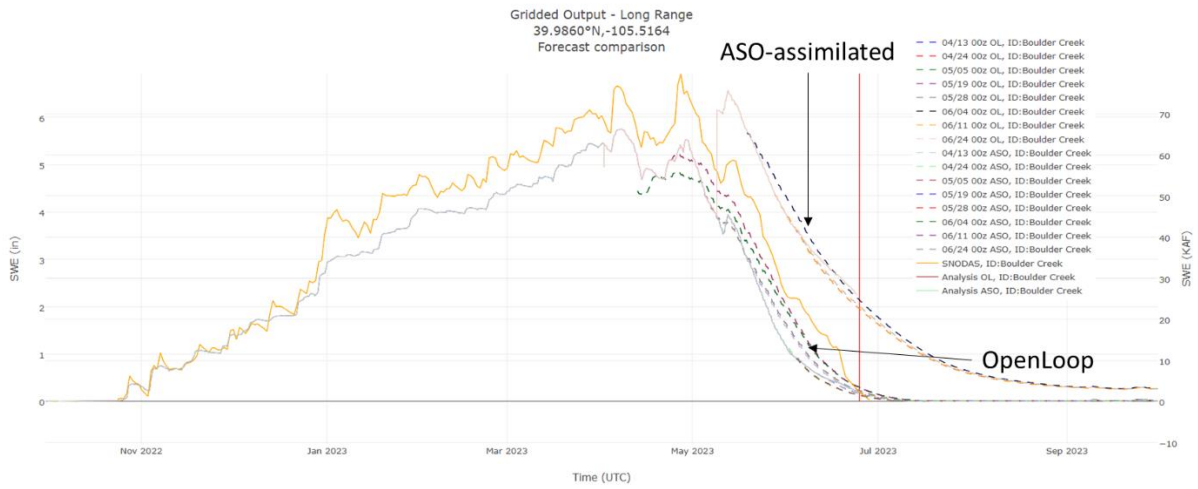
Big Thompson basin-averaged SWE:



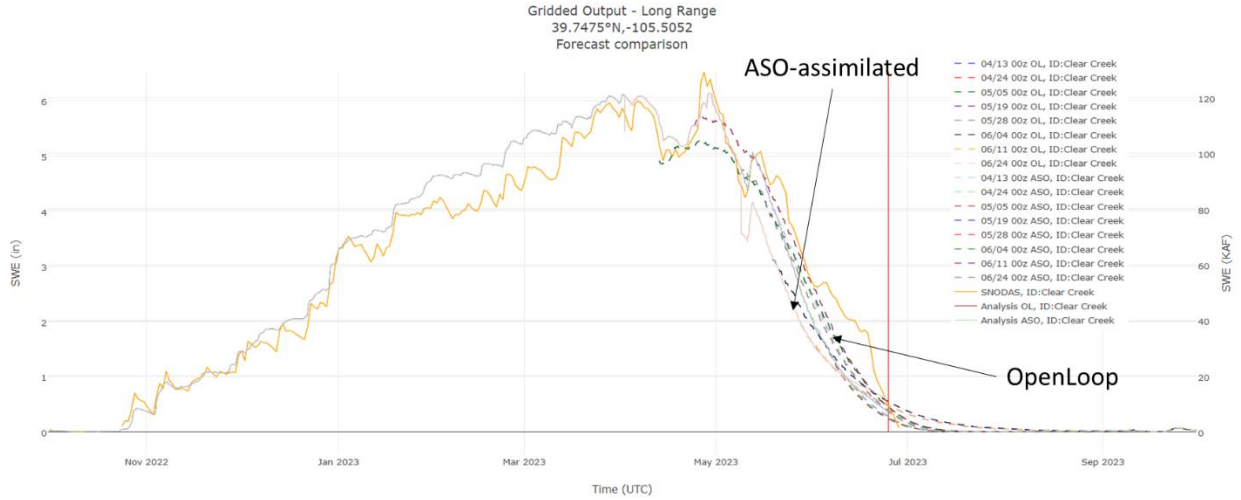
St. Vrain basin-averaged SWE:



