

Monday, 16th July 2012

Compound extremes

Quantifying interactions between
catchment flooding and storm tides in the
coastal zone



What do we mean by an extreme event?



PM edition



'...the hit to our economy will be much larger than 1974 and much larger than other natural disasters in our memory' - Wayne Swan

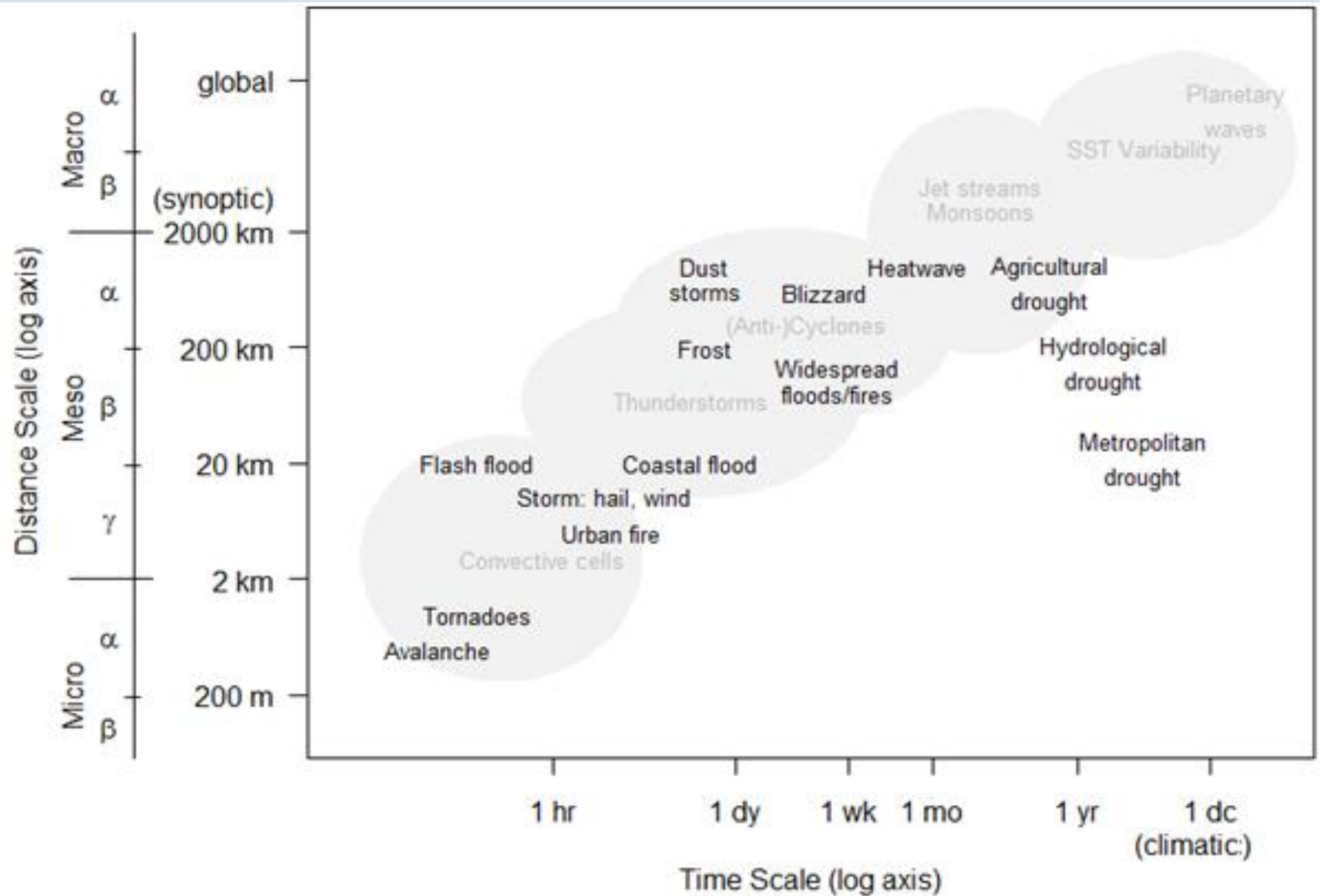
WE'LL ALL PAY



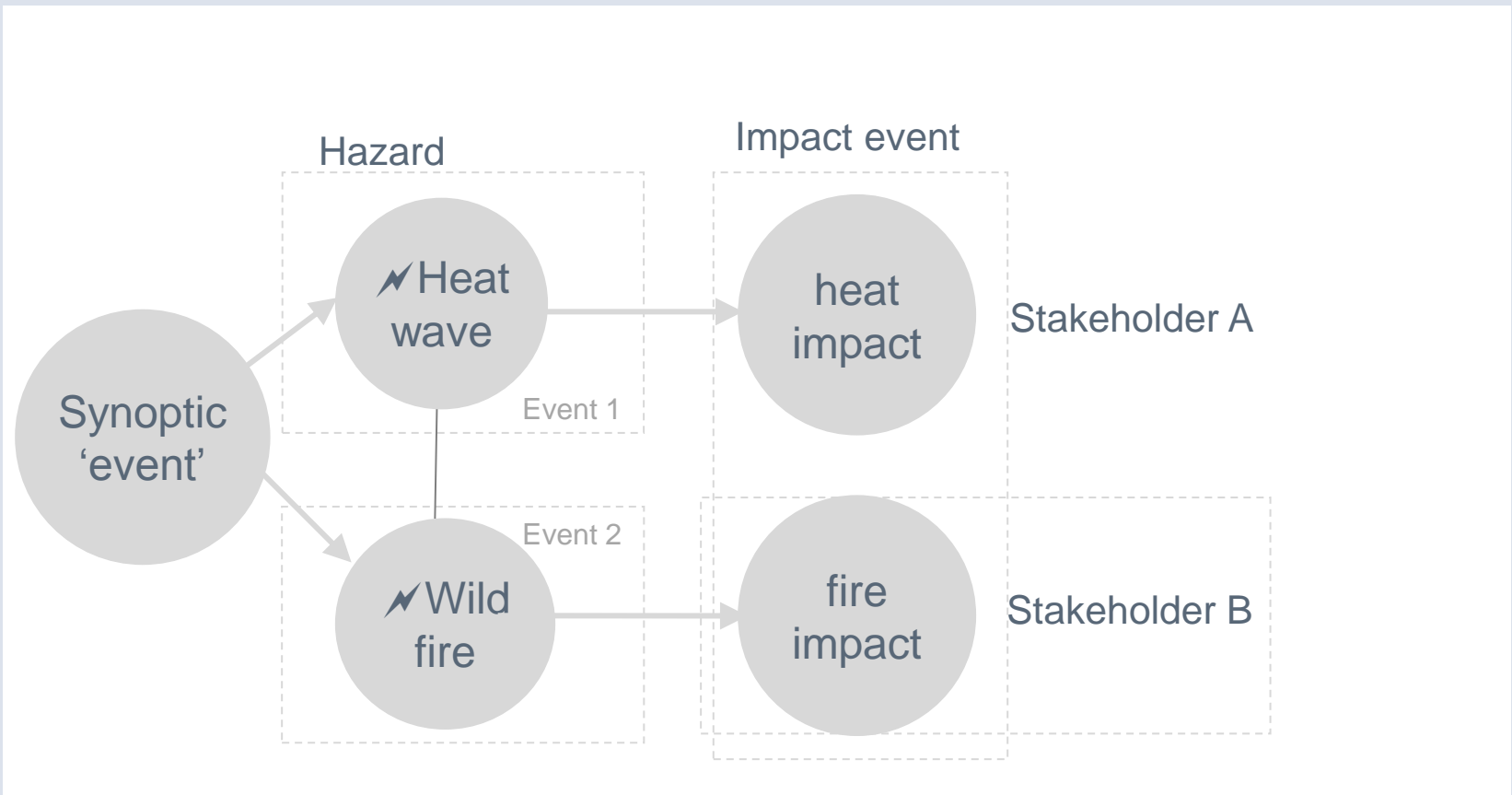
Quantifying the *risk* of extreme events

