CBRFC WFO Teleconference

NOAA/NWS Colorado Basin River Forecast Center

May 21, 2013

Outline

- MODIS – Derived satellite snow data (Stacie Bender – CBRFC)
- Spring runoff issues / comments (All)
- E-19 Status – (All)
- Future Calls – Summer Issues we might address (All)

Use of Snowpack Information from NASA/JPL's MODSCAG (snow cover) and MODDRFS (dust) Products

As of May 21, 2013

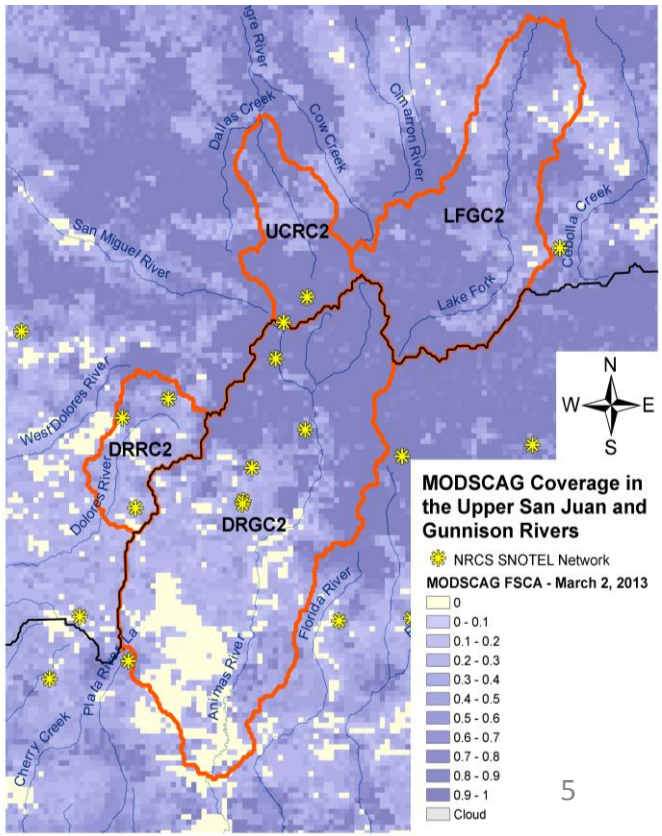
Stacie Bender - CBRFC

Overview

- Motivations for the project, project history and timeline
- Introduction to datasets
- Examples of NASA/JPL datasets being used in CBRFC daily operations

Motivations for the Project

- More complete snowpack info should improve hydrologic forecasts.
- Snow observations from satellite-borne instruments now have a long enough record that they can be used for analysis beyond very specific case studies.
- Remote sensing data can fill in gaps between point stations.
- Collaboration with a research agency
  - Improve understanding and communication between operational and research groups.
  - CBRFC gains detailed knowledge of and experience with the remote sensing data.



Brief Project Timeline

- **Early 2012** – a collaborative project between NASA/JPL
- and CBRFC was funded to study potential uses of NASA/JPL datasets in CBRFC operations.

- **2012/early 2013** – CBRFC downloaded and processed NASA/JPL snow covered area (SCA) data, as well as a portion of the NASA/JPL data used to indicate reduced albedo due to deposition of dust on the snow.

- **Melt season 2013 -** CBRFC uses the snow cover data to make minor adjustments to model states. Annie Bryant from the NASA/JPL group spent 3 weeks at the RFC to be come more familiar with RFC operations.

Common Questions

1. What kind of datasets are these?
2. How does MODIS-derived snow data (especially snow cover data) help CBRFC?
3. Is CBRFC using dust-on-snow information?
4. Does this CBRFC effort include snow observations from the NASA/JPL Airborne Snow Observatory (ASO)?

Introduction to datasets

- <u>In general:</u>
- MODIS = Moderate Resolution Imaging Spectroradiometer (instrument on both of NASA's Terra and Aqua polar orbiters)
- Provides information about snow, vegetation, oceans, and more
- Daily snow datasets are of 500m spatial resolution.
- Clouds are a major drawback (MODIS can't see through them).

