

Dust & Hydroclimate

**Presented by
Sarah B. Kapnick**

Geophysical Fluid Dynamics Laboratory Fall Science Symposium
November 2, 2017



How are dust & hydroclimate connected?

Vegetation & Climate

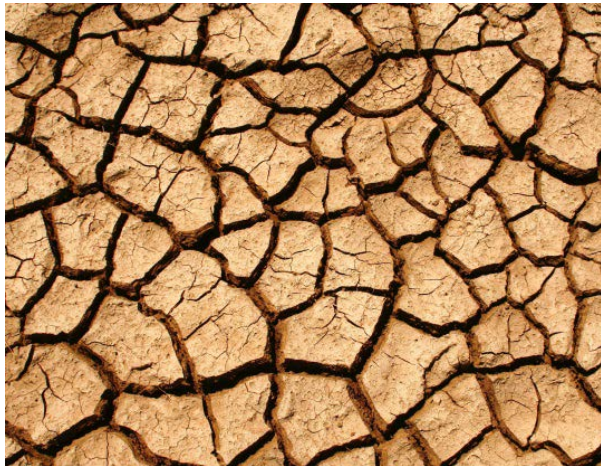
Farmland

Cryosphere

Low Dust



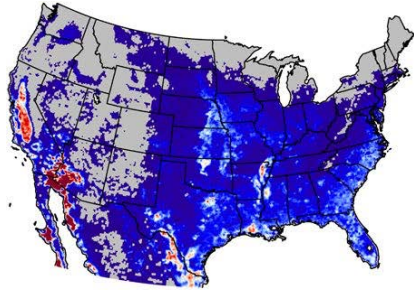
High Dust



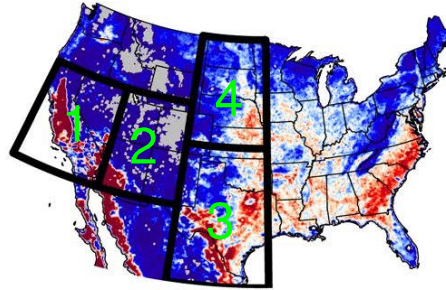
United States Dust Climatology & Causes

Frequency

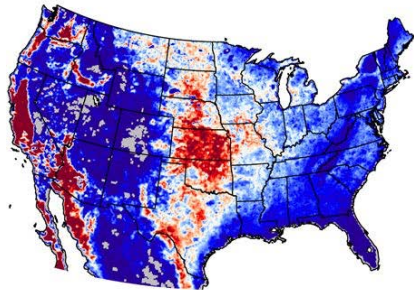
DJF



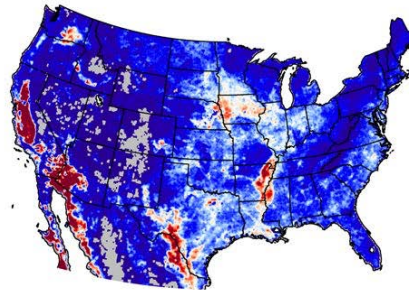
MAM



JJA



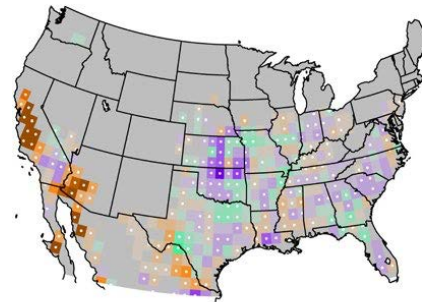
SON



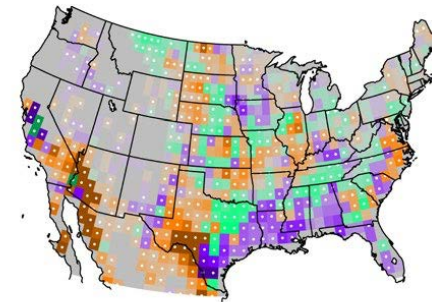
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 %