- Large diversity in extremes, in terms of *climate processes, land surface responses* and *human impacts*
- (Almost) all extremes can be regarded as 'compound' events:
 - Two or more extreme events occurring simultaneously or successively
 - Combination of extreme events with underlying conditions which will amplify the events
 - Combinations of events which are not themselves extreme but lead to an extreme event or impact when combined.
- Operate over a variety of (interacting) spatial and temporal scales
- The *perspective of the stakeholder* is key if we are to understand the *system boundaries* and define the 'event' whose risk is to be quantified

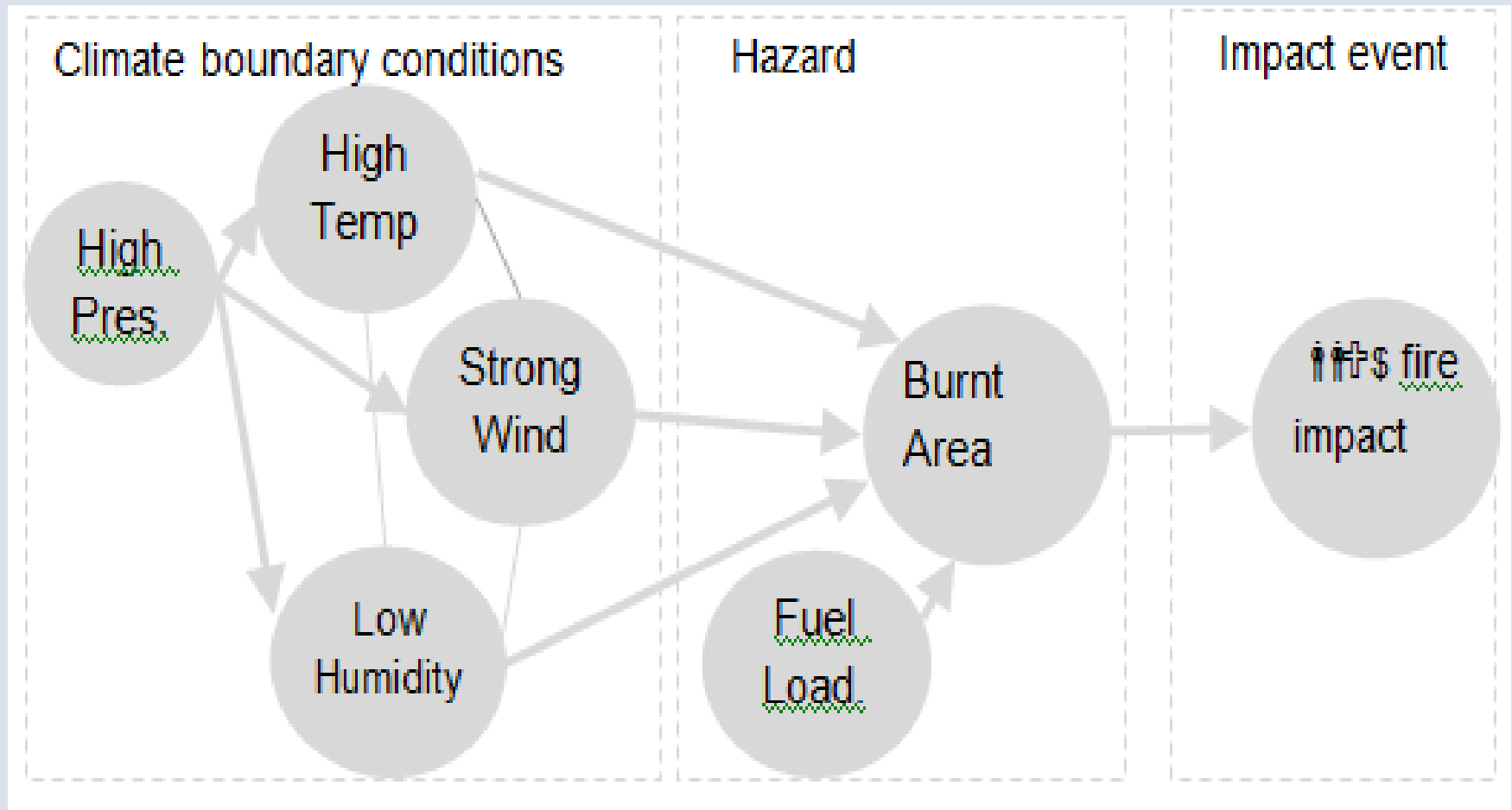
Quantifying the *risk* of extreme events



