Water Cycle Intensification Indicator (WCI)

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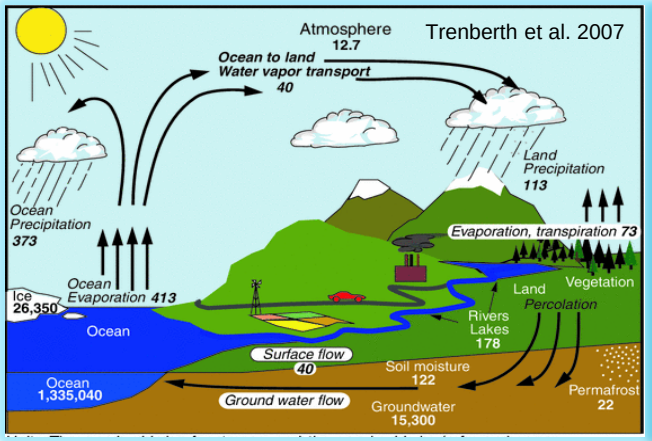
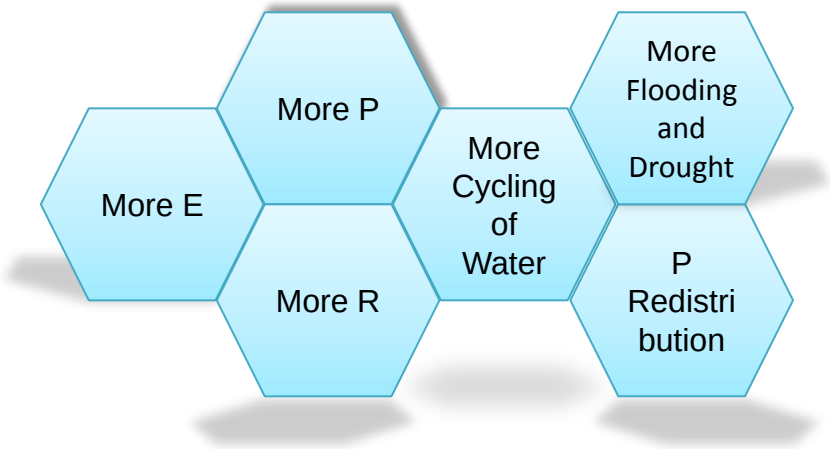
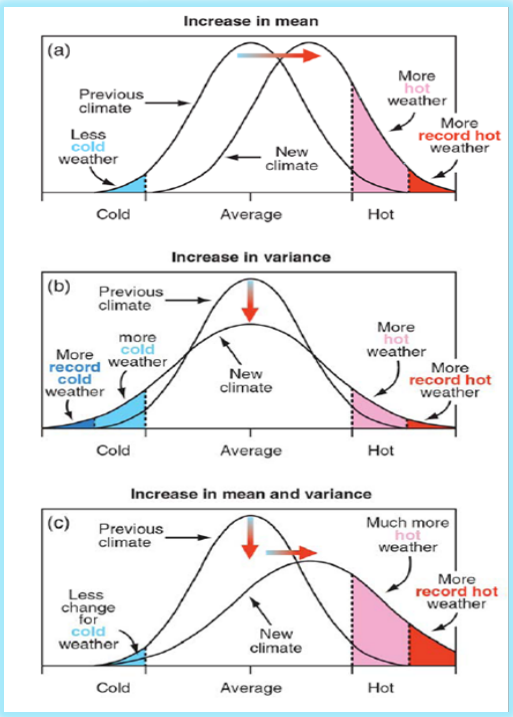


Water cycle is the process by which water is evaporated from ocean and land, transported by atmosphere, and condensed as clouds and precipitation, eventually falling to land and oceans.

Global warming intensifies the water cycle (Held and Soden 2006, Huntingtion et al. 2006, Wild et al. 2008, Gallant and Karoly 2010, Durak et al. 2012, Syed et al 2012)

Intensification of Water Cycle

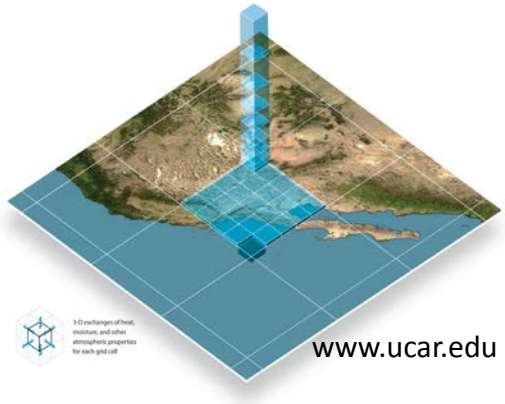




Folland et al. 2001

Project Objective

We will develop and test potentially spatially- and temporally-scalable Water Cycle Intensification Indicators (WCI) using NASA observations, reanalyses and model output in support of the National Climate Assessment (NCA).



Methodology

Terrestrial water balance equation is

$$\frac{\partial S}{\partial t} = P - E - R$$

S is Terrestrial storage, P is precipitation, E is evaporation, R is runoff.

Atmospheric water balance equation is

$$\frac{\partial W}{\partial t} = C + E - P$$

W is atmospheric water content, C is moisture convergence flux.

Data

Primarily NASA-based observations, Reanalysis and model products:

- GPCP
- NVAP-M
- GRACE
- MERRA
- MEaSURES
- NCA-LDAS
- GISS E2

Proposed Water Cycle Intensification Indicator (WCI) suite

Trend (mean)	Dry Extreme (daily lower 10th percentile	Wet Extreme (daily upper 10th percentile)
P trend	Dry P extreme	Wet P extreme
E trend	Dry E extreme	Wet E extreme
R trend	Dry R extreme	Wet R extreme
C trend	Dry C extreme	Wet C extreme
S trend	Dry S extreme	Wet S extreme
W trend	Dry W extreme	Wet W extreme
Composite trend	Composite dry extreme	Composite wet extreme
	Composite area dry extreme (not gridded)	Composite area wet extreme (not gridded)
Composite intensification (includes all primary trend and extreme indicators)		

WCI Application and Outreach