



ASO + M3 Works Modeling Report

Roaring Fork River Basin

Model date: May 16, 2023

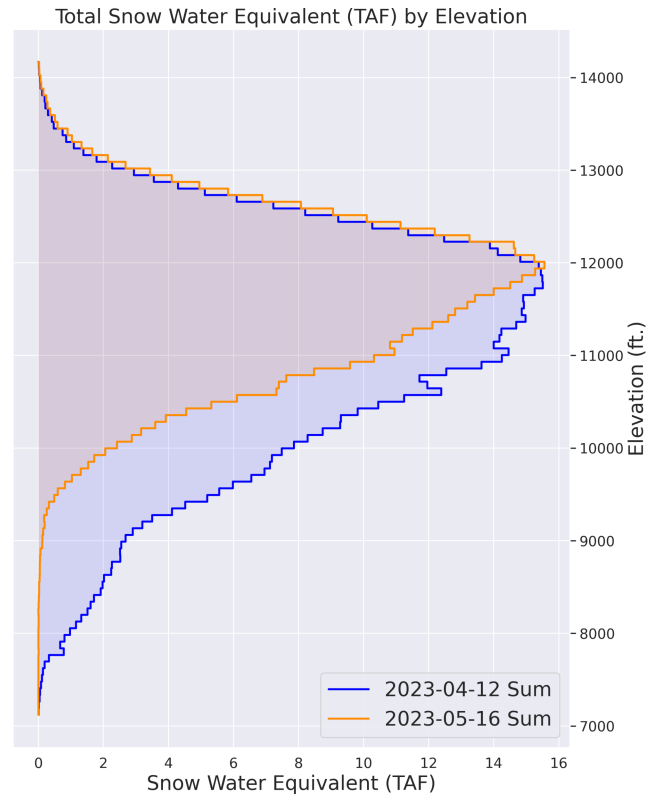
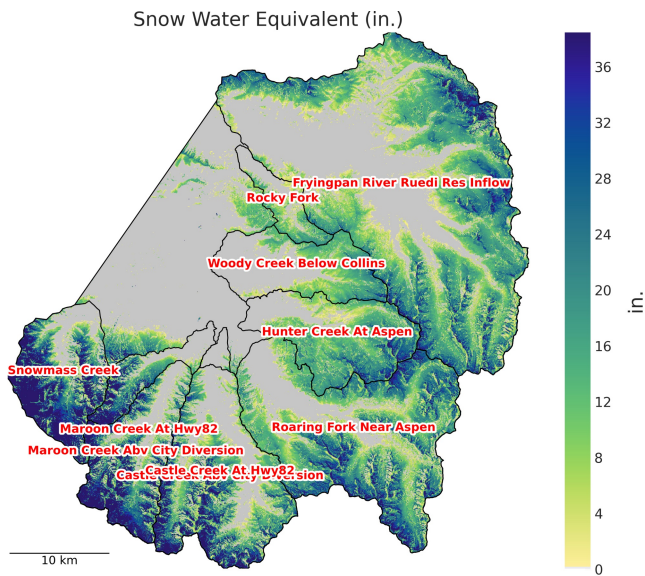


Historical data and reports can be found at:
data.airbornesnowobservatories.com

ROARING FORK RIVER BASIN MAY 16, 2023 MODELING REPORT

Current model date: May 16, 2023
Model Total Snow Water Equivalent: 422.4 TAF
Model Mean Snow Water Equivalent: 11.5 in.
Model Mean Cold Content: -0.0 MJ/m²

Model reporting period: April 12 - May 16, 2023
Change in Total Snow Water Equivalent: -173.4 TAF
Change in Mean Snow Water Equivalent: 1.3 in.
Change in Mean Cold Content: 0.6 MJ/m²



| DESCRIPTION | TOTAL | ROCKY FORK | HUNTER CREEK AT ASPEN | MARON CREEK ABV CITY DIVERSION | ROARING FORK NEAR ASPEN | WOODY CREEK BELOW COLLINS | CASTLE CREEK ABV CITY DIVERSION |
|---------------|-------|------------|-----------------------|--------------------------------|-------------------------|---------------------------|---------------------------------|
| Mean SWE in. | 11.5 | 6.1 | 11.9 | 21.9 | 13.4 | 6.4 | 14.0 |
| Total SWE TAF | 422.4 | 4.0 | 27.4 | 49.0 | 75.7 | 12.1 | 51.9 |

| FRYINGPAN RIVER RUEDI RES INFLOW | MARON CREEK AT HWY82 | CASTLE CREEK AT HWY82 | SNOWMASS CREEK |
|----------------------------------|----------------------|-----------------------|----------------|
| 9.8 | 20.6 | 13.5 | 28.4 |
| 117.4 | 63.0 | 52.0 | 60.8 |

The model has been updated with ASO survey data, a brief summary of the changes to the model are provided:
 April 11 - April 12 update summary: removed 213.8 TAF of Snow Water Equivalent

State of the Snowpack

Interpretation Notes

Elevation bands are in increments of 1000 ft, e.g., 4000 is 4000 - 5000 ft.