Contributors

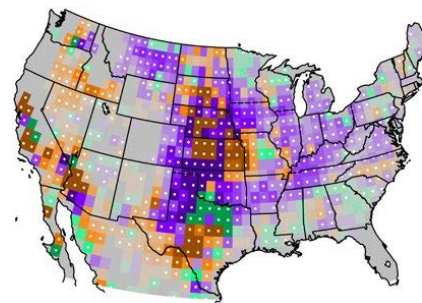
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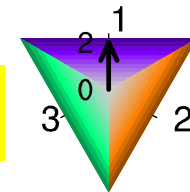
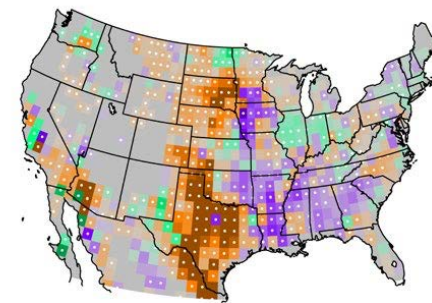
MAM



JJA



SON



1-PRE
2-Bareness
3-ref V

Dustiness related to land cover, precipitation, & winds

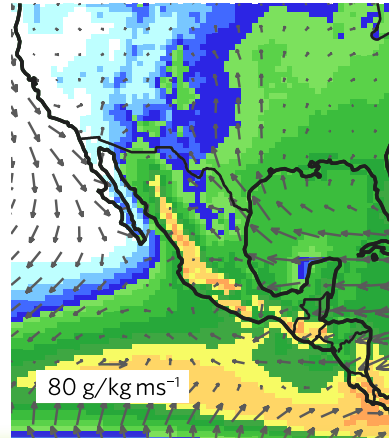
Source: Bing Pu & Paul Ginoux, Scientific Reports 2017

American Southwest: Improving the Hydroclimate

GPCC Observations

MERRA

LOAR (200km)



FLOR (50km)

