Wednesday, 2nd December 2015

Attributing changes in natural hazards to climate and non-climate causes

Seth Westra, Anthony S. Kiem, Christopher J. White

THE UNIVERSITY of ADELAIDE

Background to this session

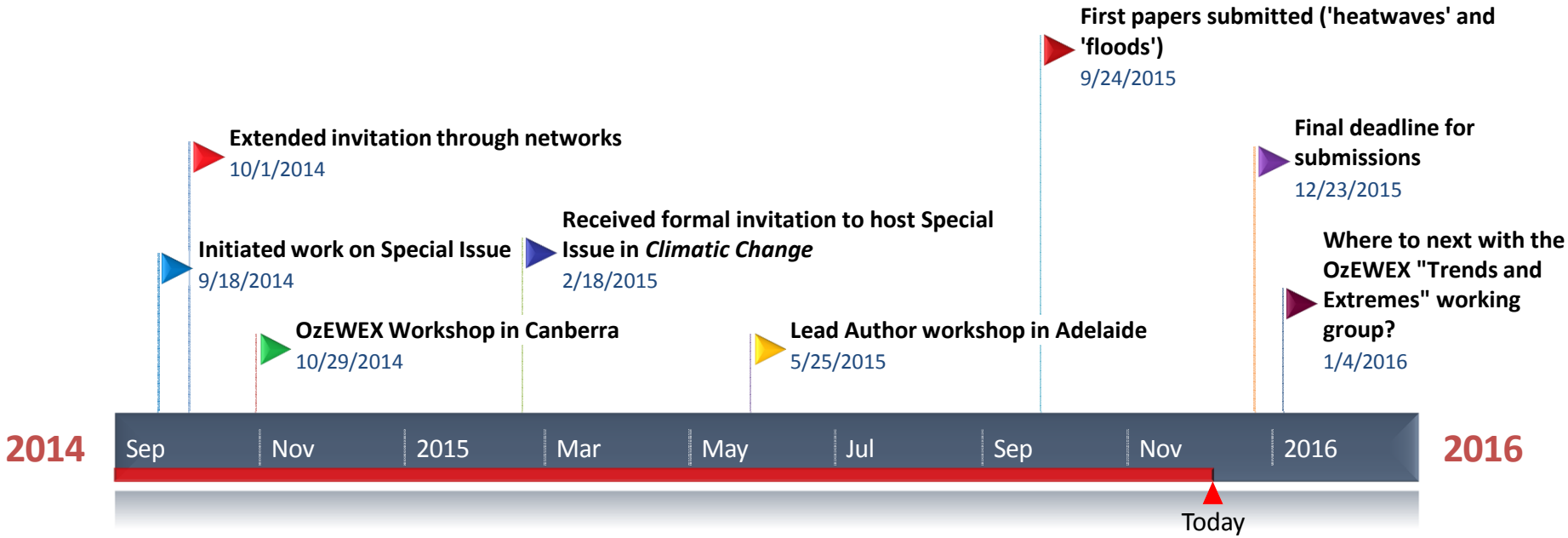
- Initiative of the OzEWEX "*Trends and Extremes*" working group
- Aim is to **describe, analyse and attribute observed variability and change in averages and extremes of water- and energy-related variables**
- Main initiative of 2015 is to complete a comprehensive review of changes both to **Australian climate-related natural hazards**, and to **the atmospheric variables that cause those hazards**
- A key objective of the review is to identify **research gaps**, and initiate a debate on **research priorities**

Overview of the Special Issue

- 52 unique authors across nine universities, the CSIRO and the Bureau of Met
- Authorship comprises climate scientists; hydrologists; oceanographers; palaeontologists; geographers; engineers; statisticians