Boulder Creek basin-averaged SWE:



Clear Creek basin-averaged SWE:



Poudre River Sub-basin forecast flow, (initialized on 6/23/2023):

Cache La Poudre nr Fort Collins (CDWR CLAFTCCO): 190.5 kac-ft (New forecast site, considerable anthropogenics upstream considerable anthropogenics upstream...using naturalized flow from Northern of 206.3 kac-ft WCD yields total of 236.8 kac-ft)

Big Thompson/Little Thompson River Sub-basin forecast flow, (initialized on 6/23/2023):

Big Thompson abv Lake Estes (CDWR BTABESCO): 70.9 kac-ft (New forecast site)

N. Fork Big Thompson at Drake (CDWR BTNDFRCO): 17.1 kac-ft (New forecast site...major upstream management)

Little Thompson River nr Berthoud (CDWR LTCANYCO): 8.6 kac-ft (New forecast site...upstream diversions not yet accounted for)

St. Vrain River Sub-basin forecast flow, (initialized on 6/23/2023):

Button Rock Reservoir Inflow...no inflow data yet available...

South St Vrain near Ward, CO...(CDWR SSVWARCO): 13.2 kac-ft (New forecast site...needs adjustment...no observation data available prior to May 15)

North St. Vrain abv Button Rock Reservoir (CDWR NSVABRCO)...CDWR station discontinued in 2019

Middle Fork St. Vrain at Peaceful Valley (CDWR MIDSTECO): 19.1 kac-ft (New forecast site)

St. Vrain at Lyons (CDWR SVCLYCO): 68.3 kac-ft (New forecast site...considerable anthropogenics upstream...using naturalized flow from Northern WCD of 73.2 kac-ft yields total of 93.5 kac-ft)

Boulder Creek Sub-basin forecast flow, (initialized on 6/23/2023):

Middle Boulder Cr at Nederland...(CDWR BOCMIDCO)...in progress...

Boulder Cr. at Orodell (CDWR BOCOROCO): 45.6 kac-ft (New forecast site, considerable anthropogenics upstream...using naturalized flow from Northern WCD 35.9 yields total of 51.5 kac-ft)

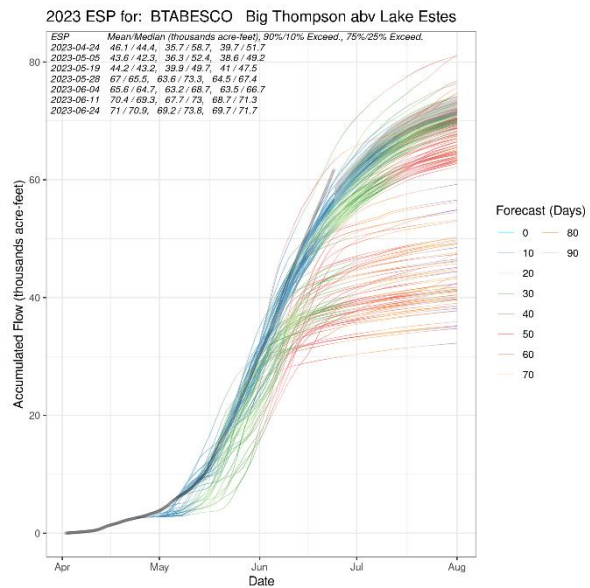
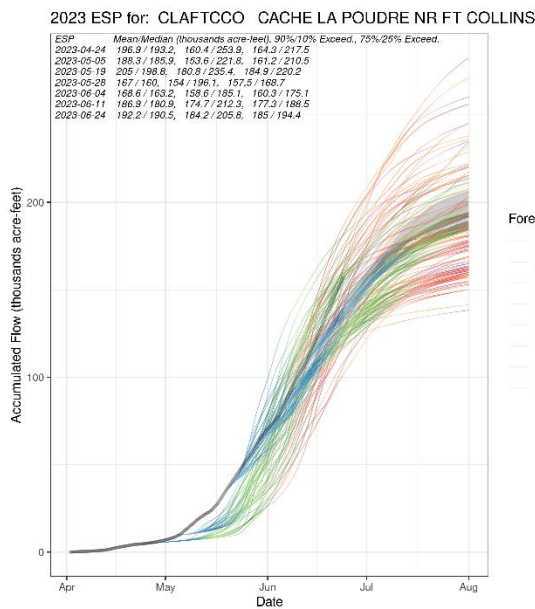
Clear Creek Sub-basin forecast flow, (initialized on 6/23/2023):

