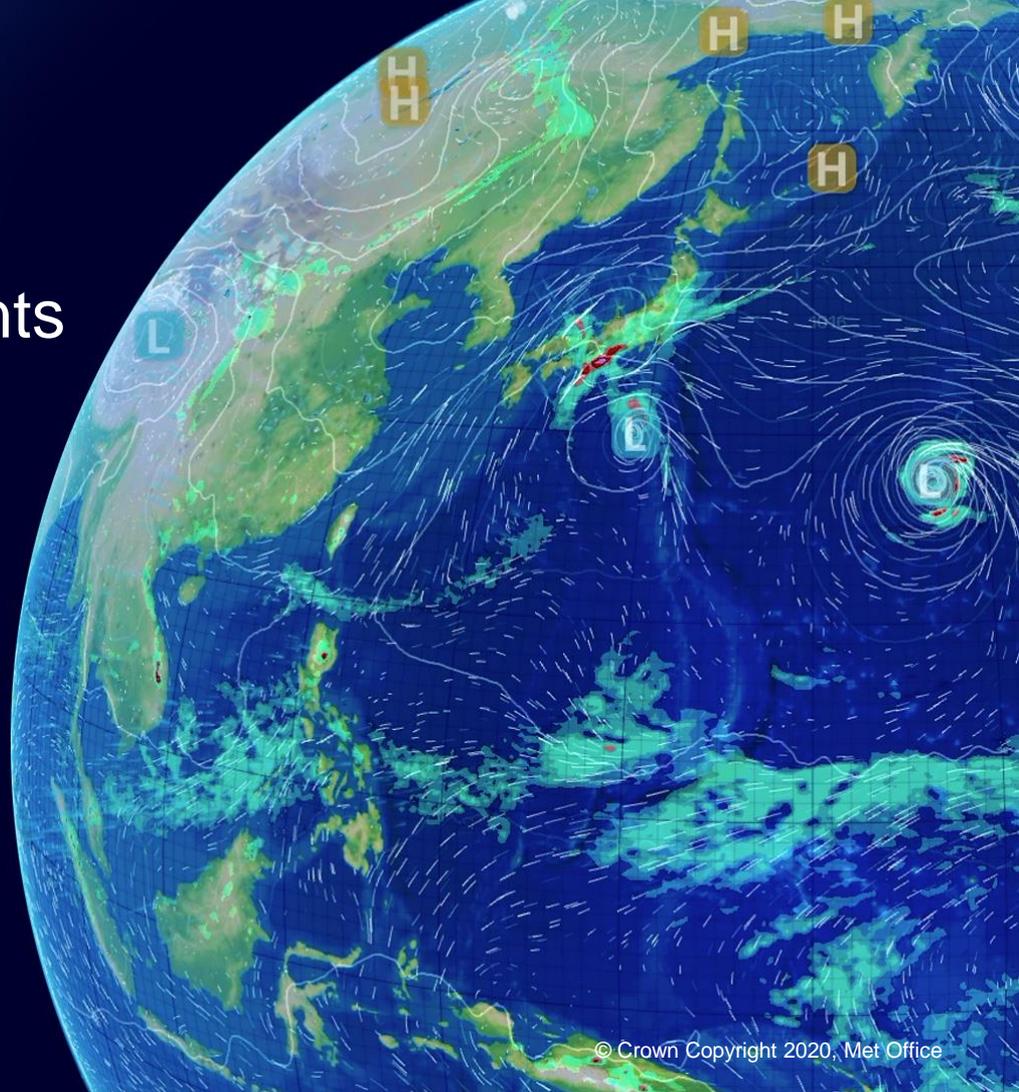


# UNSEEN: using hindcasts to estimate unprecedented events

Leon Hermanson



Two studies using the same methodology, but different applications:

LETTER • OPEN ACCESS

## Current chance of unprecedented monsoon rainfall over India using dynamical ensemble simulations

Shipra Jain<sup>1,2</sup> , Adam A Scaife<sup>3,4</sup>, Nick Dunstone<sup>3</sup>, Doug Smith<sup>3</sup>  and Saroj K Mishra<sup>1</sup>

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[Environmental Research Letters, Volume 15, Number 9](#)