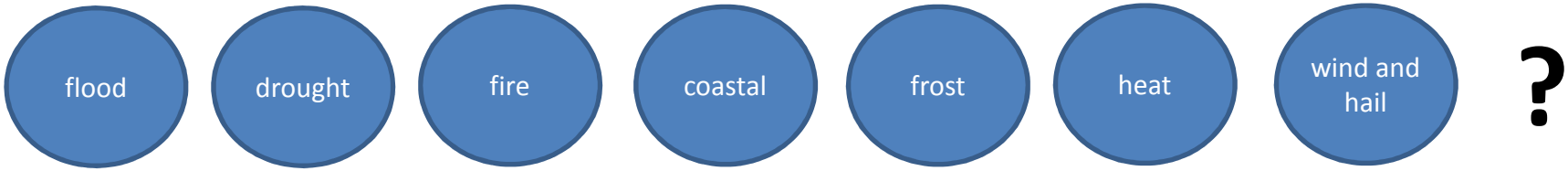
- Westra, S., White, C.J. & Kiem, A.S., "*Introduction: The effect of historical and future climate changes on natural hazards in Australia*"

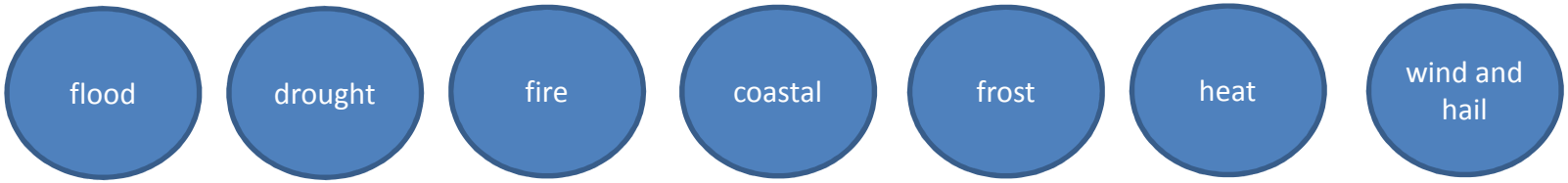
1. Johnson, F., White, C.J., van Dijk, A., Ekstrom, M., Evans, J.P., Jakob, D., Kiem, A.S., **Leonard, M.,** Rouillard, A. & Westra, S., "*Natural hazards in Australia: floods*"
2. Perkins, S.E., White, C.J., Alexander, L.V., Argueso, D., Boschat, G., Cowan, T., **Evans, J.P**., Ekstrom, M., Oliver, E.C.J., Phatak, A. & Purich, A., "*Natural Hazards in Australia: heatwaves*"
3. McInnes, K., White, C.J., Haigh, I.D., Hemer, M.A., Hoeke, R.K., Kiem, A.S., Oliver, E.C.J., Ranasinghe, R., Walsh, K.J.E., **Westra, S.** & Cox, R., "*Natural hazards in Australia: sea level and coastal extremes*"
4. Walsh, K., White, C.J., McInes, K., Holmes, J., Schuster, S., Richter, H., **Evans, J.P**., Di Luca, A. & Warren, R.A., "*Natural hazards in Australia: storms, wind and hail*"
5. **Kiem, A.S**., Johnson, F., Westra, S., van Dijk, A., Barr, C., Evans, J.P., Jakob, D., Mehrotra, R., O'Donnell, A., Rouillard, A., Sivakumar, B., Thyer, M., Tyler, J. & Woldemeskel, F., "*Natural hazards in Australia: droughts*"
6. **Sharples, J**., Mooney, S., Fletcher, M-S., Baker, P., Cary, G., Fox-Hughes, P., Evans, J., McRae, R., Fromm, M. & Grierson, P., "*Natural hazards in Australia: extreme bushfire*"
7. Crimp, S.J., Gobbet, D., Kokic, P., Nidumolu, U., Howden, M. & Nicholls, N., "*Recent seasonal, decadal and long-term changes in Southern Australian frost occurrence*"