Clear Creek abv Georgetown (CDWR CLEGLKCO): 25.2 kac-ft (New forecast site)

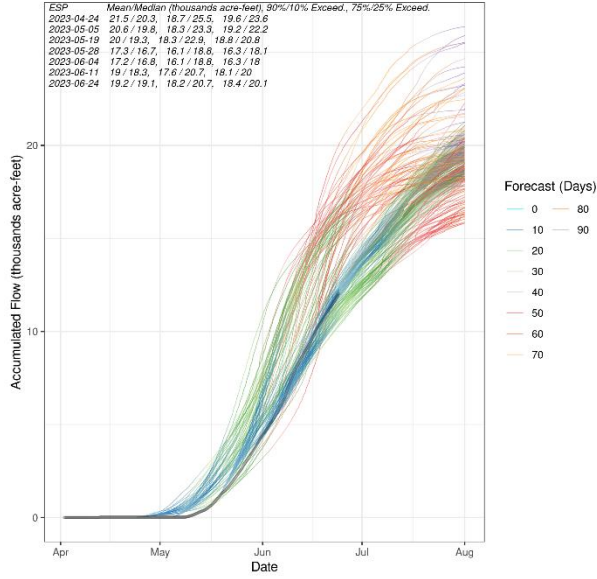
Clear Creek at Lawson (CDWR CLELAWCO): 71.8 kac-ft (New forecast site, some anthropogenics upstream, no naturalized observed flow data yet available)

North Fork Clear Creek abv mouth at Black Hawk (CDWR NCCBLACO)...in progress...

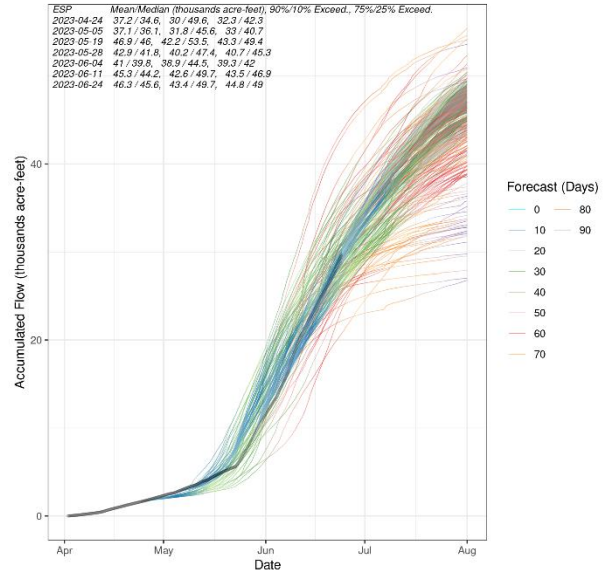
Example ensemble flow accumulation plot for Apr-Jul inflow:



2023 ESP for: MIDSTECO MIDDLE St. VRAIN AT PEACEFUL VALLEY



2023 ESP for: BOCOROCO BOULDER CREEK NEAR ORODELL



2023 ESP for: CLEGLKCO Clear Creek abv Georgetown

