

Can temperatures capture drought conditions as does precipitation?

Drought trends indicated by evapotranspiration deficit over the contiguous United States during 1896-2013

Daeha Kim (d.kim@apcc21.org) & Jinyoung Rhee

BACKGROUND

EVAPOTRANSPIRATION (ET) can show another important aspect of drought situations that cannot be seen by precipitation deficiency only, but considerations of ET in prior studies are limited to:

- hypothetical potential ET (PET) based on Penman's hypothesis
- applications using land surface models with precipitation data

However, as if a fully precipitation-based index can be a drought index (e.g. Standardized Precipitation Index; SPI), a ET- or temperature-dependent index can solely be a good drought indicator.

METHODOLOGY

THE COMPLEMENTARY RELATIONSHIP (CR) of ET based on Bouchet's hypothesis enables to estimate PET and actual ET (AET) together using only temperature datasets with some assumptions.

ET deficit, PET minus AET, inversely indicates water availability of unsaturated lands.

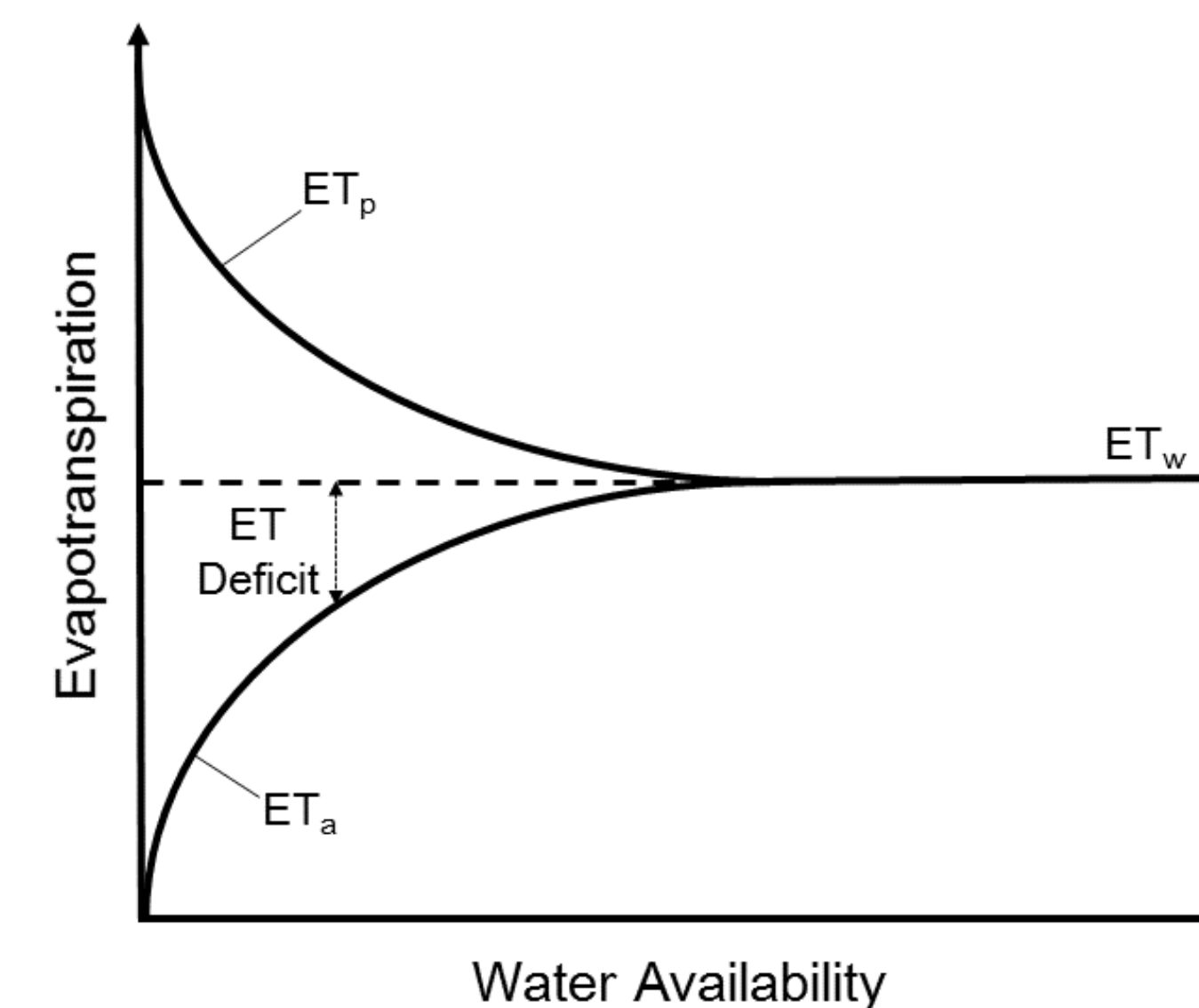


Fig. 1 Complementary Relationship of ET

Combination of the structure of SPI and ET deficit proposes the Standardized Evapotranspiration Deficit Index (SEDI)

RESULTS

Historical monthly temperature datasets of the PRISM CLIMATE GROUP at 4-km resolution are used for calculating the SEDI during 1896-2014 in the contiguous United States (CONUS).