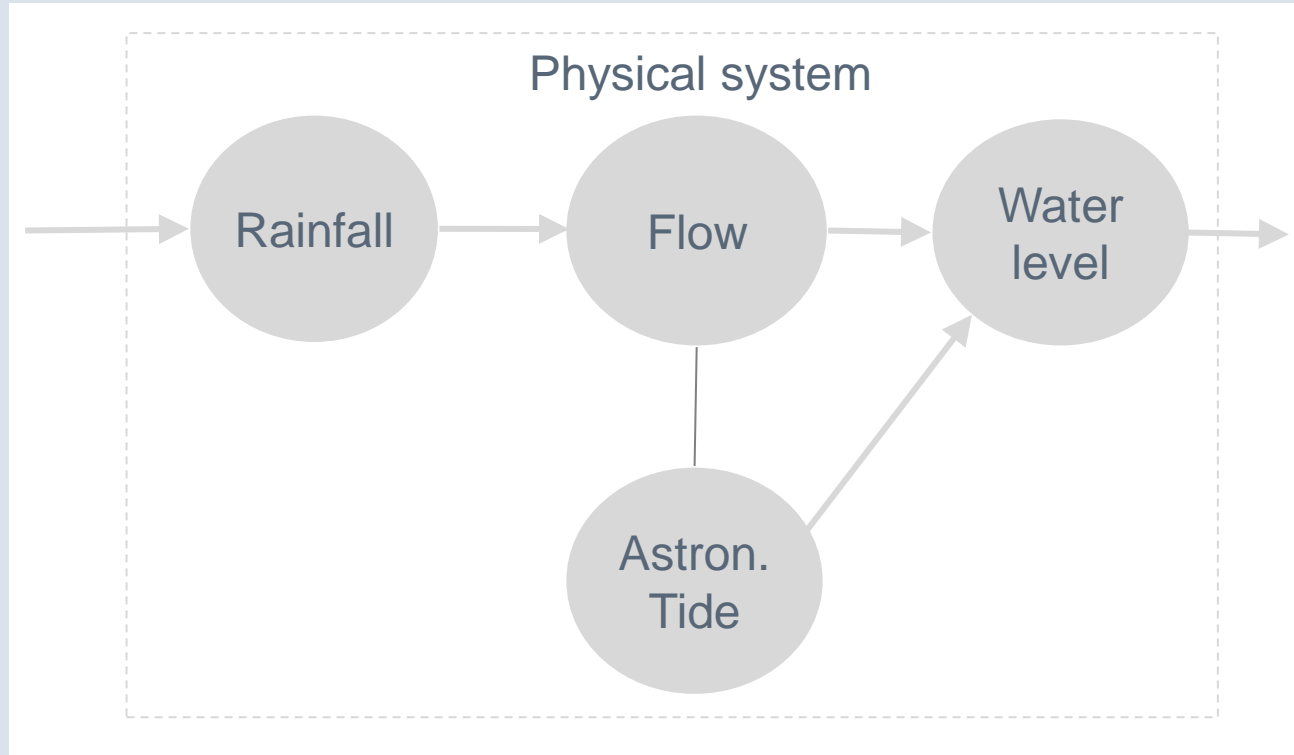
The role of the stakeholder defining the 'event'



Relationship between climate forcing and the impact



Human systems can induce interactions!



Why focus on the compound nature of extremes now?

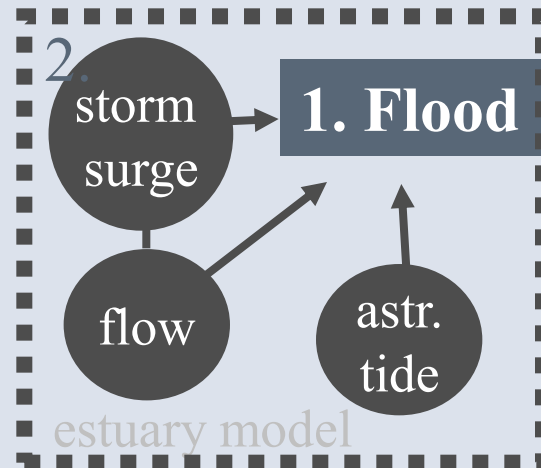
Non-stationarity!