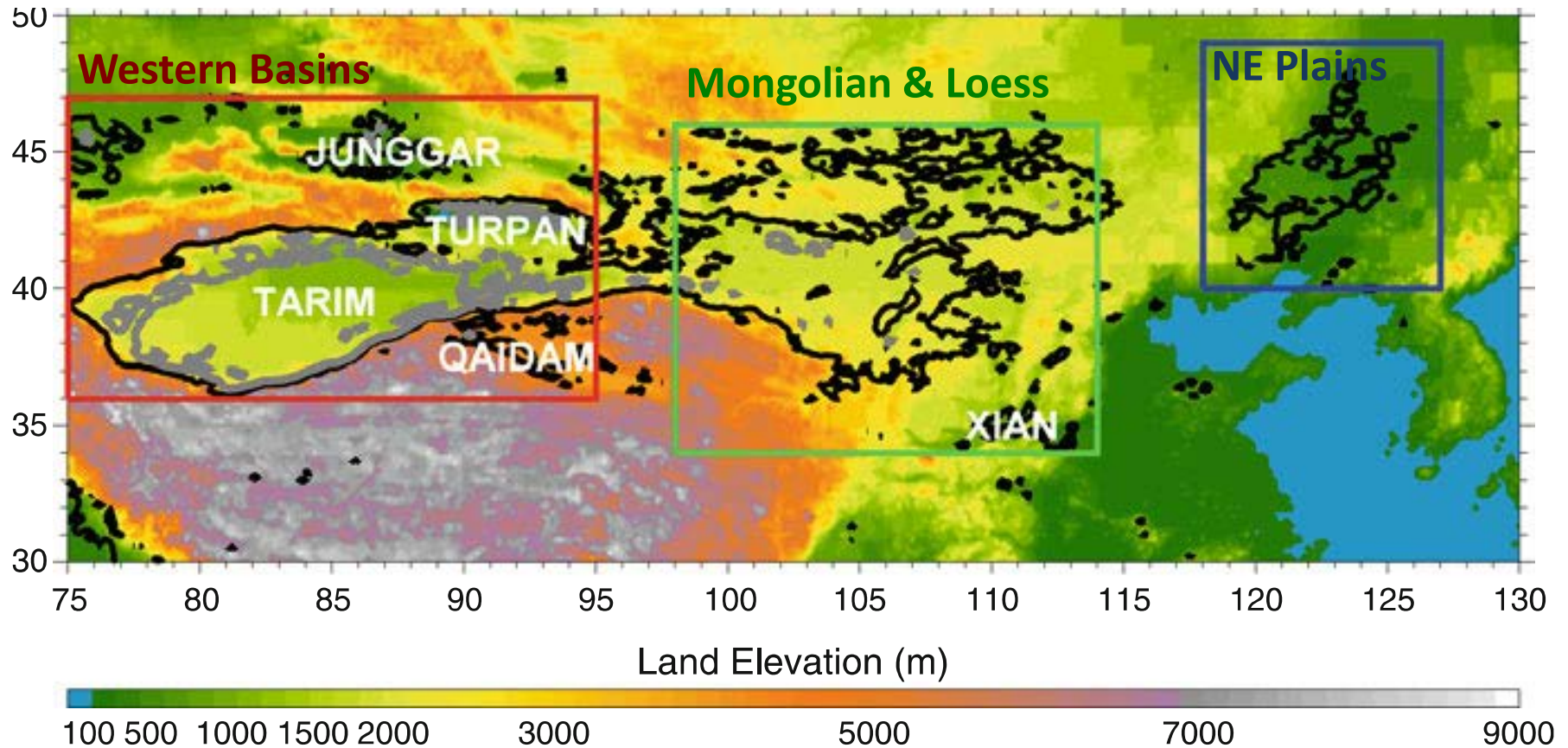
FLORFA (50km Flux-Adjust)

Rainfall Seasonal Cycle



Source: Pascale et al., Nature Climate Change 2017

Known Dust Sources in East Asia (2003-15)



>5% or 18 days/year
>25% or 91 days/year

MODIS Dust Optical Depth tells a very
dusty story north of high mountain Asia

Source: Ginoux & Deroubaix 2017

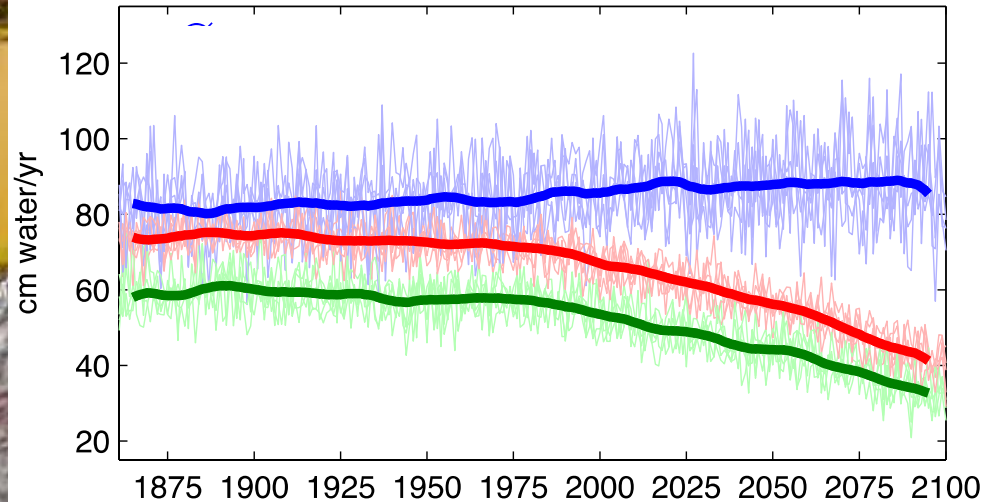
Is “the Karakoram Anomaly” due to dust or meteorology?

