Declining Great Salt Lake and Exceptional Drought: Impacts on Dust Sources and Transport in Eastern Great Basin, USA

Maura Hahnenberger, SLCC
*Elijah Alfred, SLCC & University of Utah
Stine Ornes, SLCC
*Natalie Jackson, SLCC
*Shane Schmidt, SLCC
*Talon Roberts, SLCC & University of Utah

Salt Lake Community College
Geosciences Department

* indicates students

Controls on Dust Transport in Great Basin

➔ SOURCES:

- Playas, Agriculture, Wildfire Scars, Dry Lakeshores

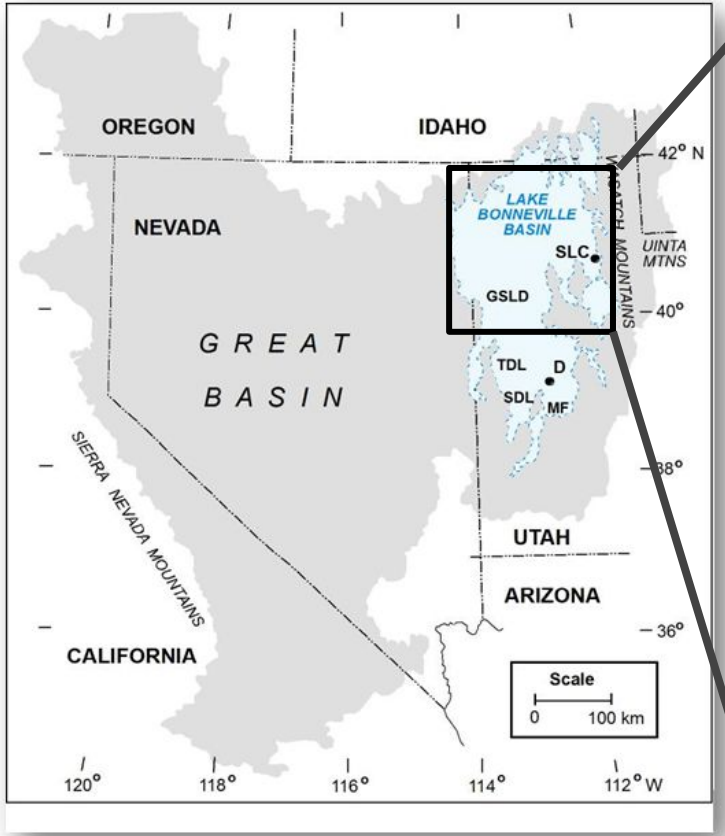
➔ METEOROLOGY

- Synoptic (intermountain cyclones)
- Convective (monsoon thunderstorms)
- Variations in Drought conditions