The increasing complexity of quantifying risk

1. Flood

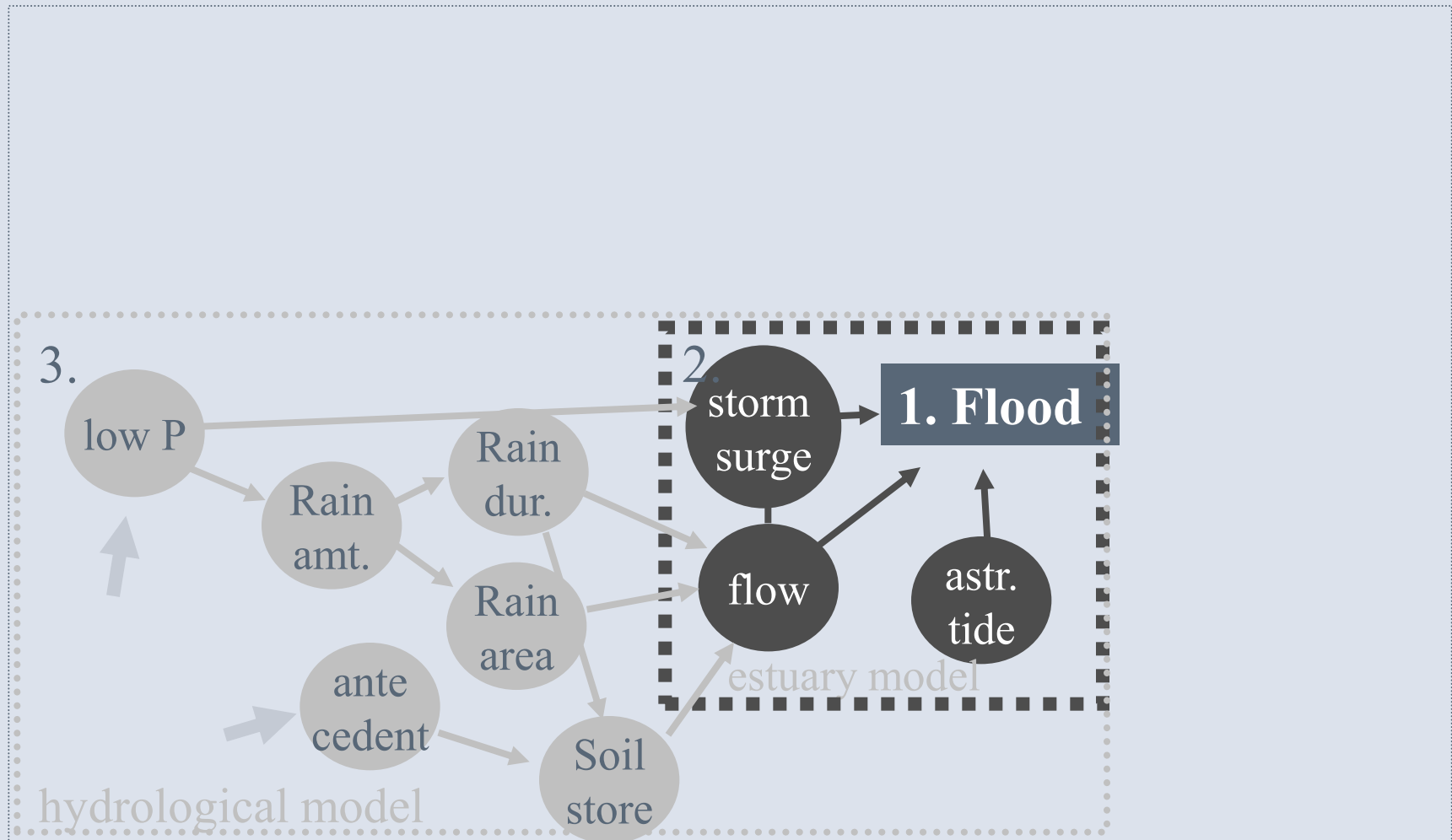
1. Inferring risk from historical observations