- <u>Specific to this CBRFC-NASA/JPL project:</u>
- **MODSCAG = MODIS Snow Covered Area and Grain size** - snow covered area dataset)
- **MODDRFS = MODIS Dust Radiative Forcing in Snow** - "dust on snow" dataset – an estimate of how much additional energy gets input to the snowpack if the albedo is reduced due to dusty conditions

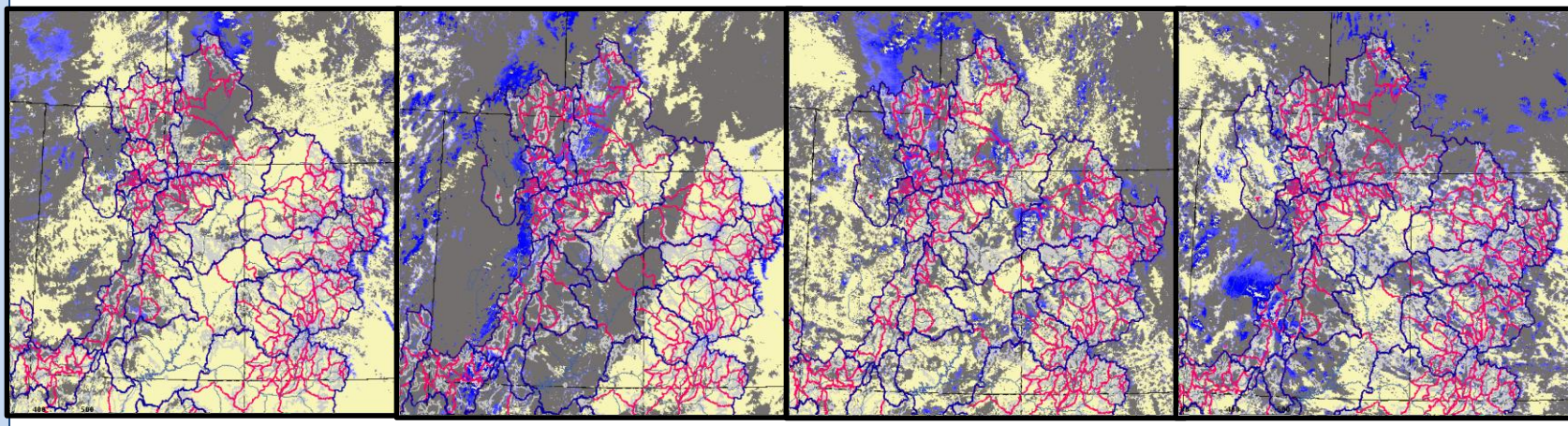
*** <u>Are these data the same as the data from the NASA/JPL Airborne Snow Observatory (ASO)?</u> **No**. Only a very small portion of CBRFC's area (SW CO) is covered by the ASO program, so CBRFC chose to focus the RFC's resources on the MODIS (satellite) data.

Introduction to datasets

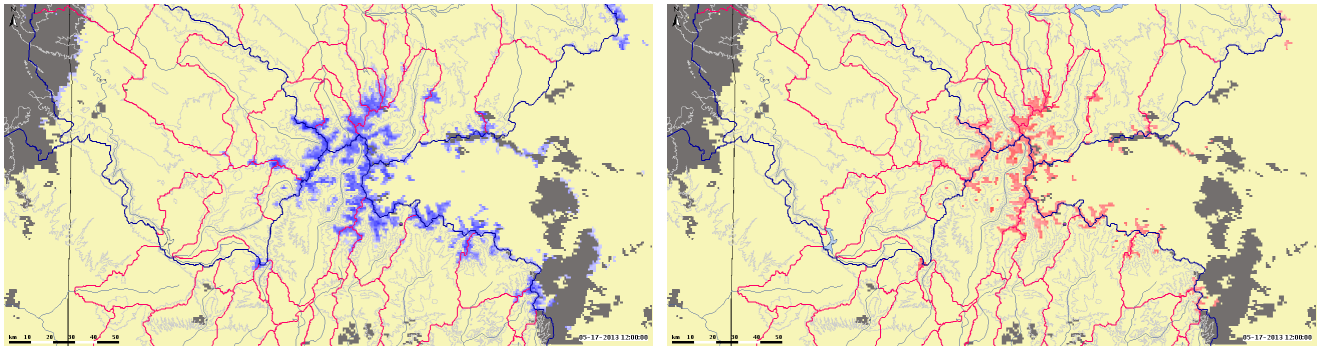
CLOUD CHALLENGES AND TRADEOFFS

Clouds → storms → precipitation → a **good** thing this year!