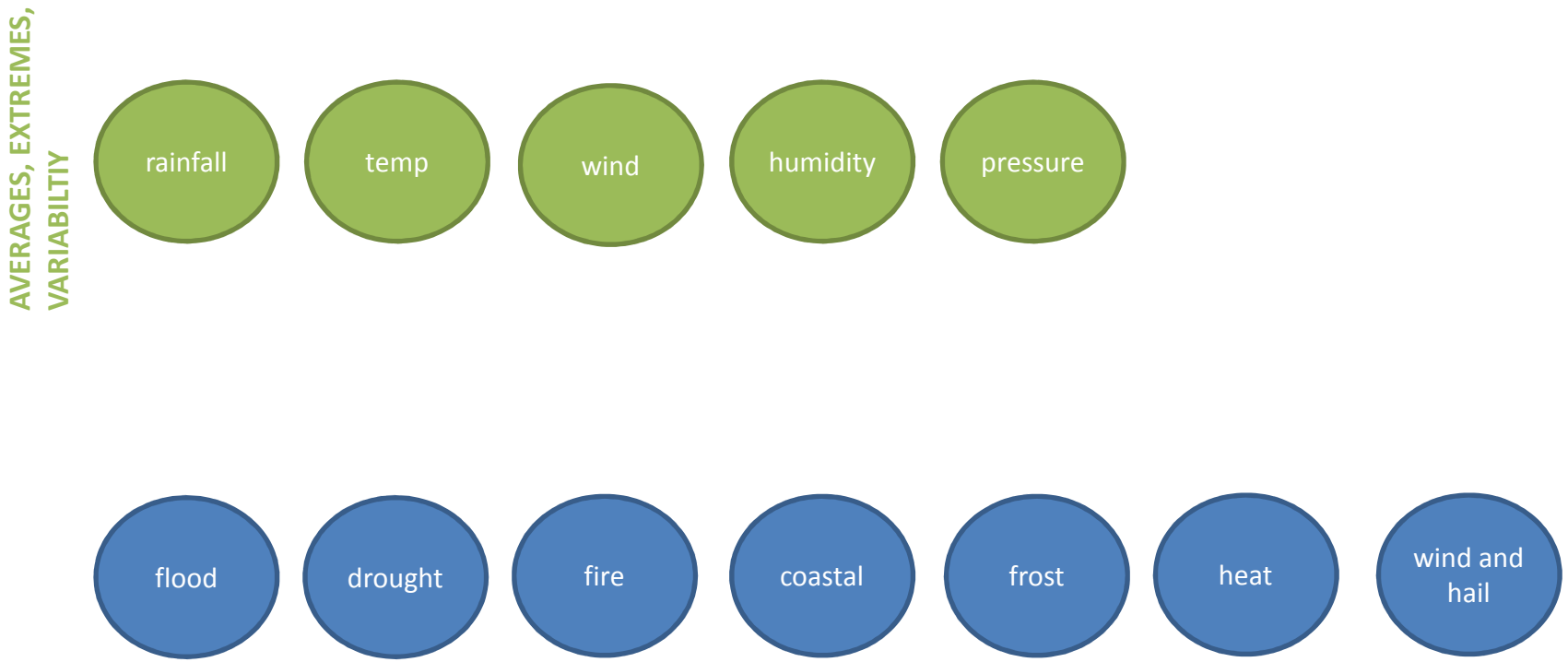

First papers submitted ('heatwaves' and 'floods')
9/24/2015
Extended invitation through networks
10/1/2014
Final deadline for submissions
12/23/2015
Received formal invitation to host Special Issue in *Climatic Change*
2/18/2015
Initiated work on Special Issue
9/18/2014
Where to next with the OzEWEX "Trends and Extremes" working group?
1/4/2016
OzEWEX Workshop in Canberra
10/29/2014
Lead Author workshop in Adelaide
5/25/2015
2014
Sep
Nov
2015
Mar
May
Jul
Sep
Nov
2016
2016
Today