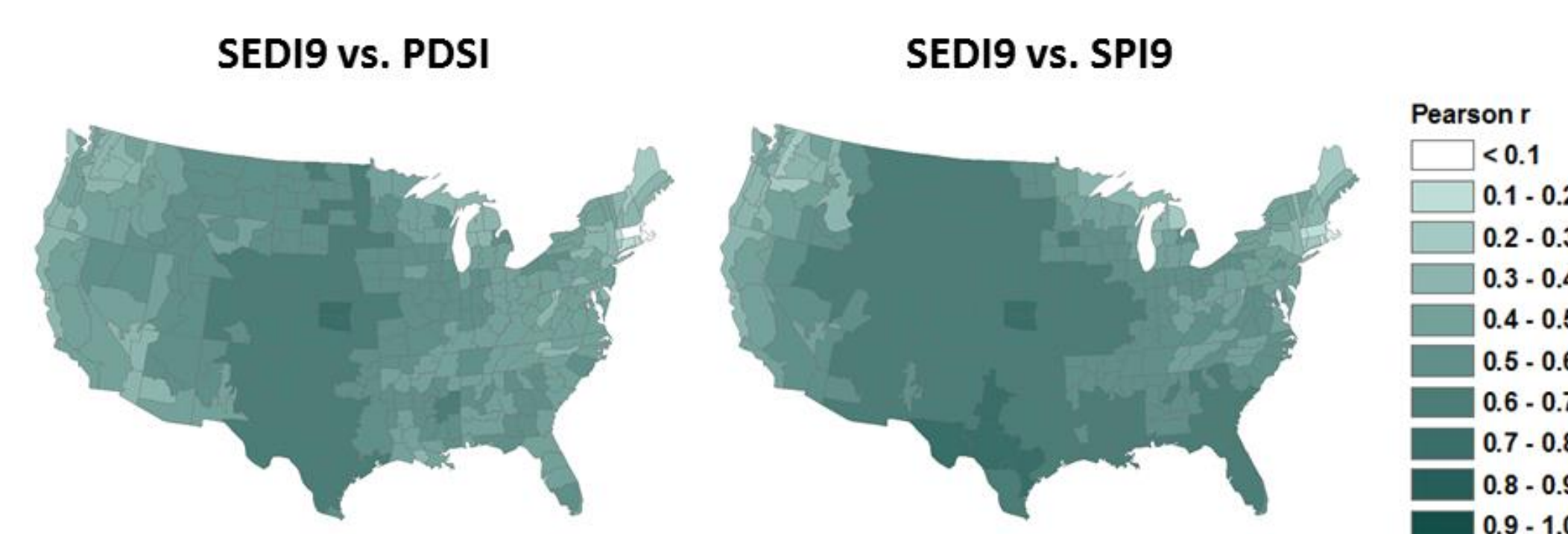


Fig.2 Comparison between SEDI and conventional indices

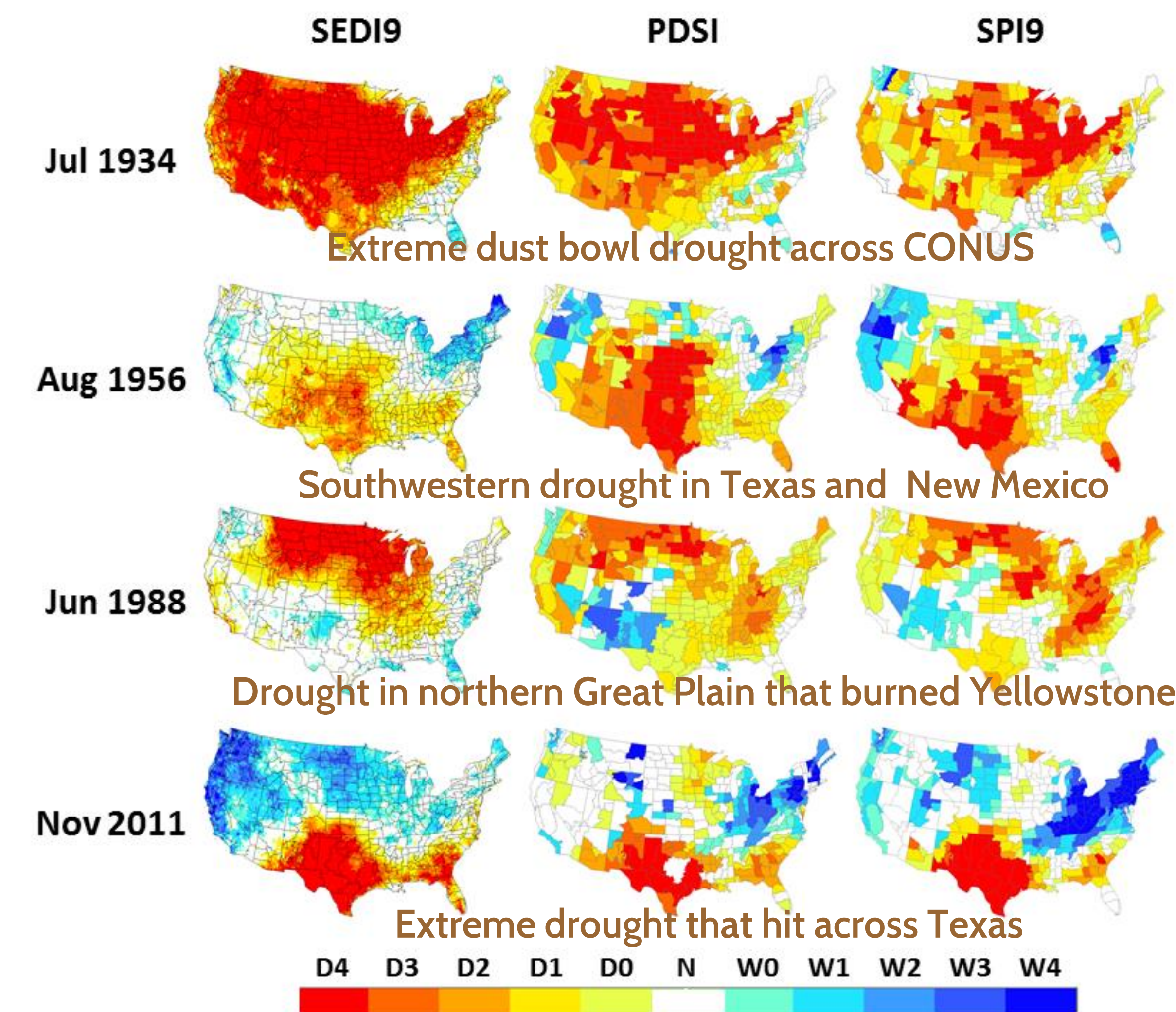


Fig.3 Drought indication of SEDI9 for major droughts

Major drought events in CONUS identified by 9-month SEDI (SEDI9) were consistent with 9-month SPI (SPI9) and PDSI.