Clouds → storms → very little snow cover extent information received → **not that helpful**



MODSCAG Snow Cover from (L-R): May 16, 17, 18, 19, 2013



MODSCAG Snow Cover and MODDRFS "dust info" over SW CO: May 17, 2013

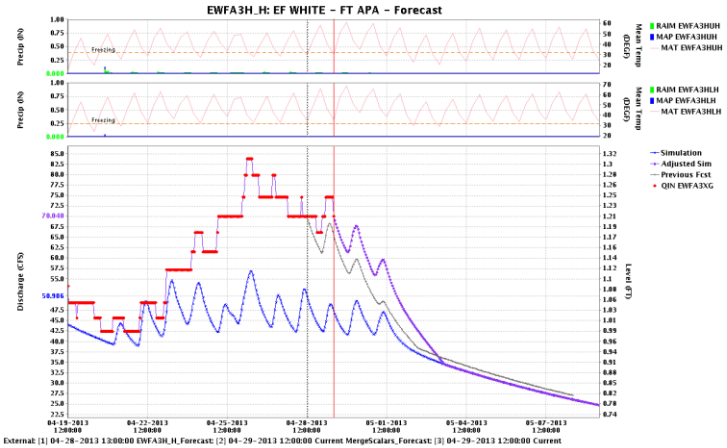
RFC Model Adjustments using NASA/JPL Datasets

- **MODSCAG (Snow Cover):**
- Used in a **binary fashion** to add/subtract minor amounts of SWE in the snow model (SNOW-17) when the streamflow simulation departs from recent streamflow observations.
- Examples on following slides
- **MODDRFS (indicator of dust/reduced snowpack albedo):**
- *CBRFC has not made any model adjustments yet using the DRFS data.*
- Dust layers were exposed in early and mid May but their impacts on the snowpack in May were modified by a new layer of clean snow (May 6-7 snowfall in SW CO) and by extensive cloud cover from slow moving low over the weekend.
- A “Melt Factor Correction” would be the most likely adjustment if any adjustment was used.

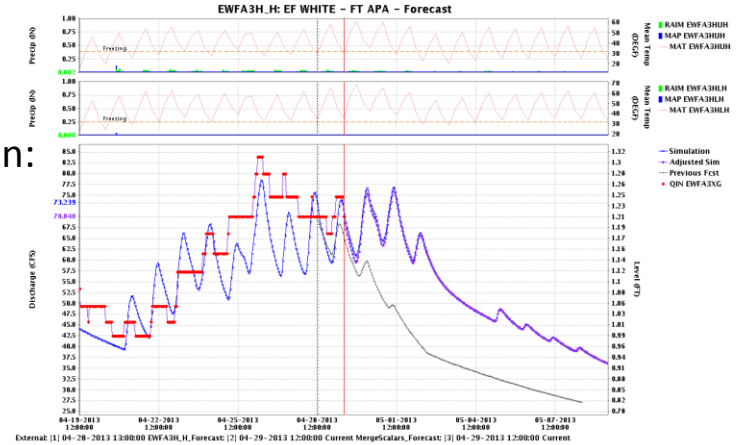
April 29 CBRFC forecast modifications due to MODSCAG (snow cover) – EWFA3

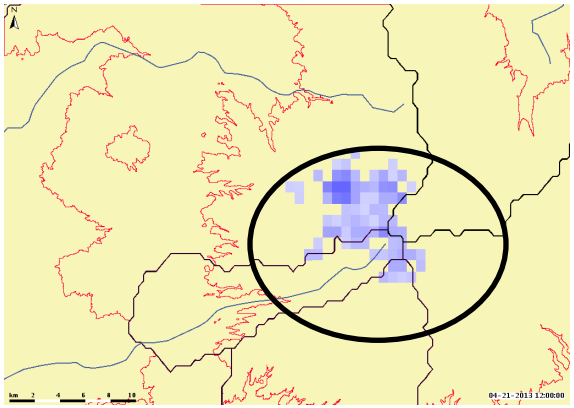
- East Fork White R., near Fort Apache, AZ
- (NWS ID: EWFA3, USGS ID: 09492400)

Before small SWE adjustment:



After small SWE addition:





MODSCAG Snow Cover
April 21, 2013

Did the adjustment help?

