

# Identifying the anthropogenic footprints Using observation and climate models

Jin-Ho Yoon<sup>1</sup>, S.-Y. (Simon) Wang<sup>2</sup>, Philip J. Rasch<sup>1</sup>

<sup>1</sup>PNNL, <sup>2</sup>USU



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## Motivation & Objectives

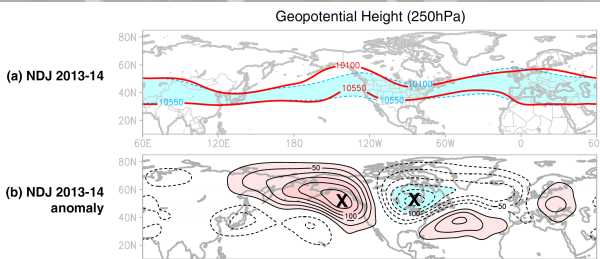
- Detection/Attribution study has been hampered by a couple of reasons:
  1. Large natural variabilities in the Earth climate system.
  2. Inadequate representation of these natural variabilities in the coupled climate models.
- A series of studies using modern reanalysis and advanced climate models indicate more clear indication of the anthropogenic footprints.
- **2013 – 14 California drought** as an example

## Scientific questions & Tools

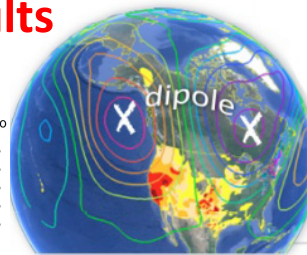
- In 2014 & 14, California has experiences the worst drought in its history. There is no known link to natural climate variabilities.
- Also, the wavy circulation patterns is blamed for this drought and also frigid cold winter over the East Coast of the U.S.
- Using modern reanalysis and a fully coupled climate model, the Community Earth System Model (CESM), to identify its cause.

## Looking into the future...

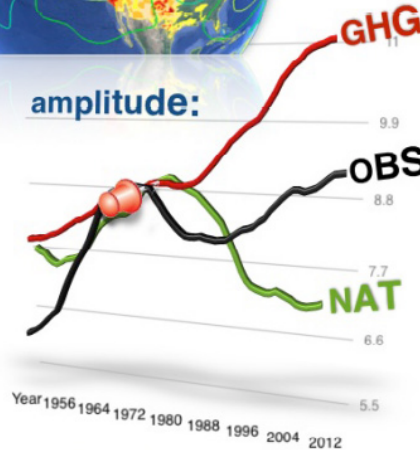
Because GHGs will increase in the coming years, **we expect this dipole activity will also be strengthening.**



## Results



amplitude:



More comprehensive analysis and sensitivity experiments will come soon.

Wang S-Y S, L Higgs, RR Gilles, and J Yoon. 2014. "Probable causes of the Abnormal Ridge Accompanying the 2013-14 California Drought: ENSO Precursor and Anthropogenic Warming Footprint." *Geophysical Research Letters*, accepted early online. DOI: 10.1002/2014GL059748

- Based on observational dataset, this particular drought is likely caused by **the dipole pattern** across the U.S., which blocks the pathways of moisture from the Pacific Ocean into California.
- Interestingly, this is not linked to El Niño or La Niña itself, but **the ENSO's precursor over the Western North Pacific**.
- Historical single forcing experiments of the CESM suggests this dipole activity has been increasing due to **the greenhouse gases (GHGs)**.



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[www.pnnl.gov](http://www.pnnl.gov)