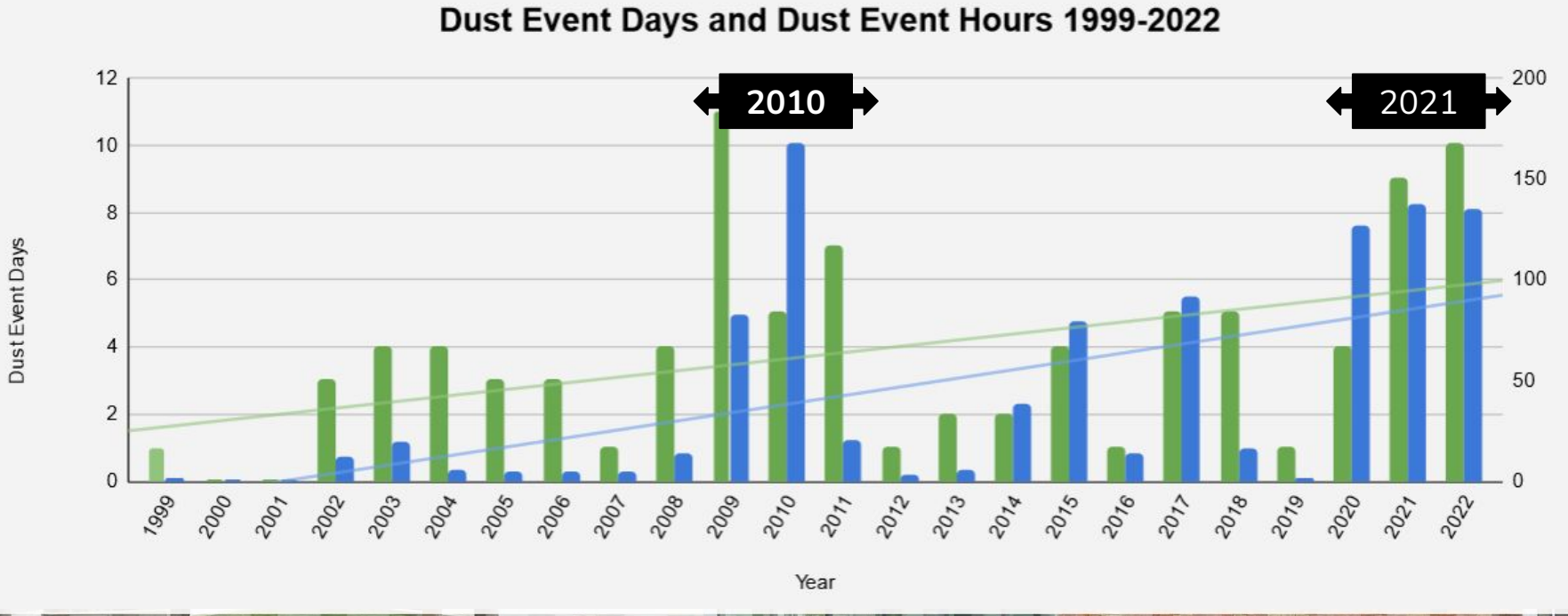
➔ HUMAN FACTORS

- Water diversions, Post-fire rehabilitation, Agricultural practices, Other source disturbance