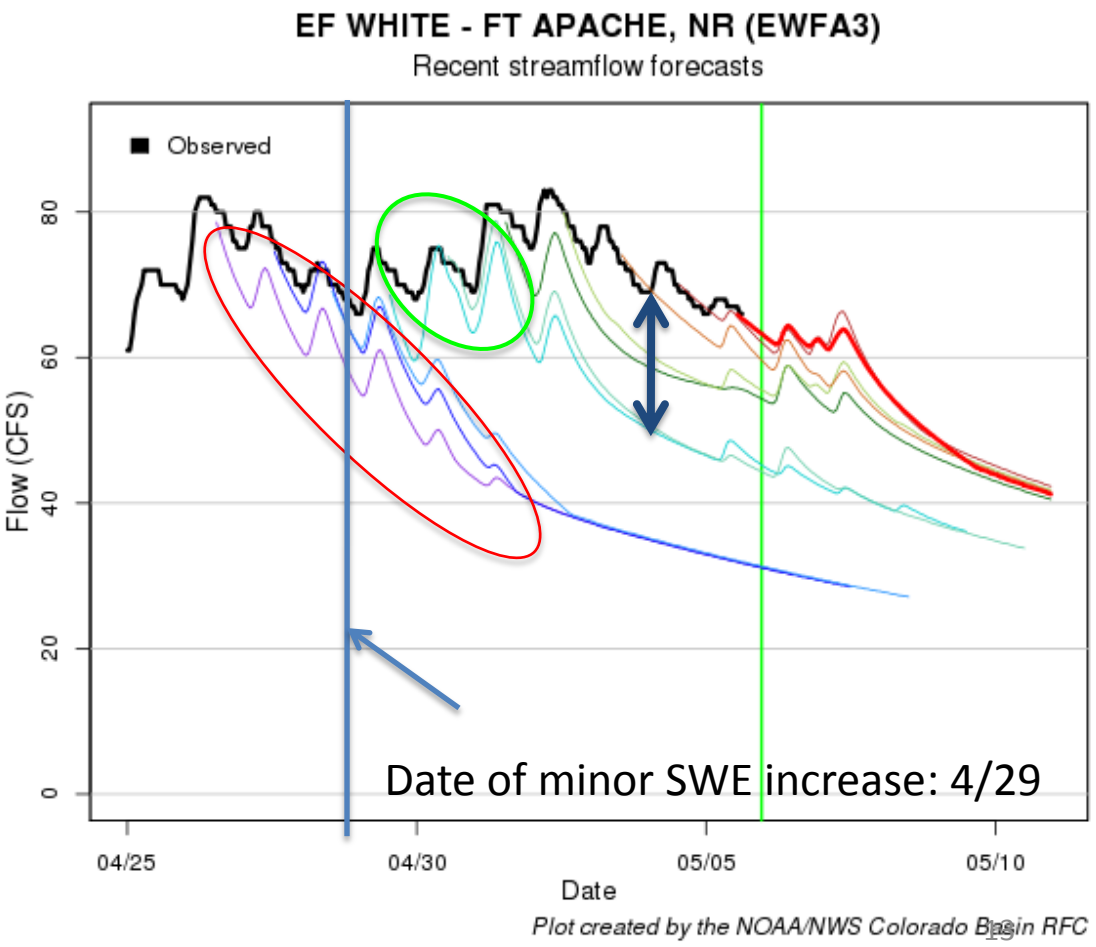
Forecast was better *with* the adjustment. Not perfect, but at least somewhat improved.

Prior to the adjustment, streamflow fcsts were dropping off too quickly.

Forecast flows were closer to the observed than they would have been otherwise. The adjustment resulted in a better fcst over ~2 days.

Beyond ~2 days, the fcst flows still dropped off too much vs. obs.