Mean SWE is calculated over the total basin area. Mean cold content is calculated over the snow covered area to reflect the ripeness of the existing snowpack.

Surface Water Input (SWI) includes liquid water leaving the bottom of the snowpack and rain on bare ground.

Forcing data is created with the Spatial Modeling for Resources Framework (SMRF) using the High Resolution Rapid Refresh (HRRR) output fields as inputs. The HRRR data is locally optimized for mass input to the basin.

Model Results

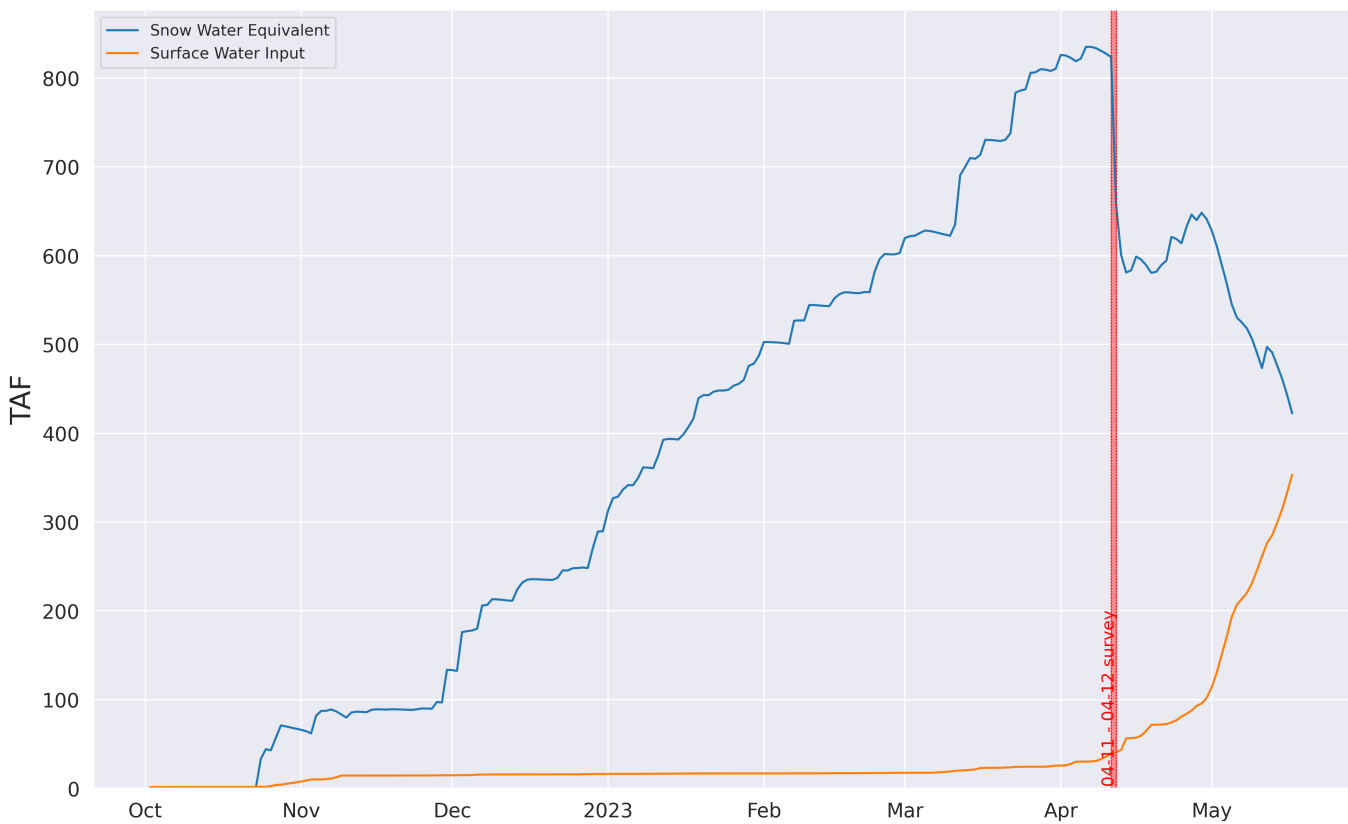
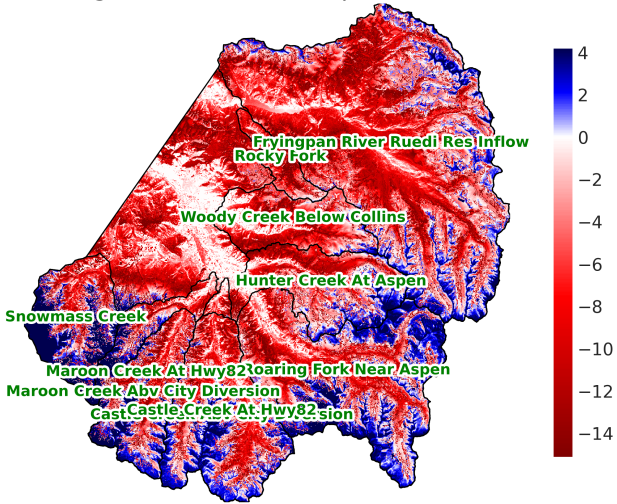