While the Himalayan glaciers are reducing in size/length, the Karakoram are maintaining size/expanding



Ata glacier 1933 vs. 2006

Snowfall



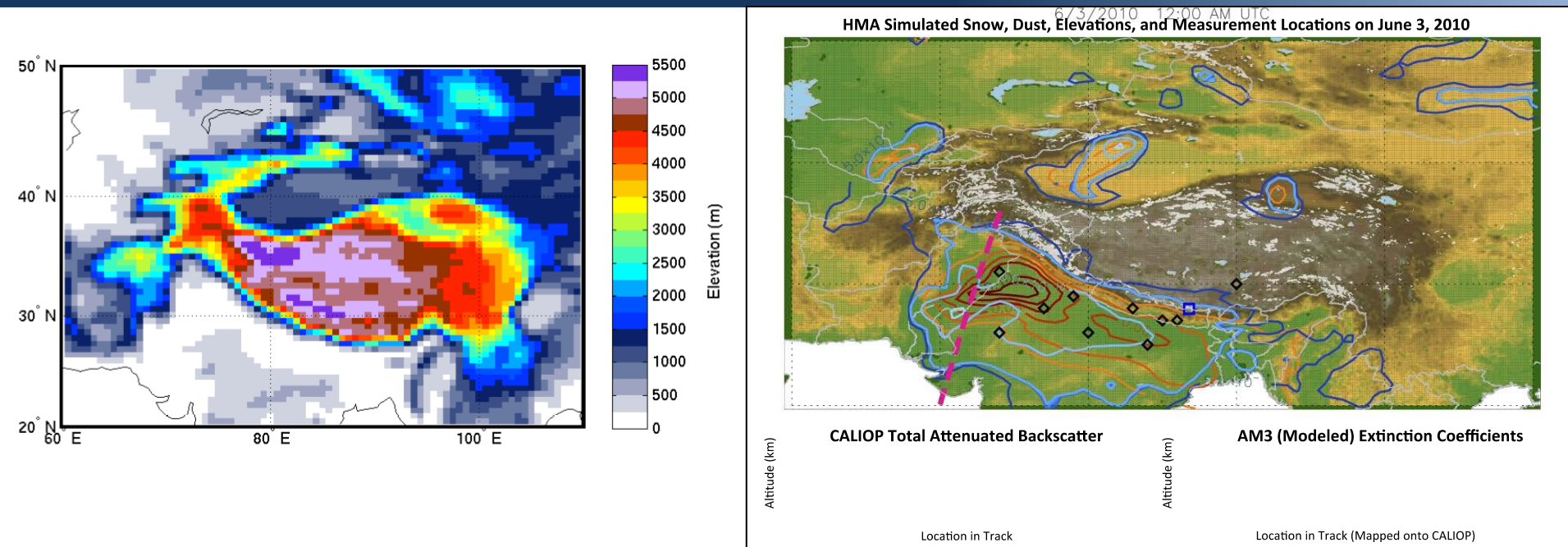
Karakoram Central

Eastern

Could differences in dust/aerosols also play a role?

High Mountain Asia Hydroclimate: Case Study

A case study for cryosphere/aerosol interactions



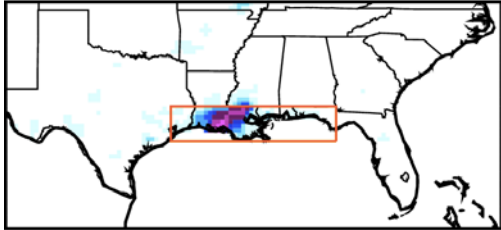
- This region is being used as a case study through the High Mountain Asia Team (HiMAT, FY2017-2019) to focus satellite data, new reanalysis products, and modeling on understanding the regional cryosphere dynamics, water supply variability, & hazards
- GFDL team leaders collaborating with NASA remote sensing experts: Sarah Kapnick (PI) & Paul Ginoux (Dust lead)