Citation Shipra Jain *et al* 2020 *Environ. Res. Lett.* 15 094095

LETTER • OPEN ACCESS

## What chance of a sudden stratospheric warming in the southern hemisphere?

L Wang<sup>1,2,3</sup> , S C Hardiman<sup>4</sup> , P E Bett<sup>4</sup> , R E Comer<sup>4</sup>, C Kent<sup>4</sup> and A A Scaife<sup>4,5</sup>

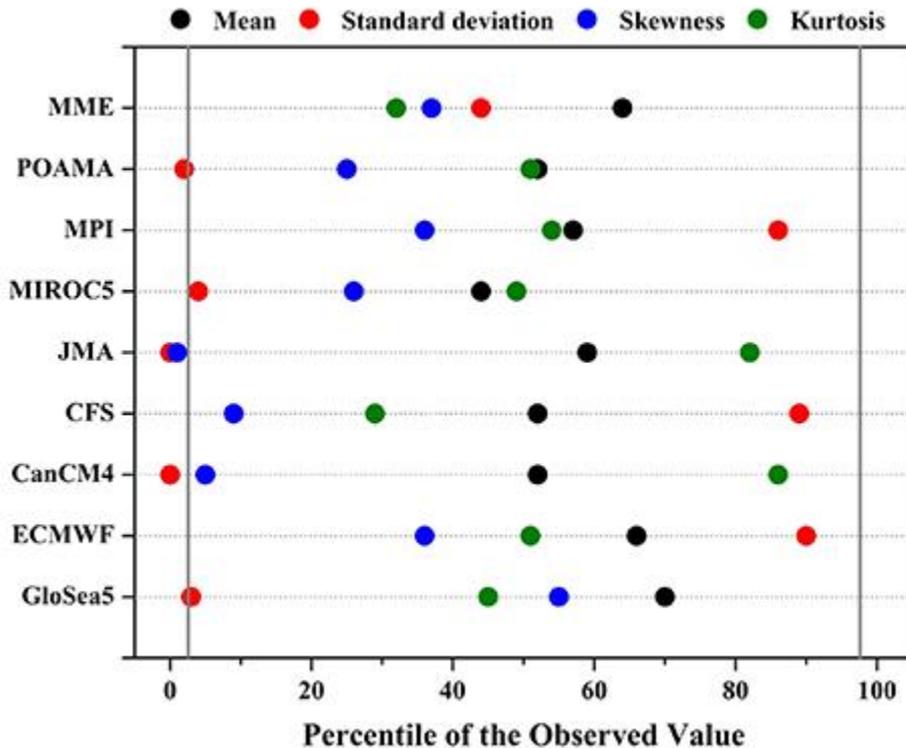
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[Environmental Research Letters, Volume 15, Number 10](#)

Citation L Wang *et al* 2020 *Environ. Res. Lett.* 15 104038

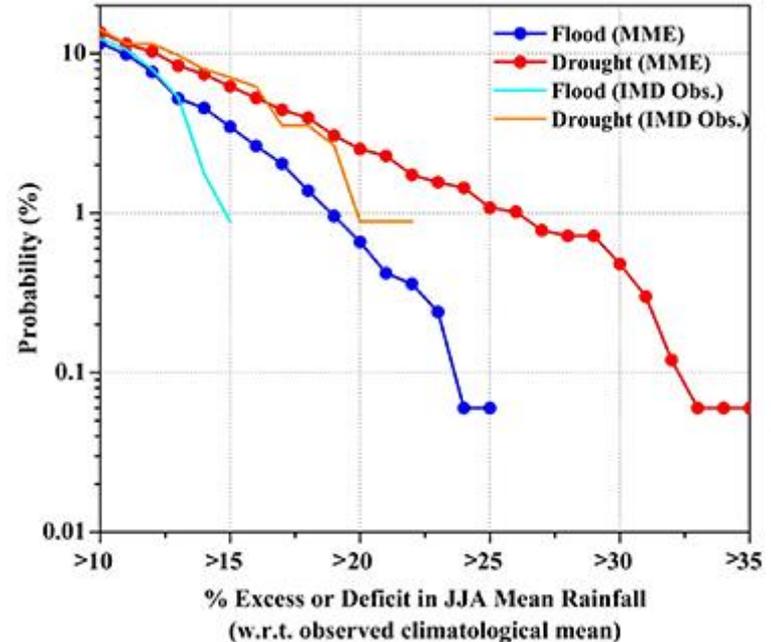
# Jain et al - Data and methods

- 113 years of observed rainfall (1901—2013)
- Uses hindcast data from Climate-system Historical Forecast Project (CHFP)
- 8 seasonal forecast models, hindcasts initialised around 1 May
- Five models pass the model fidelity test and are used in the study
- A total of 1669 years of simulated rainfall