Fig.3 Water Year timeseries. Vertical lines indicated ASO survey dates.

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Change in Snow Water Equivalent (in.)



Change in Total Snow Water Equivalent (TAF) per Elevation band

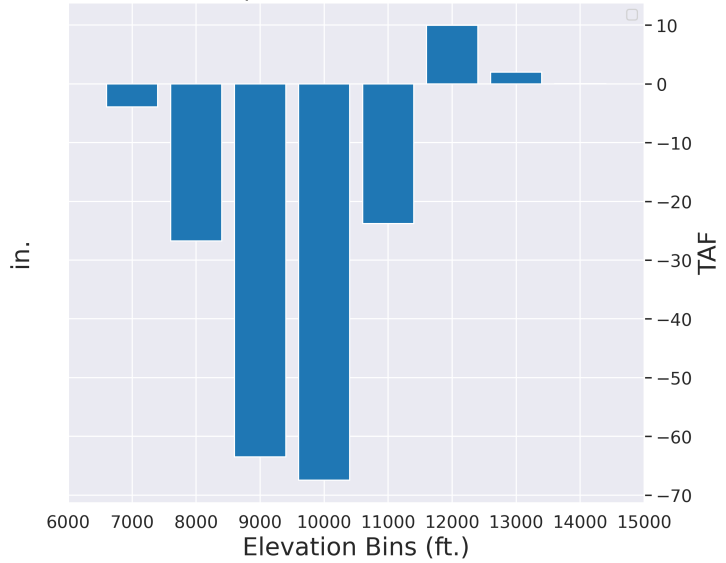
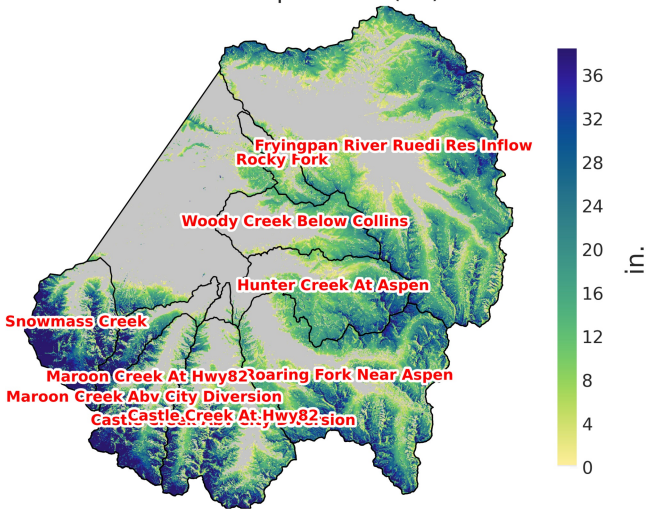


Fig.4 Change in Snow Water Equivalent from 2023-04-12 to 2023-05-16

Snow Water Equivalent (in.)