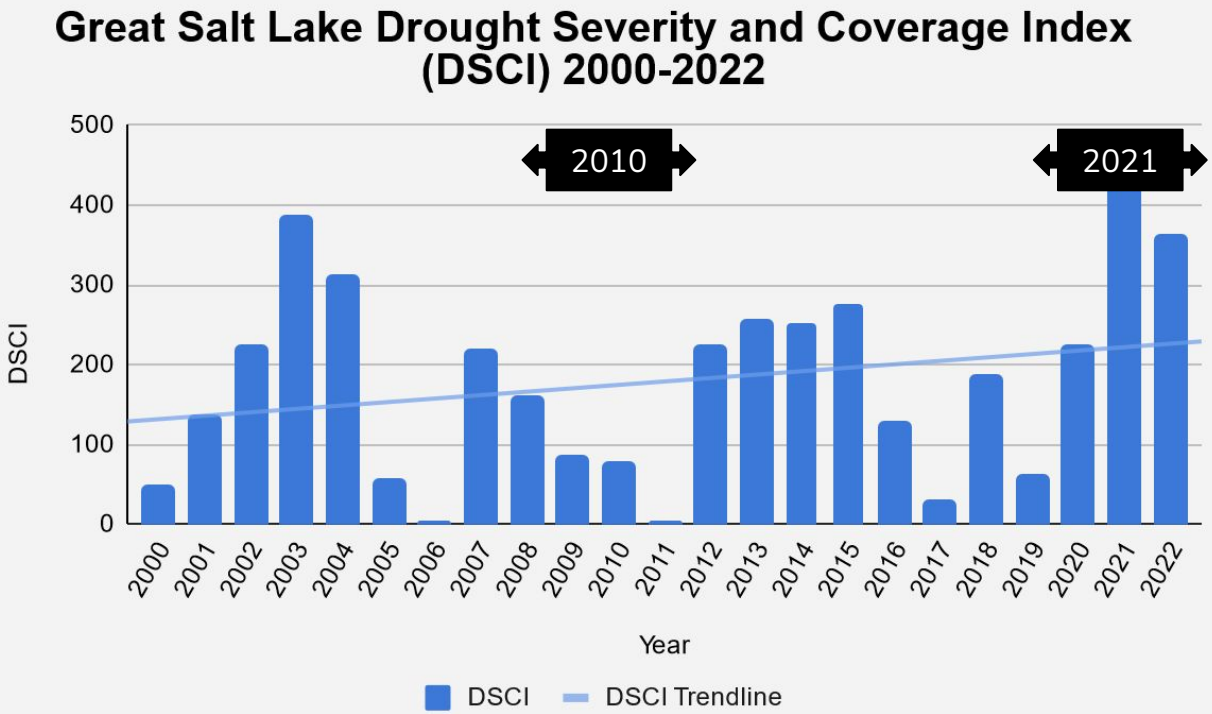
Great Basin & Great Salt Lake Region



Climatology of Dust Events

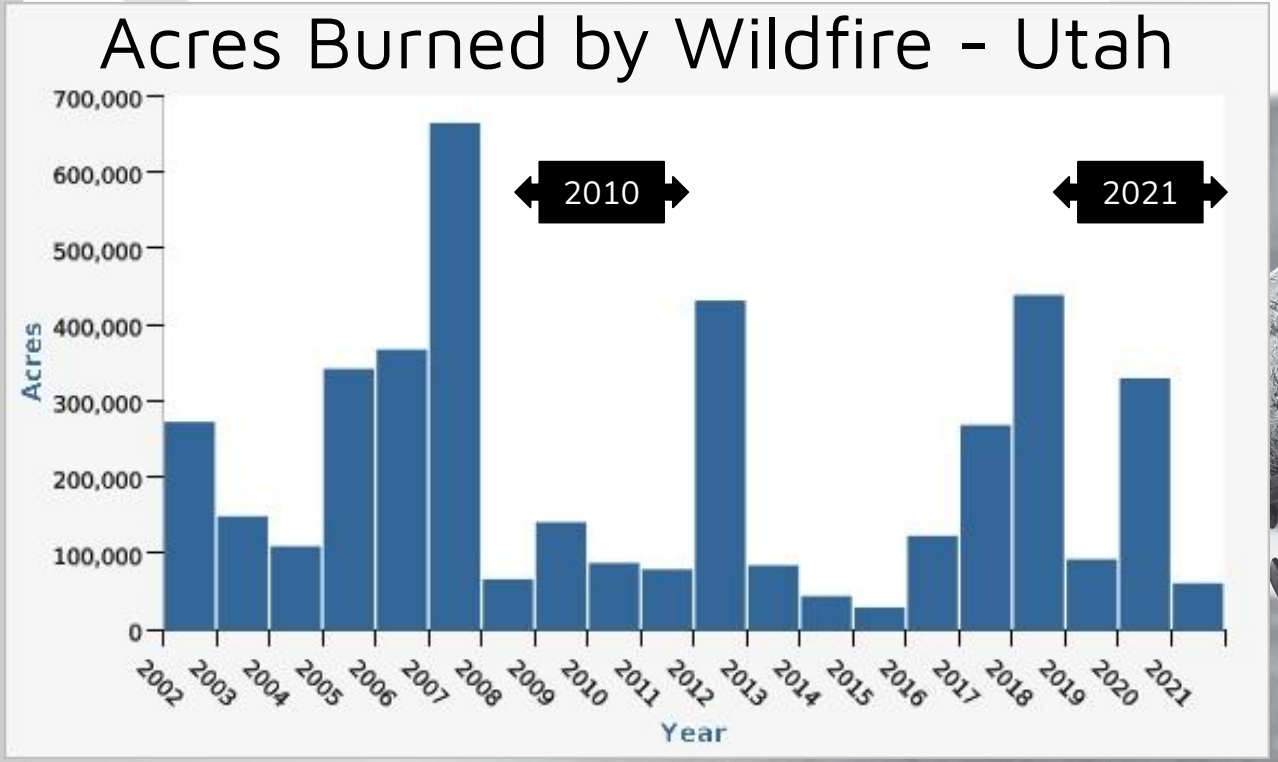


Drought has impact, but not #1 driver



- 2010 Peak: Moderate Drought
- 2021 Peak: Exceptional Drought
- Only small dust event peak during 2003 Extreme Drought

Wildfire can have impact but location matters



- 2007 Milford Flat Fire was largest in Utah History at over 300,000 acres
- Fire was in valley locations of grassland & shrub/scrub land cover