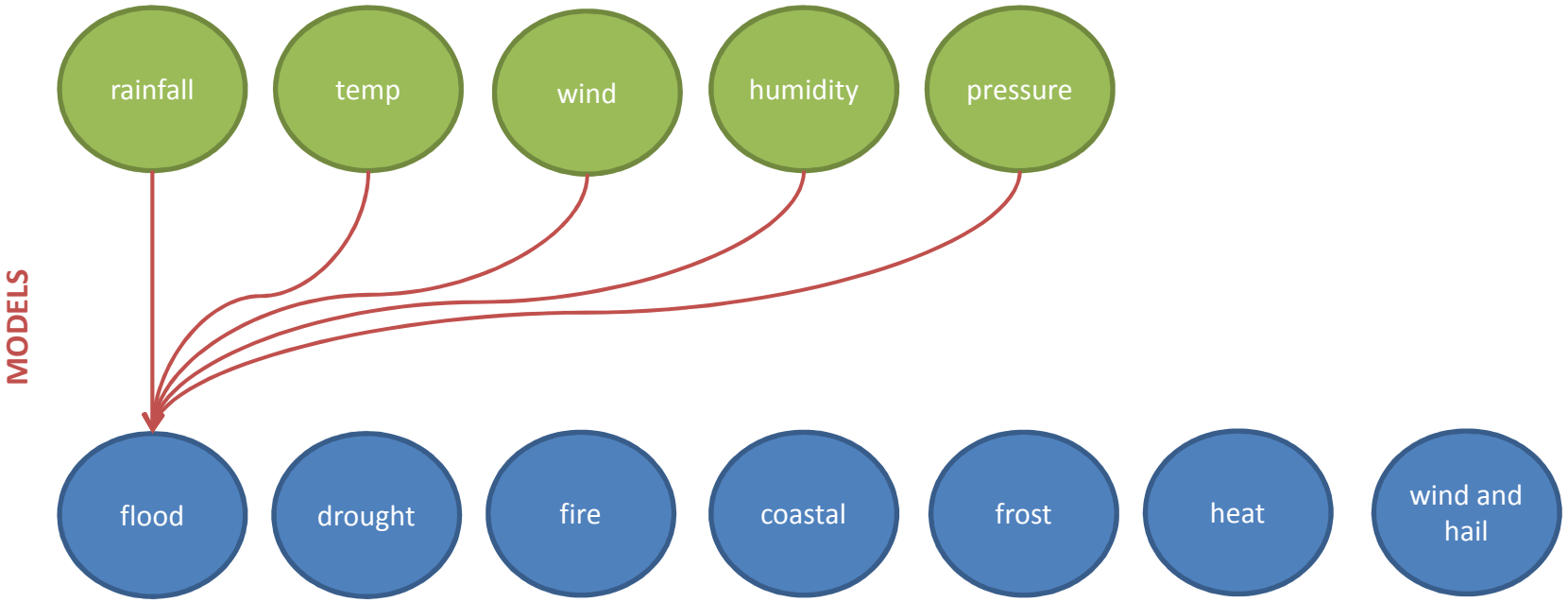
OCCURRENCE, FREQUENCY, SEVERITY

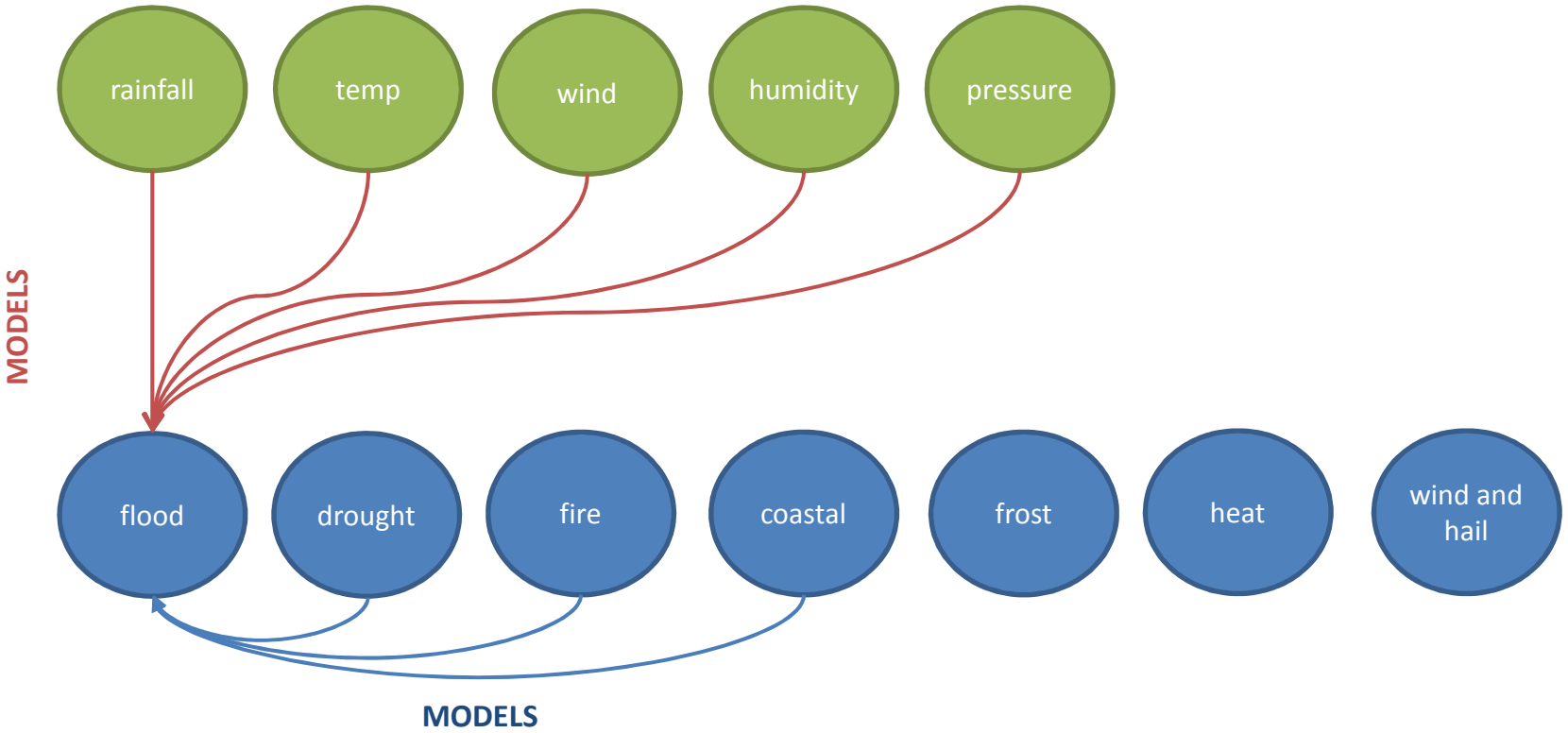
Problem: Understanding of climatic changes to natural hazards constrained by data, and 'contaminating' influences.