Total Snow Water Equivalent (TAF) per Elevation band

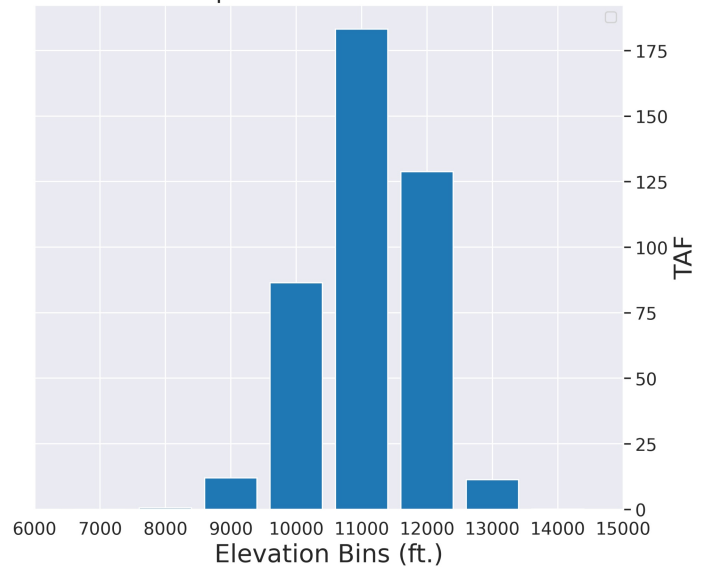


Fig.5 Snow Water Equivalent as of 2023-05-16

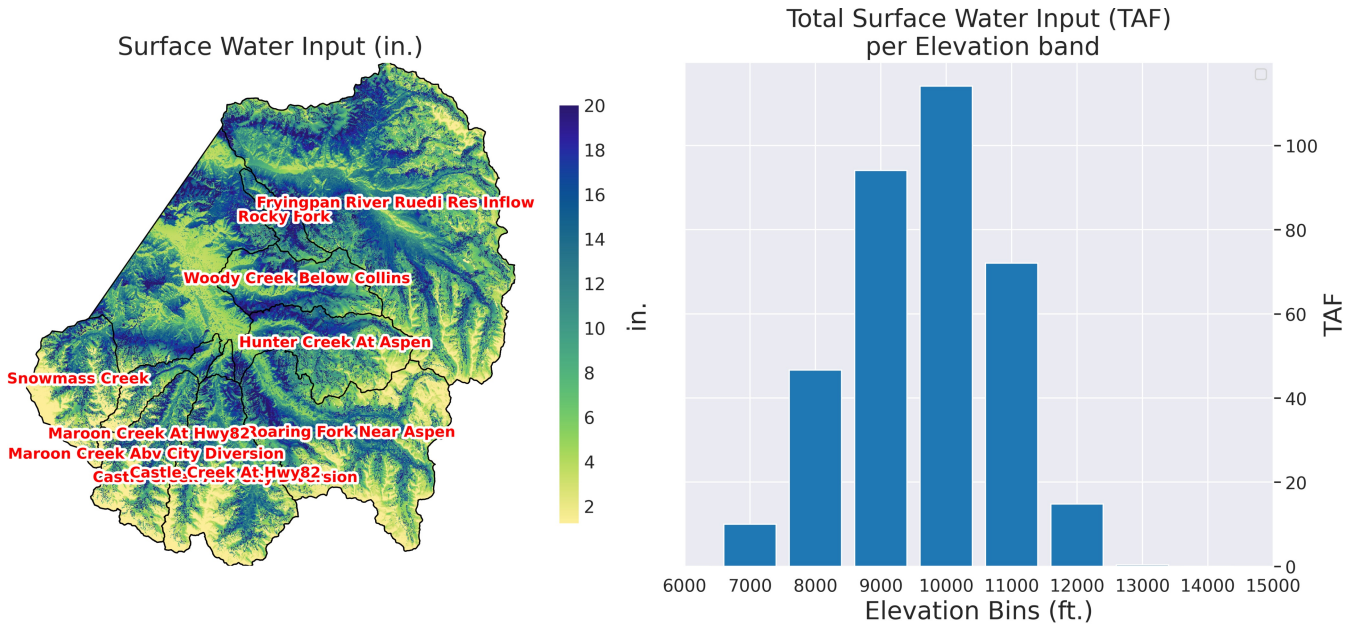


Fig.6 Accumulated Surface Water Input from 2023-04-12 to 2023-05-16