# Jain et al – Chances of extreme rainfall

- Multi-model ensemble can be used to estimate the probability of rarer events than observations alone
- Observations appear to underestimate the chance of rainfall extreme
- The record flood year was 1988 with JJA rainfall exceeding ~16%, the chance of exceeding this is 2.6%
- The record drought year was 1972 with JJA rainfall showing ~23% rainfall deficit, the chance of larger deficit is 1.6%
- There is an estimated chance that a 30% rainfall deficit could occur around once in two centuries, which is far beyond the current record

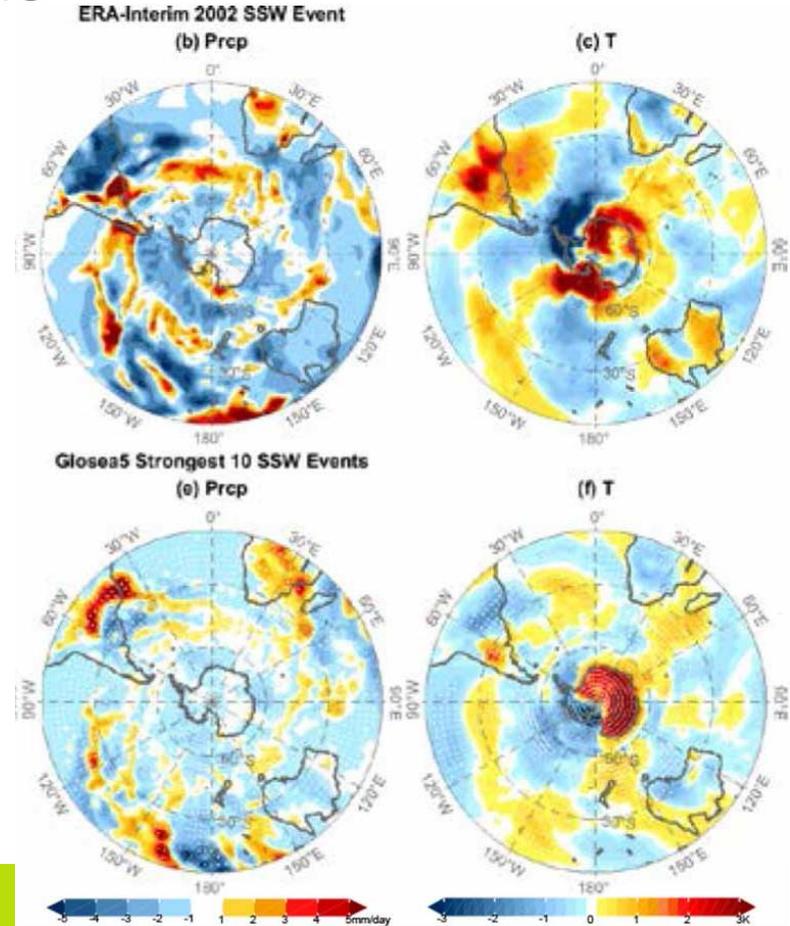


## Wang et al – Data and methods

- There has only been one observed Southern Hemisphere stratospheric sudden warming in 40 years (September 2002)
- GloSea5: 23 years of hindcasts x 112 members per year = 2576
- Model fidelity estimated from 10 hPa 60°S zonal mean zonal wind
  - Standard deviation, skewness, and kurtosis fall within observations
  - Mean winds are too strong so are bias corrected – this bias may underestimate the chances of a SH SSW
- There are 96 SH SSW events in this data set
- The chance of a SH SSW is 1 in 25 years or 4%

# Wang et al – Impacts

- Precipitation is anomalously high over 35–50°S and anomalously low poleward and equatorward of this band
- Australia, Brazil, and South Africa are drier than normal, whereas n
- Northern Argentina, southern central Africa are wet
- The Antarctic continent and southern South America experience a warmer than average spring



# The UNSEEN method

- There are now many papers based on the UNSEEN method
- Makes good use of the thousands of hindcasts that have been run
- Can be used for much more than estimating probabilities
  - Composites show impacts and drivers
  - Mechanisms can be studied to increase confidence in forecasts