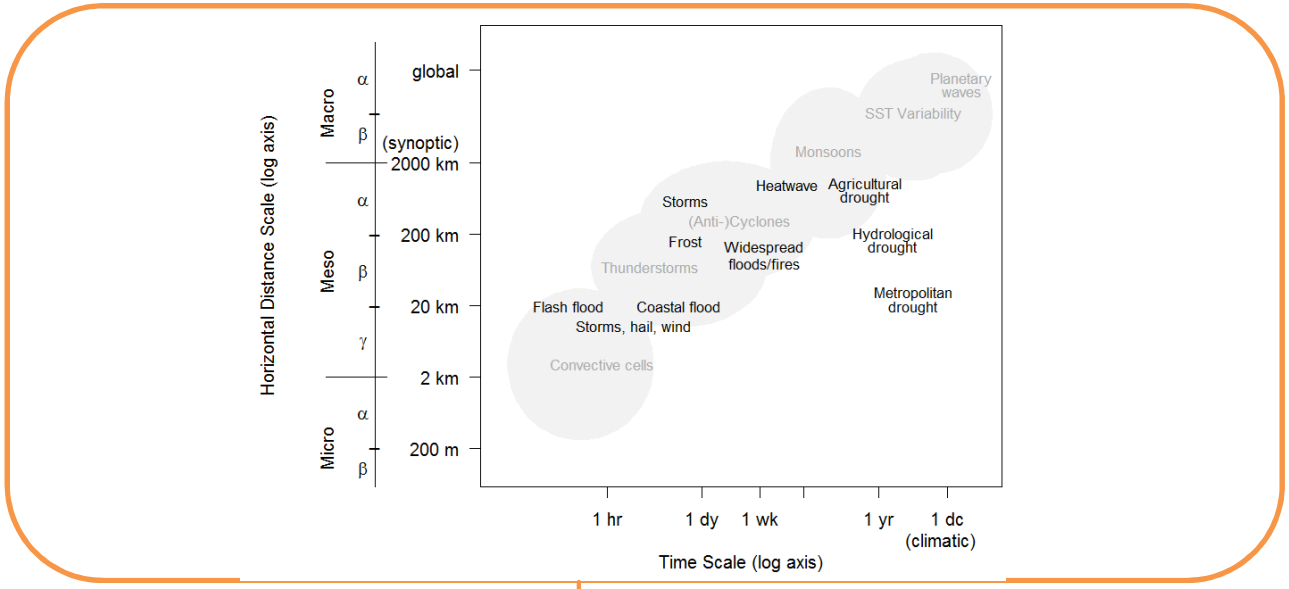


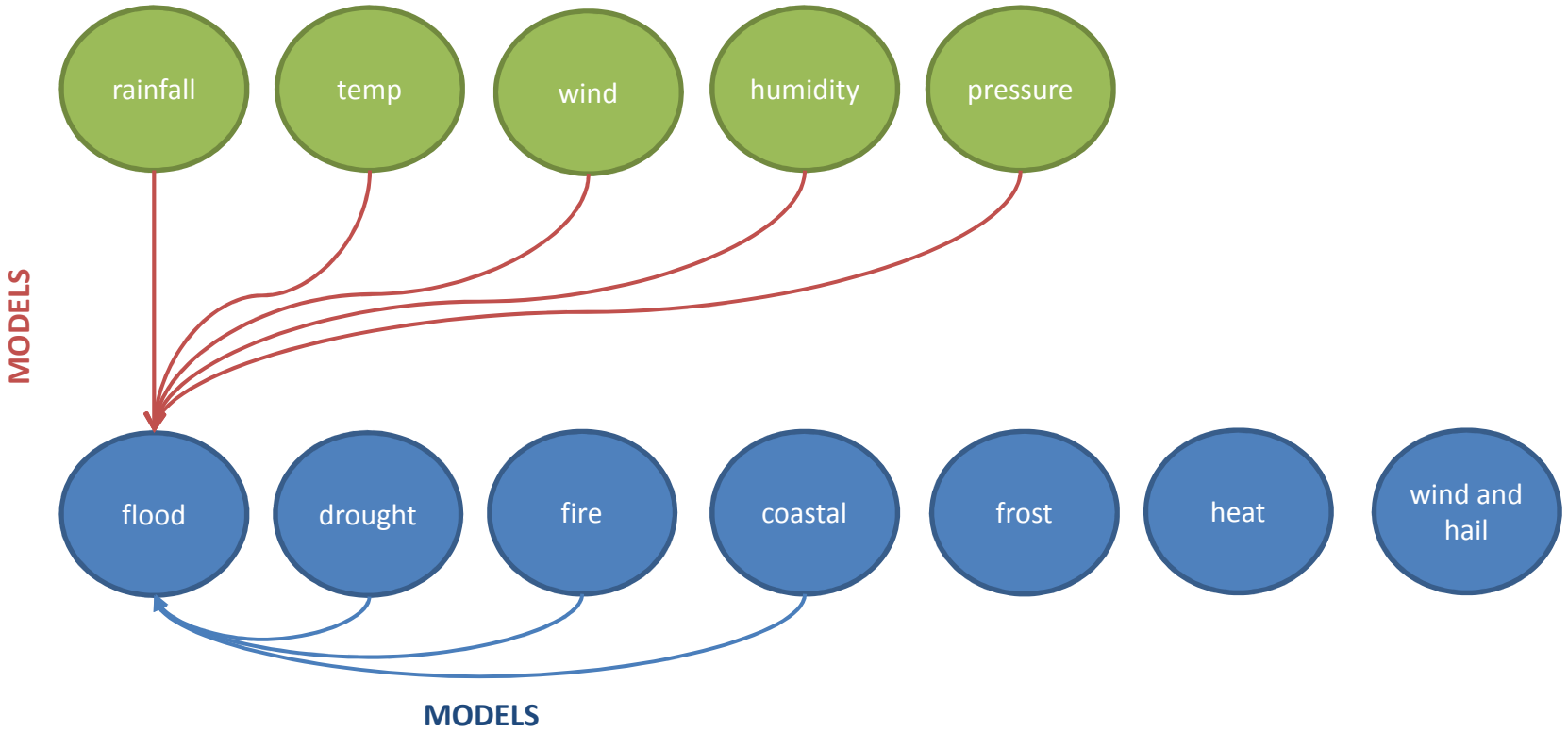

flood
drought
fire
coastal
frost
heat
wind and hail


AVERAGES, EXTREMES, VARIABILTIY
rainfall
temp
wind
humidity
pressure
flood
drought
fire
coastal
frost
heat
wind and hail


MODELS
rainfall
temp
wind
humidity
pressure
flood
drought
fire
coastal
frost
heat
wind and hail


rainfall
temp
wind
humidity
pressure
MODELS
flood
drought
fire
coastal
frost
heat
wind and hail
MODELS


Horizontal Distance Scale (log axis)
Macro
Meso
Micro
α
β
γ
global
(synoptic)
2000 km
200 km
20 km
2 km
200 m
Planetary waves
SST Variability
Monsoons
Heatwave
Agricultural drought
Storms
(Anti-)Cyclones
Frost
Widespread floods/fires
Hydrological drought
Thunderstorms
Metropolitan drought
Flash flood
Coastal flood
Storms, hail, wind
Convective cells
1 hr
1 dy
1 wk
1 yr
1 dc (climatic)
Time Scale (log axis)


rainfall
temp
wind
humidity
pressure
MODELS
flood
drought
fire
coastal
frost
heat
wind and hail
MODELS

		Hazard paper						
		Flood	**Drought**	**Storm, wind and hail**	**Sea level and coastal extremes**	**Fire**	**Heatwaves**	**Frost**
Atmospheric or oceanic variable	**Land temperature**		As it influences evapotranspiration				Summer temperature extremes	Mean and extreme minimum temperatures (i.e. 10th, 50th and 90th percentiles). Focus is on August to November
	Ocean temperature			As related to major climate drivers	Thermosteric sea level rise		Marine temperature extremes	As related to major climate drivers