Temporal correlations between SEDI and two conventional indices shows high validity of SEDI in arid or semi-arid regions

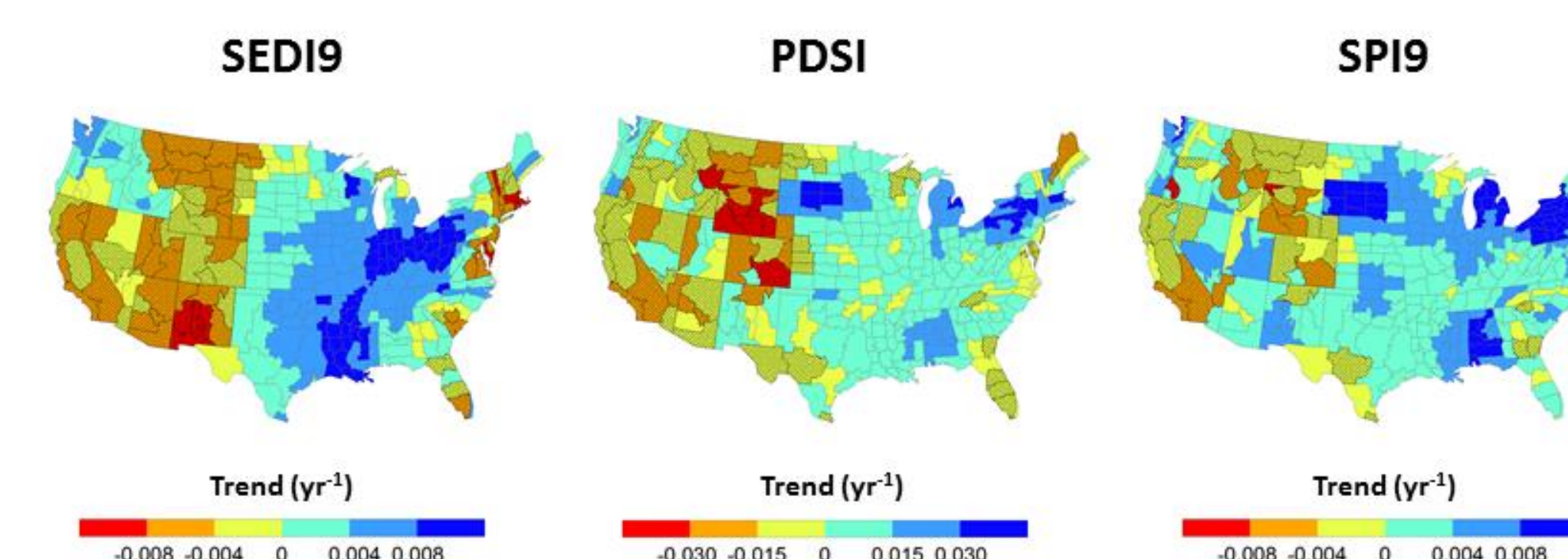


Fig.4 Non-parametric trends in SEDI9 and conventional indices over past 118 years

SEDI9, SPI9, and PDSI consistently suggest increasing drought risks in the western U.S. over past 118 years.

CONCLUSIONS

- From newly proposed SEDI, findings are
- ET deficit estimated by a CR method can indicate drought conditions in consistency with precipitation deficiency in arid and semi-arid regions in U.S.
 - Non-parametric trends in SEDI can be another observational evidence of increasing drought risk in the western U.S.

FEEDBACKS?

We want to widely use this novel index for practical purposes (e.g. drought prediction). Do you have any idea or comments?