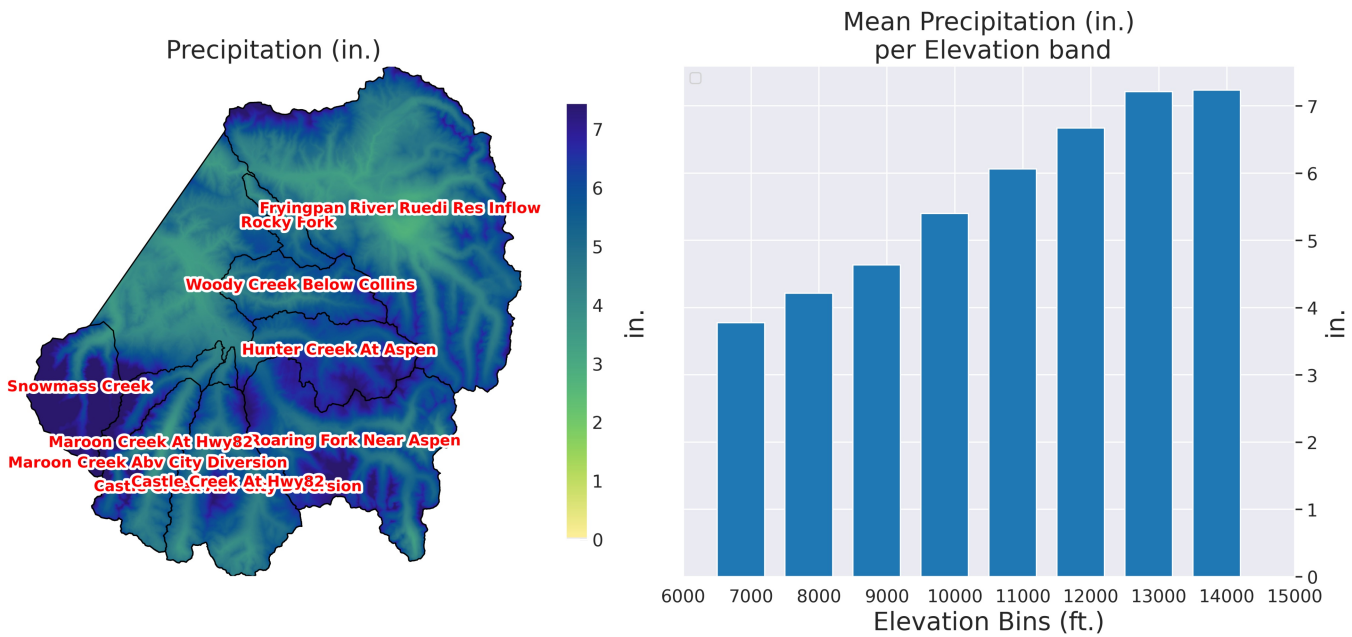


Fig.7 Accumulated Precipitation from 2023-04-12 to 2023-05-16. Precipitation fields are locally interpolated using SMRF with underlying data from HRRR.

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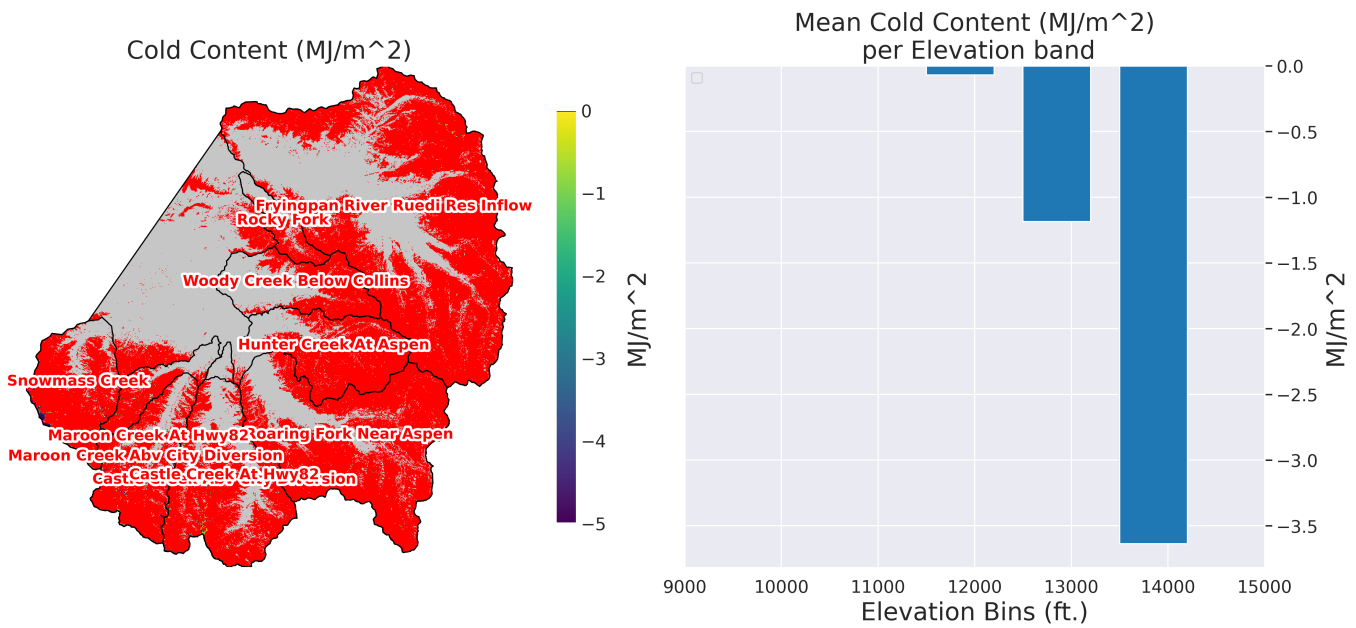