	Precipitation	Extreme rainfall	Dry Seasons	Tropical cyclones	Coincident events in estuarine regions only			
	Wind		As it influences evapotranspiration	Tropical cyclones, thunderstorms, east coast lows, mid-latitude cyclones	Wind and swell waves (wave setup); storm surges (wind setup) meteo-tsunamis			
	Humidity		As it influences evapotranspiration	High relative humidity at low levels influences thunderstorms				

Format for this session

- Yesterday afternoon detailed presentations for the hazards
- Today individual hazard presentations focus on research needs:
  1. Anthony Kiem – **Droughts**
  2. Jason Evans – **Heatwaves**
  3. Jason Sharples – **Fire**
  4. Jason Evans – **Storms, wind and hail**
  5. Michael Leonard – **Floods**
  6. Seth Westra – **Coastal Extremes**
- Discussion: "*Should we have a unified national framework for attribution*?"
- What is OzEWEX's role in supporting attribution studies

Should we have a unified national framework for attribution?”

What is a “unified framework”?

- Agreed set of minimum requirements (e.g. model performance, statistical significance…) for an attribution study
- A single agreed “model of everything”
- A set of coordinated experiments?
- …?

OzEWEX's role in supporting attribution

"What should OzEWEX do to support detection and attribution work?"

- ???

Thank you for participating!

If you would like to know more about the “Trends and Extremes” working group, or get involved, please email me at **seth.westra@adelaide.edu.au**