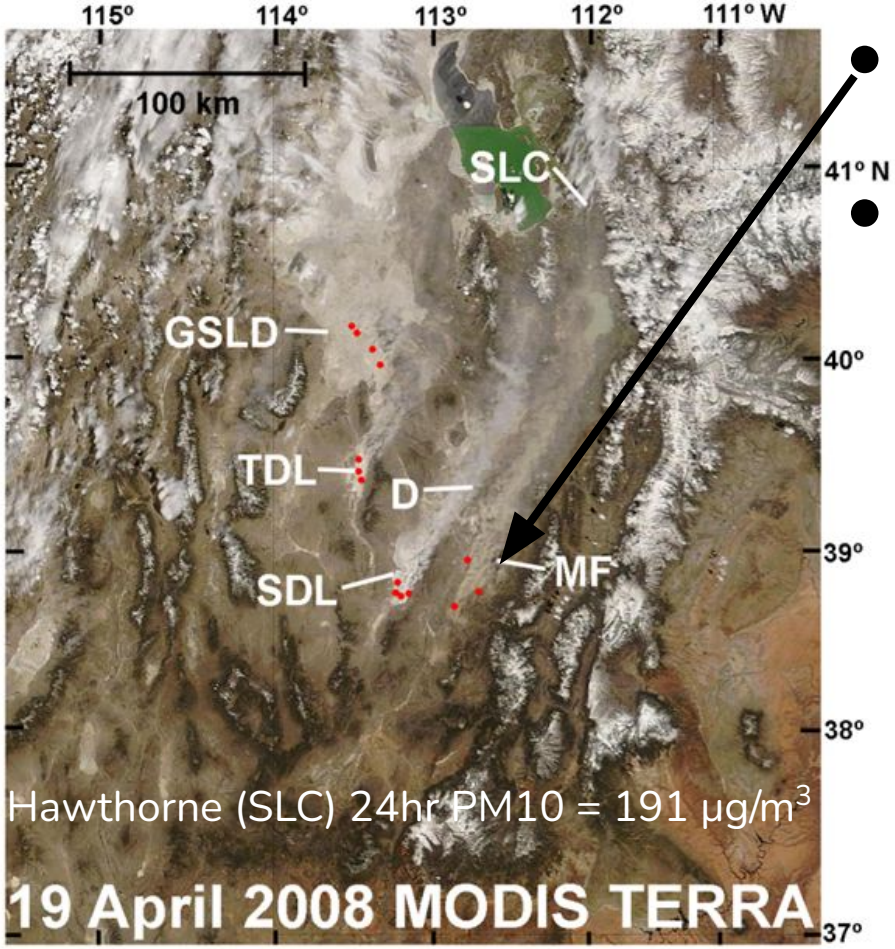
Wind Erosion at Milford Flat Fire Scar

18+ inches of soil loss

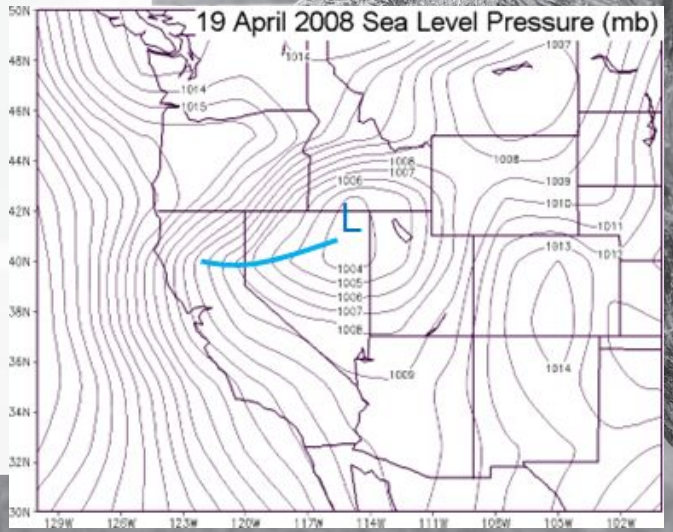
Soil deposition along fence line

Post-fire Rehabilitation included chaining and tilling.

19 April 2008 Dust Event - SW Transport



- Milford Flat source for dust at SLC
- Additional transport from Sevier Dry Lake, Tule Dry Lake, Great Salt Lake Desert



Decline of Great Salt Lake

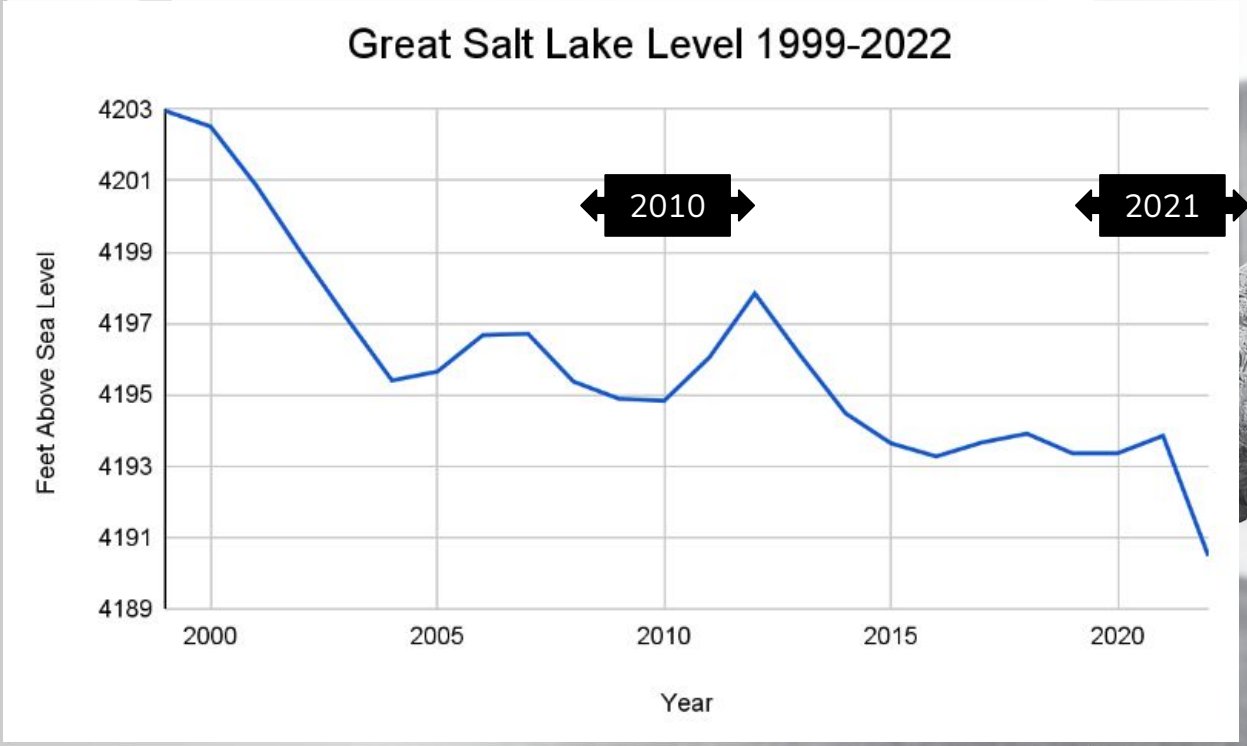
~11 feet of decline is due to human water consumption