Fig.8 Cold Content as of 2023-05-16

Very little cold content remains in the Roaring Fork basin. The remaining un-ripe snow exists only above 10357 ft., and represents approximately 2.22% of the basin SWE.

Model to station comparisons are a comparison of 50 meter cells to a point within the basin. Some differences are expected when comparing modeled and measured snowpack behavior at these different spatial scales. ASO 3m snow depth measurements at each station are indicated by the red '+' symbols. Absence of these symbols indicates that the station location or data quality are suspect, and they were not used in the ASO survey validation and report.

Station compare Snow Depth (in.)

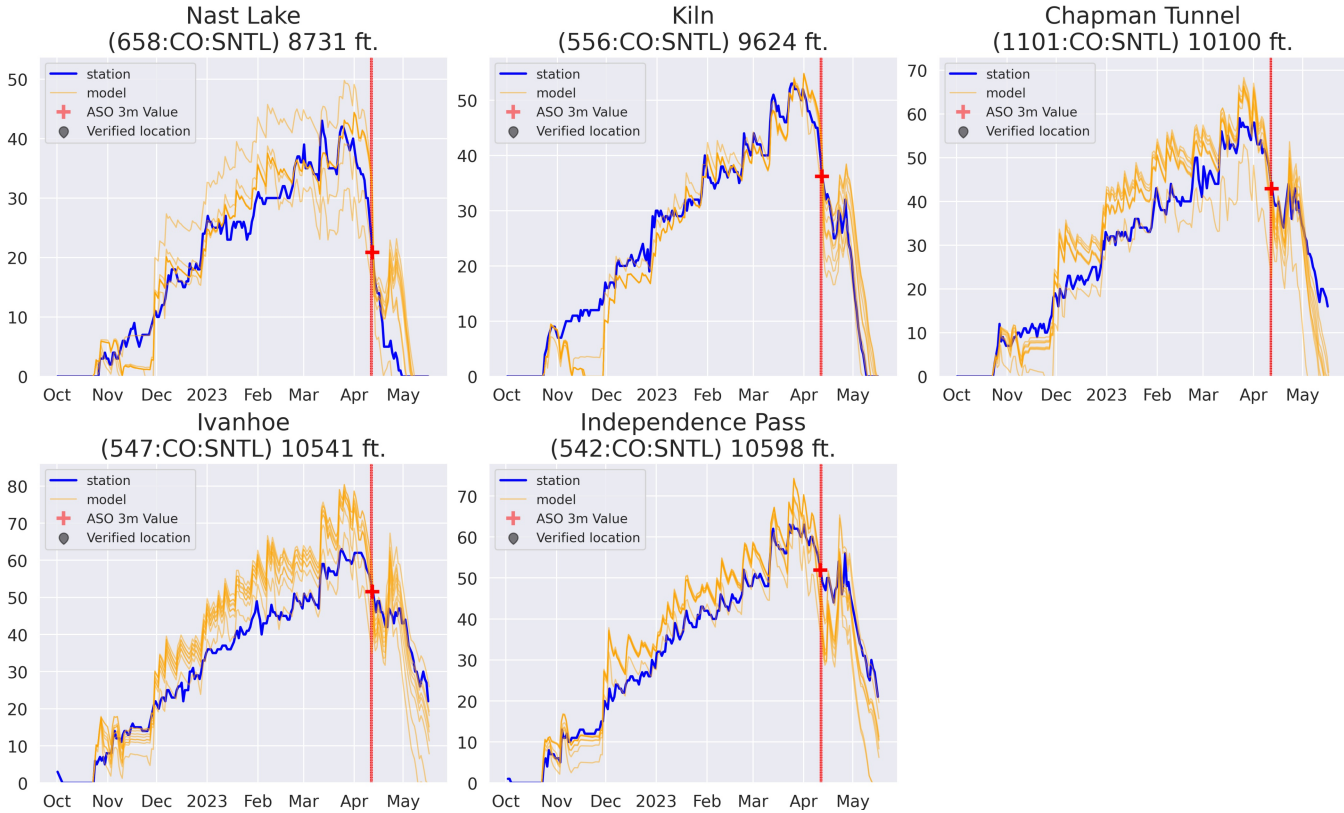


Fig.9 Comparison of modeled and measured Snow Depth. Comparisons of model pixels to measured station data are performed with the 9 nearest model pixels to give a more spatially complete view of model behavior.

Model Description

Modeled data is generated using the Automated Water Supply Model (AWSM). Underlying forcing data is sourced from the High Resolution Rapid Refresh model (HRRR). AWSM simulates the snowpack state using the physically based, distributed energy and mass balance snow model, iSnobal.

For more information on the Airborne Snow Observatories Inc. visit airbornesnowobservatories.com.

More information about M3 Works can be found at m3works.io.

ROARING FORK RIVER BASIN MAY 16, 2023 MODELING REPORT

Additional Details

Total Snow Water Equivalent values (TAF) on 2023-05-16