Beyond traditional definitions of hydroclimate extreme:

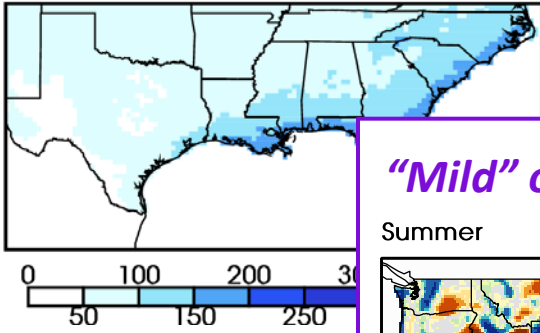
Things that matter & tie into different fields

12-14 Aug 2016: Rainfall Extreme Louisiana

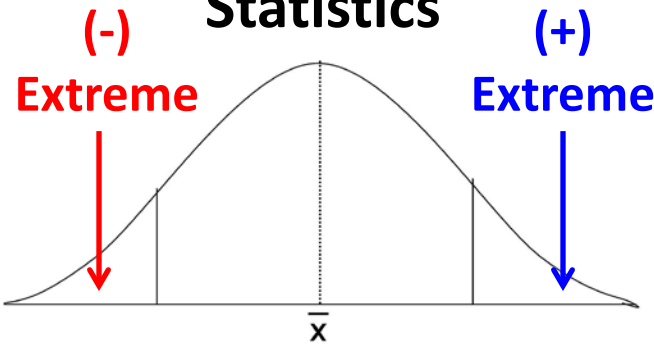
Total Rainfall 12-14 Aug; max = 535mm



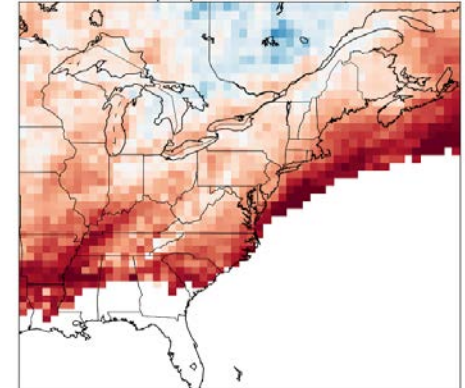
Average August Total Precipitation



Traditional Definition from Statistics



East Coast High Wind/Snow Events

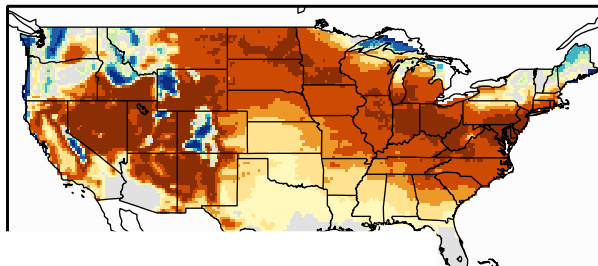


0 20 40 60 80 100
range over 70 years

"Mild" or Tourism Weather

Summer

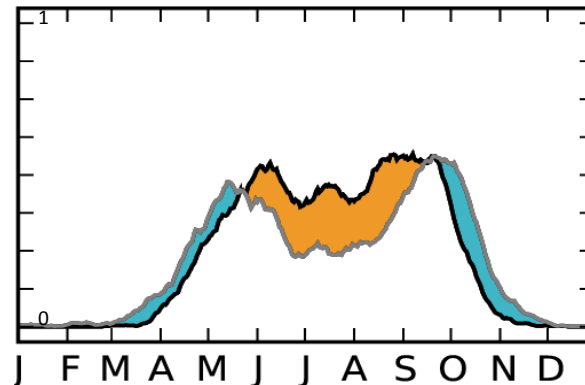
US mean: -9 days



Fewer mild



New York City



Change in days/year by 2100

More mild days