GREAT SALT LAKE ELEVATION

RECORD HIGH	AVERAGE	RECORD LOW*
4211.65 FEET	4202.2 FEET	4190.1 FEET

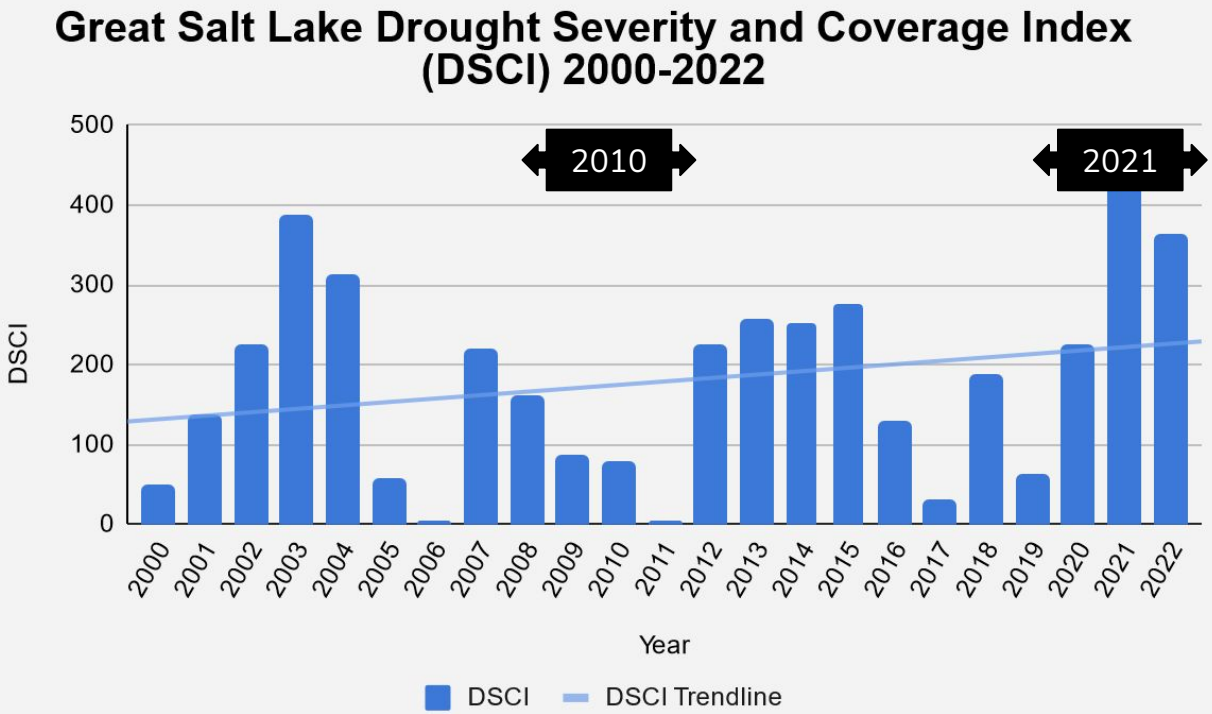
*as of July 2022

GSL Decline impacts recent events, but not exclusively



- 2010 rare to have dust from GSL
- 2021 more frequent dust from GSL, but also many other sources

Exceptional Drought during 2021



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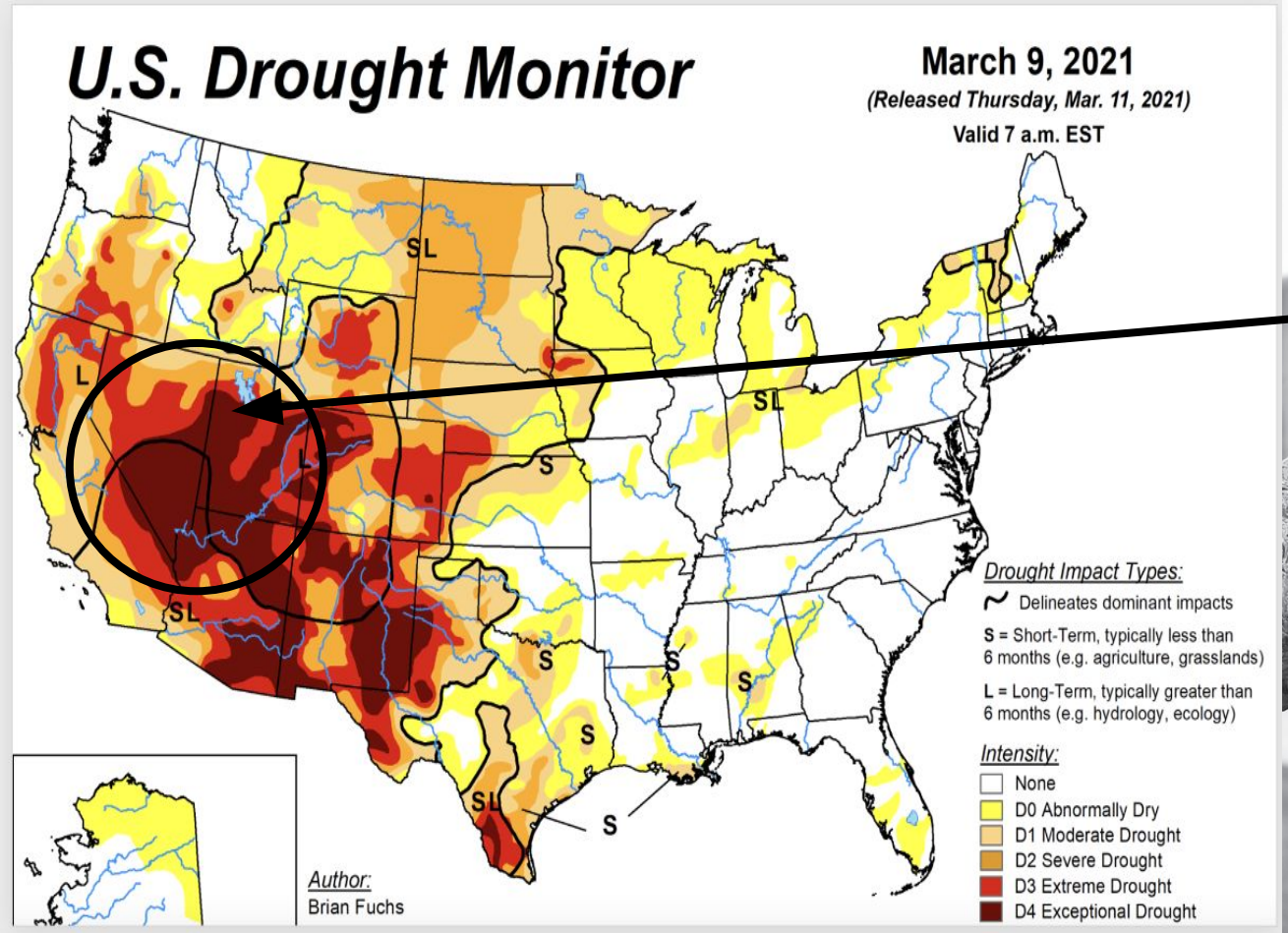
2021 Western U.S. Drought