→ No drastic changes - we're not 100% sure what the impacts will be.

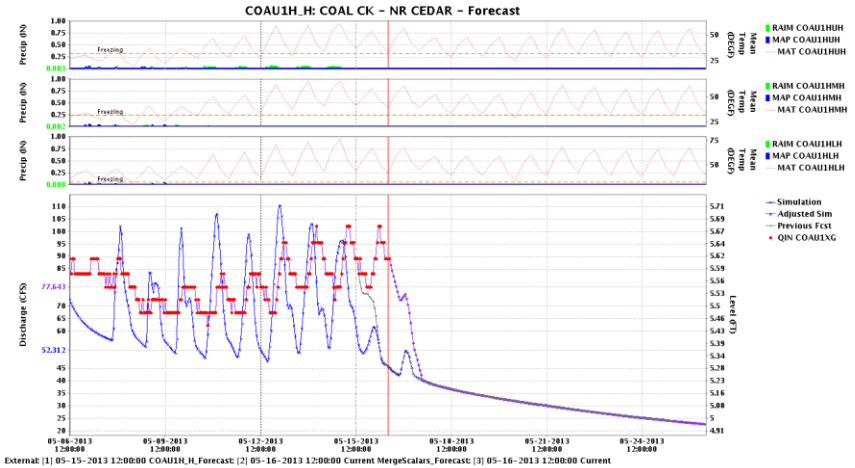


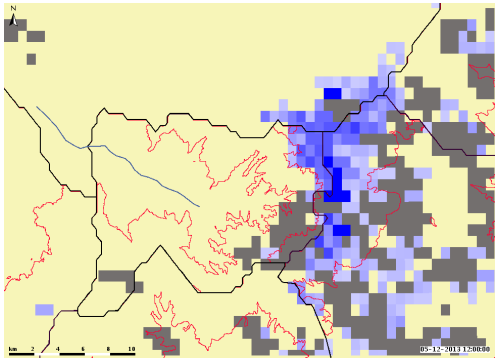
May 16 CBRFC forecast modifications due to MODSCAG (snow cover) – COAU1

Coal Creek, near Cedar City, UT

(NWS ID: COAU1, USGS ID: 10242000)

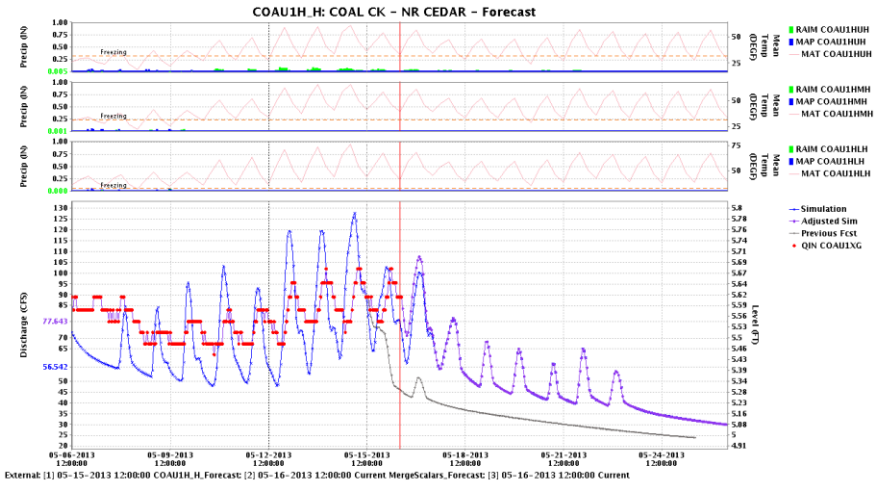
Before small SWE adjustment:





MODSCAG Snow Cover

After small SWE addition:

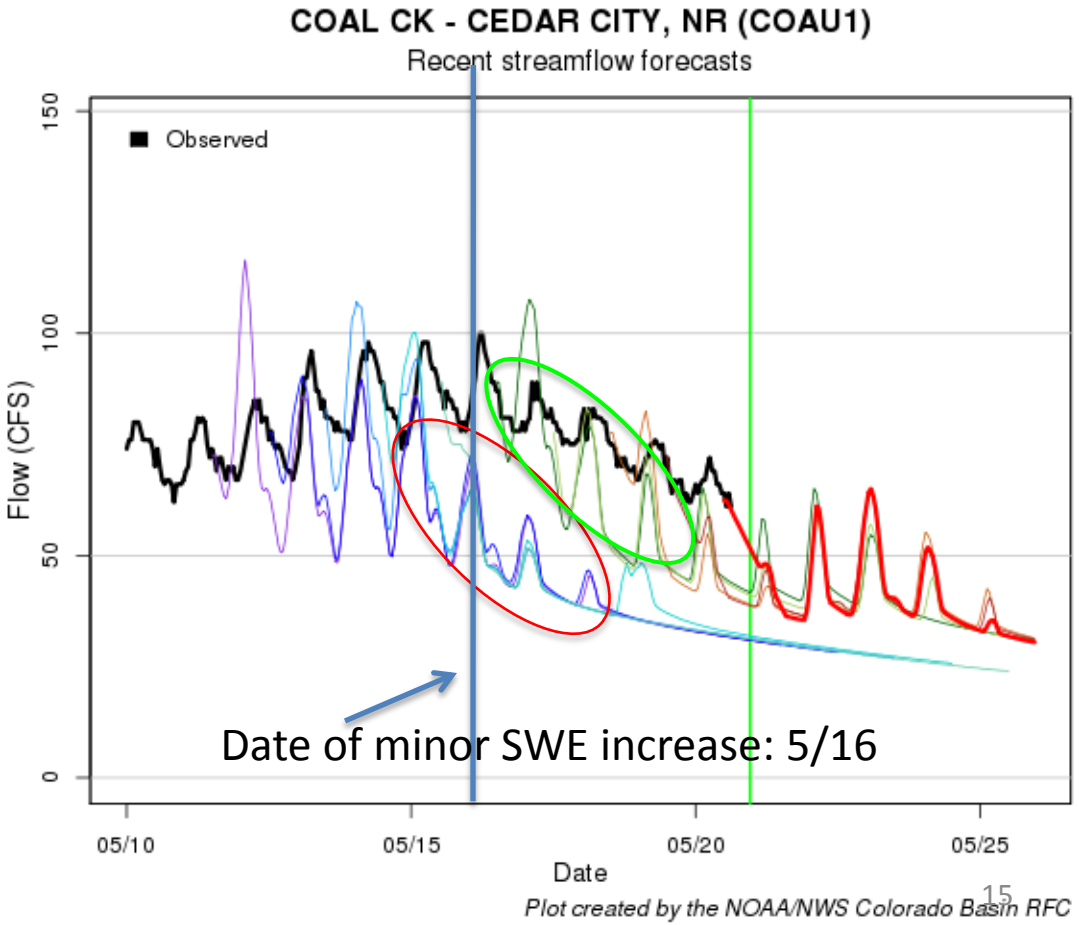


Did the adjustment help?

Forecast was better *with* the adjustment. Not perfect, but at least somewhat improved.

Prior to the adjustment, streamflow fcsts were dropping off too quickly.

Forecast flows were closer to the observed than they would have been otherwise. The adjustment resulted in a better fcst for most of the forecast period.



Adjustment summary

CBRFC has had some initial success with minor adjustments to model SWE, based on information provided by NASA/JPL datasets.

- Adding (shown in examples) *and* subtracting snow (not shown here) from the model.

However, we aren't 100% sure what impacts major adjustments would have, so no drastic changes are made until we have more experience with the data. So far, only minor adjustments have been made.

Future Directions

- Continue and expand collaboration with NASA to determine the utility of MODIS datasets in CBRFC operations
- Investigate/consider the use of different types of data assimilation schemes
- Investigate/consider the use of different snow models

WFO comments/issues ?

Future Calls

- Future Teleconference Schedule:
- June – Individual Calls with WFO's (service assessment)
- July – Radar Precipitation (biases, communication, office procedures)

- TOPICS For The Future:
  - Methods to coordinate and support wildfire burn scars (data exchange/model impacts)
  - Drought and low flow (impact to RFC customers – product support)
  - RFC projects update webinar (snow, hefs, chps, other development work)
  - WFO topics