Project: Incorporating Dust on Snow Information into CBRFC operations during the snowmelt season

Last Update - February 20, 2018

Goals:

1. Evaluate usefulness of Snow Contamination grids by incorporating information in the calibration record (2000-2010)
2. Implement operationally if improvement is recognized

Status: Complete. Improvements were found to the calibration record, and CBRFC is currently using the snow contamination grids provided by JPL in operations in the San Juan river basin only. Other areas did not show a significant enough improvement.

Method:

1. Gather data from JPL
2. Process grids into mean areal format
3. Develop and calibrate the model for years 2000-2010
    a. Calculate SWE/MAXSWE for each day. Only look at days where SWE/MAXSWE < 0.5 (mainly interested in early season melt)
    b. Get Mean Areal Dust for each day (MAD), and calculate MAD anomalies using banded SWE/MAXSWE
    c. For each day, modify the MAT using the MAD anomaly.
    d. TADJ=T+(MAD_a/10*.75)*(100-EGREEN)/100 where T is the 6 hourly MAT, EGREEN is the % of the basin that is evergreen (assuming heavily forested areas not affected by the dustyness of the snowpack)
    e. Re-write the MAT deck with adjusted temperatures

Outcomes, results and findings:

This is for the San Juan River Basin only. Other areas not as affected by changes in runoff due to dust (see paper by Annie ** add reference). This only applies to areas above the treeline.

Significant improvement in the timing of the snowmelt in basins with larger areas above tree line.

Volume not affected much. However, we expect the following qualitative outcomes:

- ➔ If the dust is exposed very early in the melt (March and April) , the early season melt takes place when solar radiation is relatively low. This may decrease the amount of SWE during the period of time when melt rates are normally higher. As a result there may be more early season percolation, and less surface runoff later in the season resulting in decreased seasonal volumes.

- ➔ If the dust is exposed later in the season, it may coincide with higher solar radiation thereby maximizing the melt rates. This can result in higher surface runoff and therefore increase the seasonal volumes.
- ➔ The amount of increase/decrease is expected to be small: +/- 5 percent

Operational implementation:

1. Gather data from JPL and import into CHPS.
2. Process grids into mean areal format.
    a. Calculate the percent of cells in a basin that are less than 490 W/m^2
    b. Calculate the percent of cells in a basin that are cloud covered.
3. Create current days observed MAT.
4. Determine if the snow model is melting snow by comparing the max swe to the daily swe. (If these values are the same than the snow model is still accumulating snow)
5. Calculate adjusted MAT value based contamination grid.
    a. Use coefficients created in calibration, MAD anomalies, to determine the temperature adjustment factor. The coefficients are banded based on the ratio of max swe to daily swe. These coefficients are created for each basin.
    b. If basin is over 25% cloudy/invalid value reported, no calculation is made.
    c. If snow model is not melting snow, no calculation is made.
6. Apply adjust factor to the current days MAT and write a new time series.
    a. This time series is viewable in CHPS and a forecaster can switch to this time series.