| ELEVATION RANGE | TOTAL | ROCKY FORK | HUNTER CREEK AT ASPEN | MAROON CREEK ABV CITY DIVERSION | ROARING FORK NEAR ASPEN | WOODY CREEK BELOW COLLINS | CASTLE CREEK ABV CITY DIVERSION | FRYINGPAN RIVER RUEDI RES INFLOW |
|-----------------|-------|------------|-----------------------|---------------------------------|-------------------------|---------------------------|---------------------------------|----------------------------------|
| 7000 - 7999 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8000 - 8999 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| 9000 - 9999 | 12.0 | 0.3 | 0.6 | 0.7 | 0.4 | 0.3 | 0.6 | 5.7 |
| 10000 - 10999 | 86.5 | 2.3 | 7.5 | 6.6 | 8.6 | 5.5 | 5.7 | 35.2 |
| 11000 - 11999 | 183.2 | 1.4 | 13.9 | 21.4 | 33.6 | 5.7 | 19.8 | 55.6 |
| 12000 - 12999 | 128.8 | 0.0 | 5.3 | 18.4 | 31.6 | 0.5 | 22.3 | 19.9 |
| 13000 - 13999 | 11.4 | 0.0 | 0.1 | 1.8 | 1.5 | 0.0 | 3.6 | 0.9 |
| 14000 - 14999 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Total Snow Water Equivalent values (TAF) on 2023-05-16 cont.

| ELEVATION RANGE | MAROON CREEK AT HWY82 | CASTLE CREEK AT HWY82 | SNOWMASS CREEK |
|-----------------|-----------------------|-----------------------|----------------|
| 7000 - 7999 | 0.0 | 0.0 | 0.0 |
| 8000 - 8999 | 0.1 | 0.0 | 0.1 |
| 9000 - 9999 | 1.2 | 0.6 | 0.8 |
| 10000 - 10999 | 8.5 | 5.7 | 7.7 |
| 11000 - 11999 | 27.6 | 19.8 | 23.8 |
| 12000 - 12999 | 23.6 | 22.3 | 25.2 |
| 13000 - 13999 | 2.0 | 3.6 | 3.3 |
| 14000 - 14999 | 0.0 | 0.0 | 0.0 |