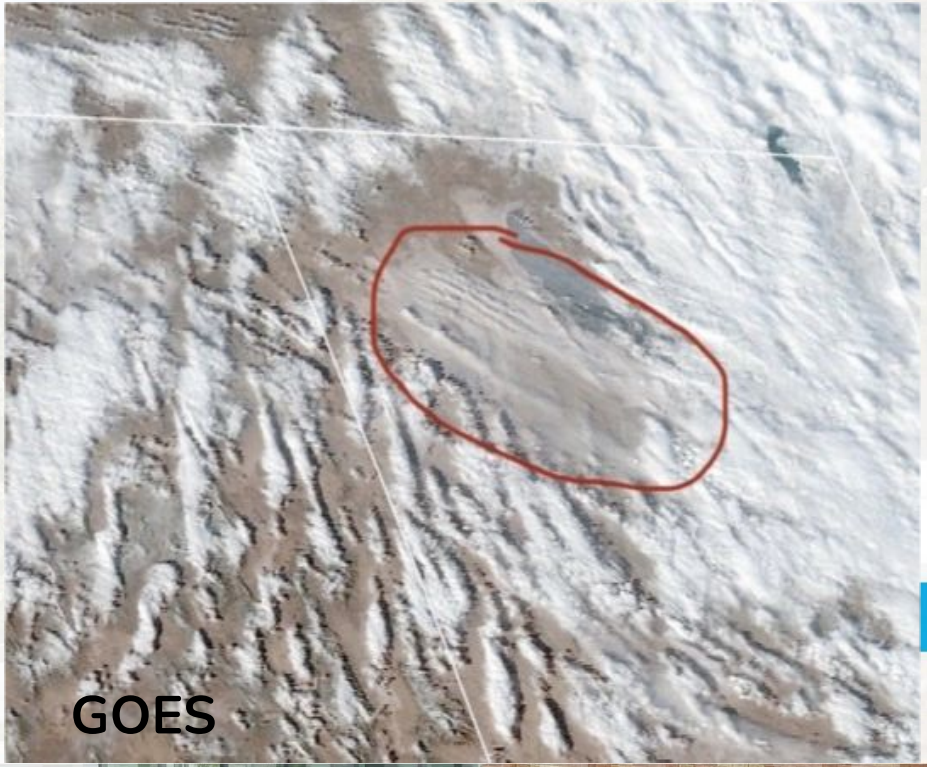
- Severe, Extreme, & Exceptional drought throughout Utah and Nevada
- Spring & Summer 2021 had persistent drought conditions

5 February 2021 Dust Event - NW Transport

- SOURCES:

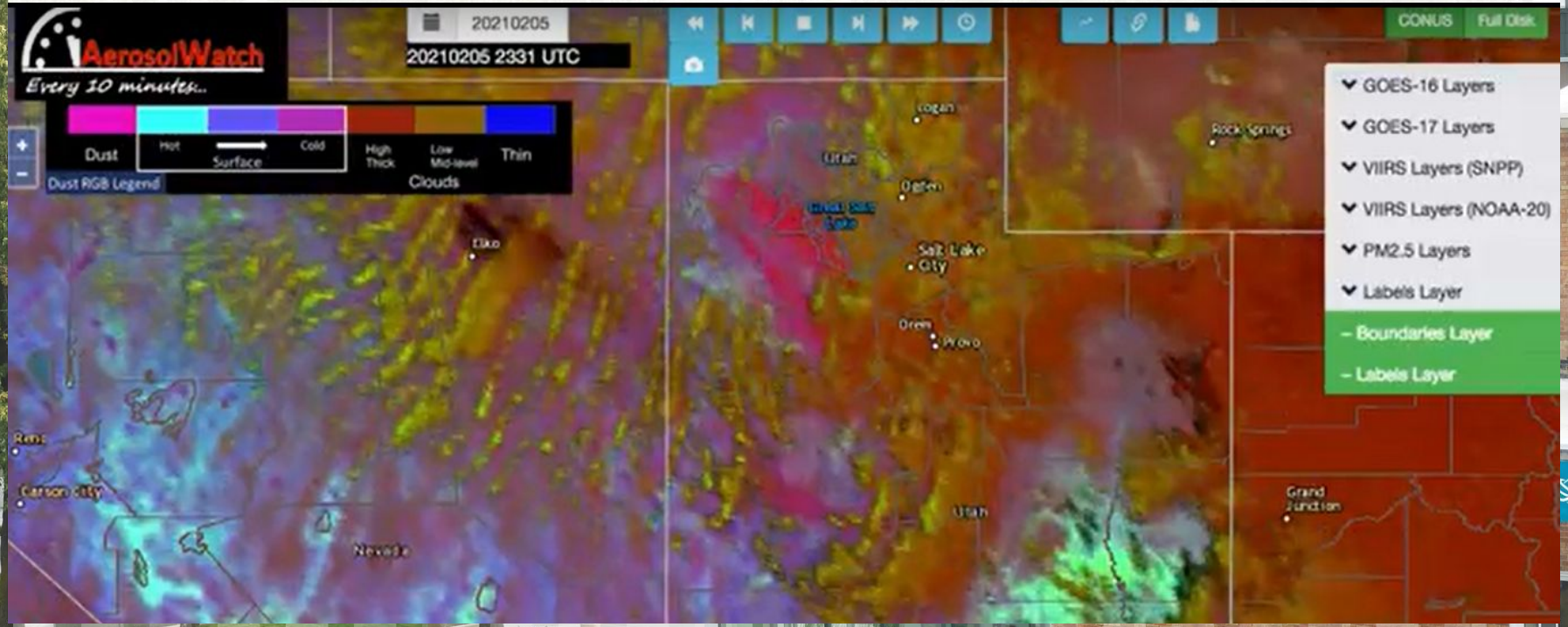
→ Great Salt Lake Desert

→ Northern shoreline of Great Salt Lake

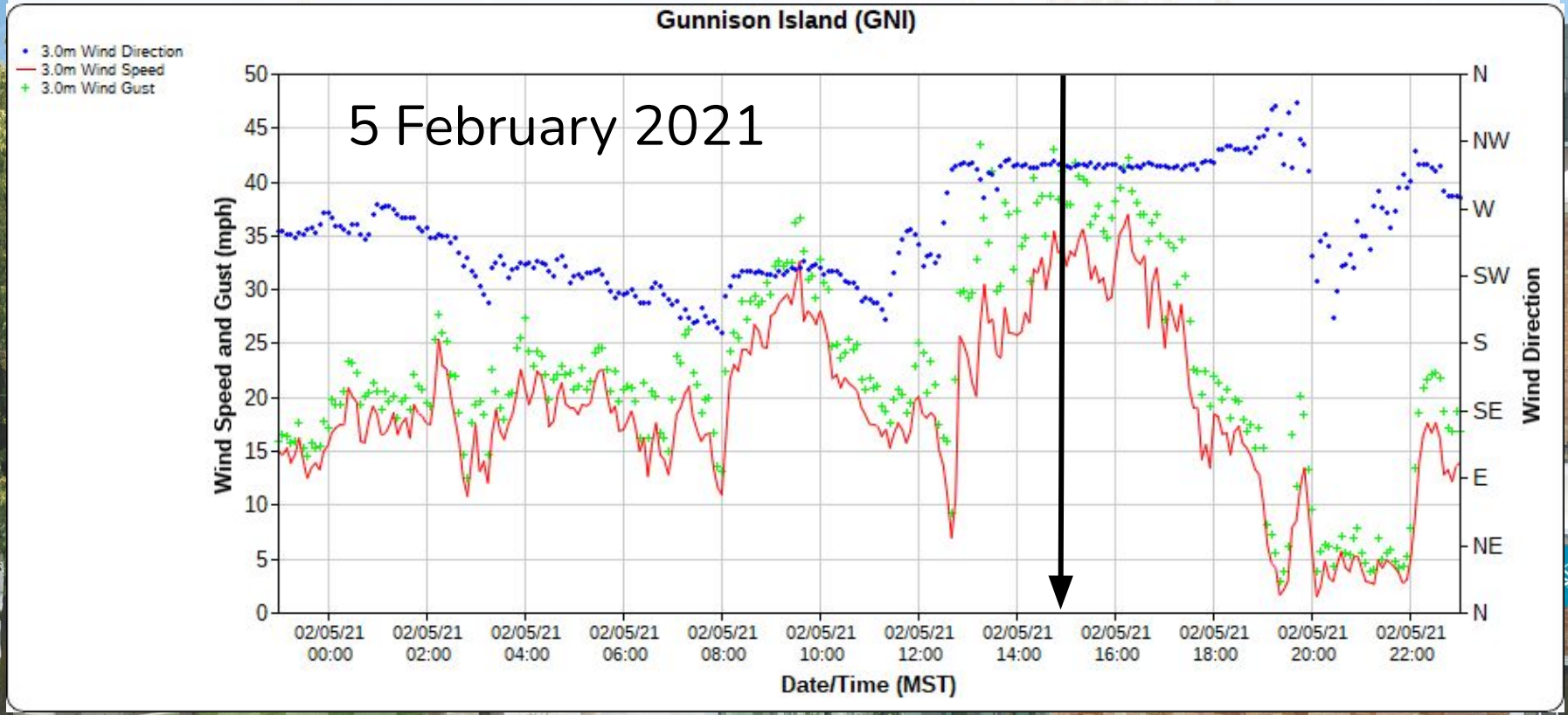


Transport from GSL & GSLD

5 February 2021

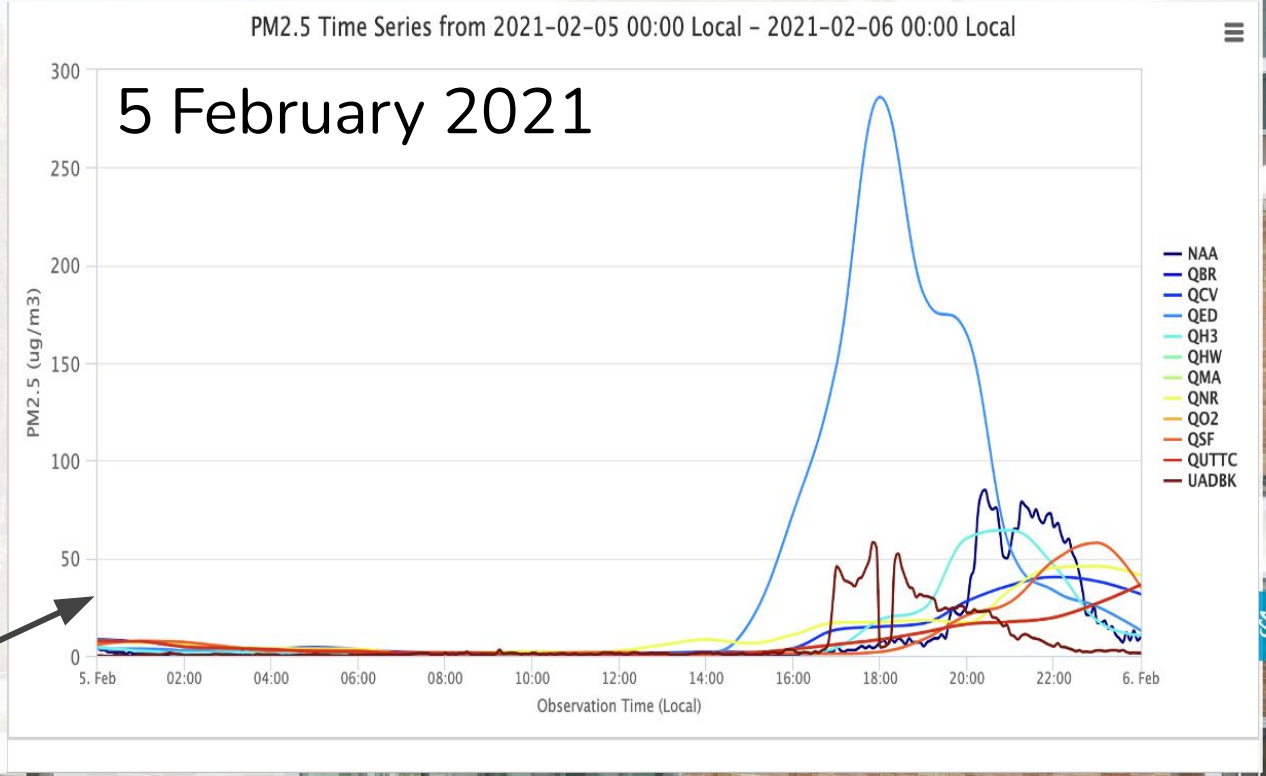


Post-frontal winds >30mph at GSL



Degraded Air Quality across Utah

- Peak PM2.5 level of 286.1 µg/m^3 at Erda, UT (S of GSL)
- PM2.5 > 35 µg/m^3 at11 stations



Muddy Snow fell Across Northern Utah

5 February 2021

Conclusions: Important Dust Drivers

- 2010
  - Wildfire
  - Post-fire Rehabilitation
  - Moderate Drought
  - Intermountain Cyclones
- 2021
  - Decline of Great Salt Lake
  - Exceptional Drought
  - Intermountain Cyclones
  - Monsoonal Thunderstorms

SALT LAKE COMMU

Salt Lake Community College

Geosciences Department

Maura Hahnenberger, PhD
maura.hahnenberger@utah.edu
Twitter: @DrMaura_Science

Twitter: @DustSquared
Mastodon:
@dustsquared@mstdn.science
Web: https://criticalzone.org/dust2