ROARING FORK RIVER BASIN MAY 16, 2023 MODELING REPORT

Accumulated Total Surface Water Input values (TAF) from 2023-04-12 to 2023-05-16

| ELEVATION RANGE | TOTAL | ROCKY FORK | HUNTER CREEK AT ASPEN | MAROON CREEK ABV CITY DIVERSION | ROARING FORK NEAR ASPEN | WOODY CREEK BELOW COLLINS | CASTLE CREEK ABV CITY DIVERSION | FRYINGPAN RIVER RUEDI RES INFLOW |
|-----------------|-------|------------|-----------------------|---------------------------------|-------------------------|---------------------------|---------------------------------|----------------------------------|
| 7000 - 7999 | 10.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 1.6 |
| 8000 - 8999 | 46.6 | 0.8 | 1.0 | 0.9 | 2.3 | 2.5 | 1.4 | 13.3 |
| 9000 - 9999 | 94.0 | 2.7 | 4.3 | 3.4 | 6.4 | 6.6 | 6.1 | 41.3 |
| 10000 - 10999 | 114.1 | 4.7 | 10.7 | 6.5 | 16.9 | 9.4 | 11.1 | 40.1 |
| 11000 - 11999 | 72.0 | 0.9 | 6.5 | 5.6 | 16.4 | 2.9 | 9.2 | 23.8 |
| 12000 - 12999 | 14.8 | 0.0 | 0.9 | 1.5 | 4.7 | 0.1 | 2.3 | 3.6 |
| 13000 - 13999 | 0.3 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.1 |
| 14000 - 14999 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Accumulated Total Surface Water Input values (TAF) from 2023-04-12 to 2023-05-16 cont.

| ELEVATION RANGE | MAROON CREEK AT HWY82 | CASTLE CREEK AT HWY82 | SNOWMASS CREEK |
|-----------------|-----------------------|-----------------------|----------------|
| 7000 - 7999 | 0.1 | 0.0 | 0.0 |
| 8000 - 8999 | 2.2 | 2.1 | 1.3 |
| 9000 - 9999 | 5.0 | 6.8 | 3.4 |
| 10000 - 10999 | 8.2 | 11.3 | 5.3 |
| 11000 - 11999 | 7.3 | 9.2 | 4.4 |
| 12000 - 12999 | 1.9 | 2.3 | 1.2 |
| 13000 - 13999 | 0.0 | 0.1 | 0.0 |
| 14000 - 14999 | 0.0 | 0.0 | 0.0 |

ROARING FORK RIVER BASIN MAY 16, 2023 MODELING REPORT

Change in Total Snow Water Equivalent values (TAF) from 2023-04-12 to 2023-05-16

| ELEVATION RANGE | TOTAL | ROCKY FORK | HUNTER CREEK AT ASPEN | MAROON CREEK ABV CITY DIVERSION | ROARING FORK NEAR ASPEN | WOODY CREEK BELOW COLLINS | CASTLE CREEK ABV CITY DIVERSION | FRYINGPAN RIVER RUEDI RES INFLOW |
|-----------------|-------|------------|-----------------------|---------------------------------|-------------------------|---------------------------|---------------------------------|----------------------------------|
| 7000 - 7999 | -3.9 | -0.1 | -0.0 | 0.0 | 0.0 | -0.1 | 0.0 | -0.9 |
| 8000 - 8999 | -26.7 | -0.5 | -0.5 | -0.6 | -0.9 | -1.1 | -0.8 | -8.4 |
| 9000 - 9999 | -63.5 | -2.0 | -2.6 | -2.3 | -4.0 | -4.1 | -3.6 | -29.5 |
| 10000 - 10999 | -67.4 | -3.1 | -5.8 | -4.2 | -10.0 | -5.6 | -6.6 | -24.0 |
| 11000 - 11999 | -23.8 | -0.4 | -1.8 | -2.2 | -5.2 | -1.0 | -3.8 | -9.2 |
| 12000 - 12999 | 10.0 | 0.0 | 0.5 | 1.0 | 2.6 | 0.0 | 1.0 | 1.1 |
| 13000 - 13999 | 2.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.0 | 0.5 | 0.2 |
| 14000 - 14999 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Change in Total Snow Water Equivalent values (TAF) from 2023-04-12 to 2023-05-16 cont.

| ELEVATION RANGE | MAROON CREEK AT HWY82 | CASTLE CREEK AT HWY82 | SNOWMASS CREEK |
|-----------------|-----------------------|-----------------------|----------------|
| 7000 - 7999 | -0.0 | -0.0 | 0.0 |
| 8000 - 8999 | -1.3 | -1.1 | -0.8 |
| 9000 - 9999 | -3.3 | -4.0 | -2.1 |
| 10000 - 10999 | -5.1 | -6.7 | -2.5 |
| 11000 - 11999 | -2.5 | -3.8 | 0.3 |
| 12000 - 12999 | 1.5 | 1.0 | 3.1 |
| 13000 - 13999 | 0.4 | 0.5 | 0.5 |
| 14000 - 14999 | 0.0 | 0.0 | 0.0 |