The increasing complexity of quantifying risk



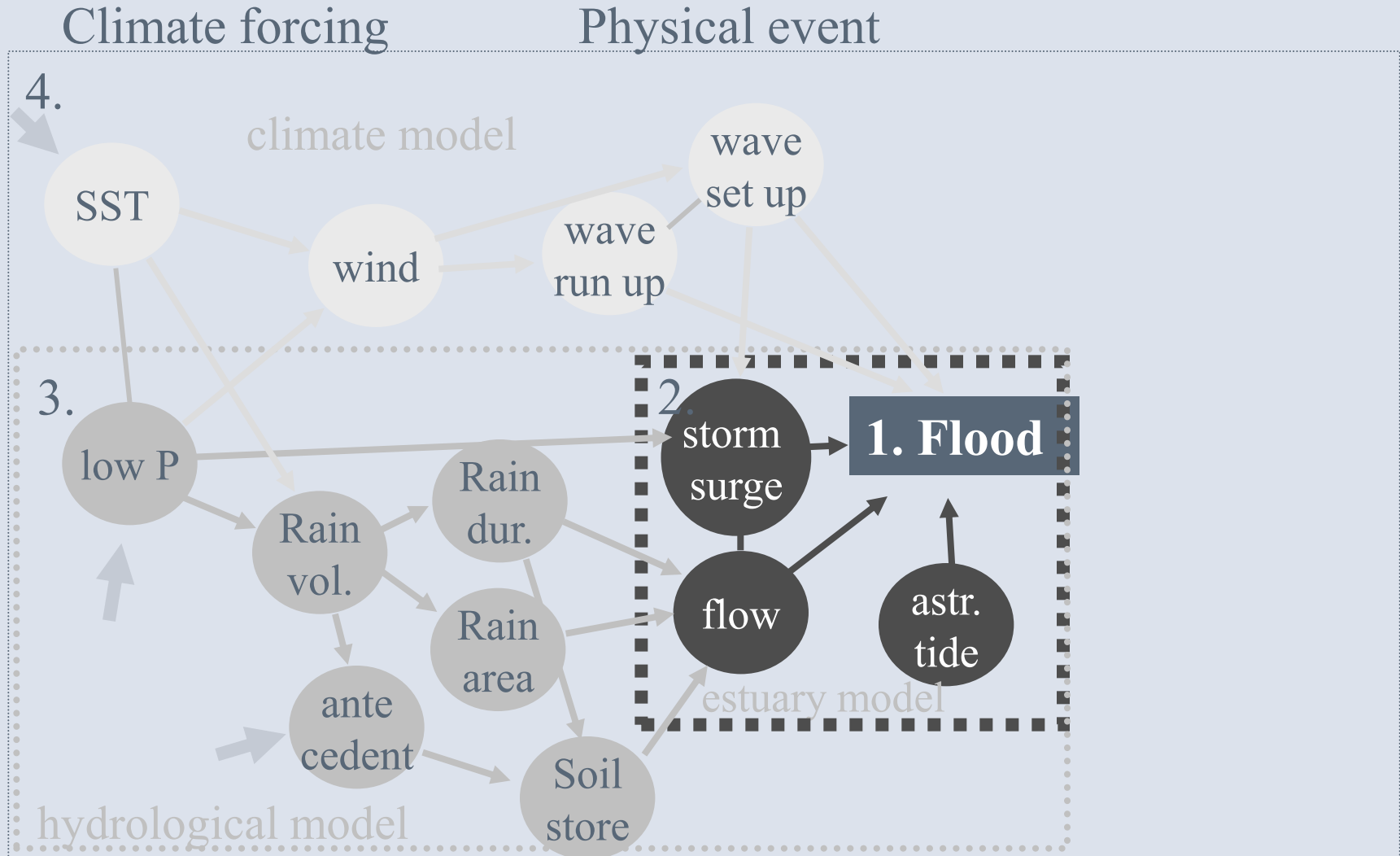
2. Accounting non-stationarity in the estuary by modelling the immediate boundary conditions

The increasing complexity of quantifying risk



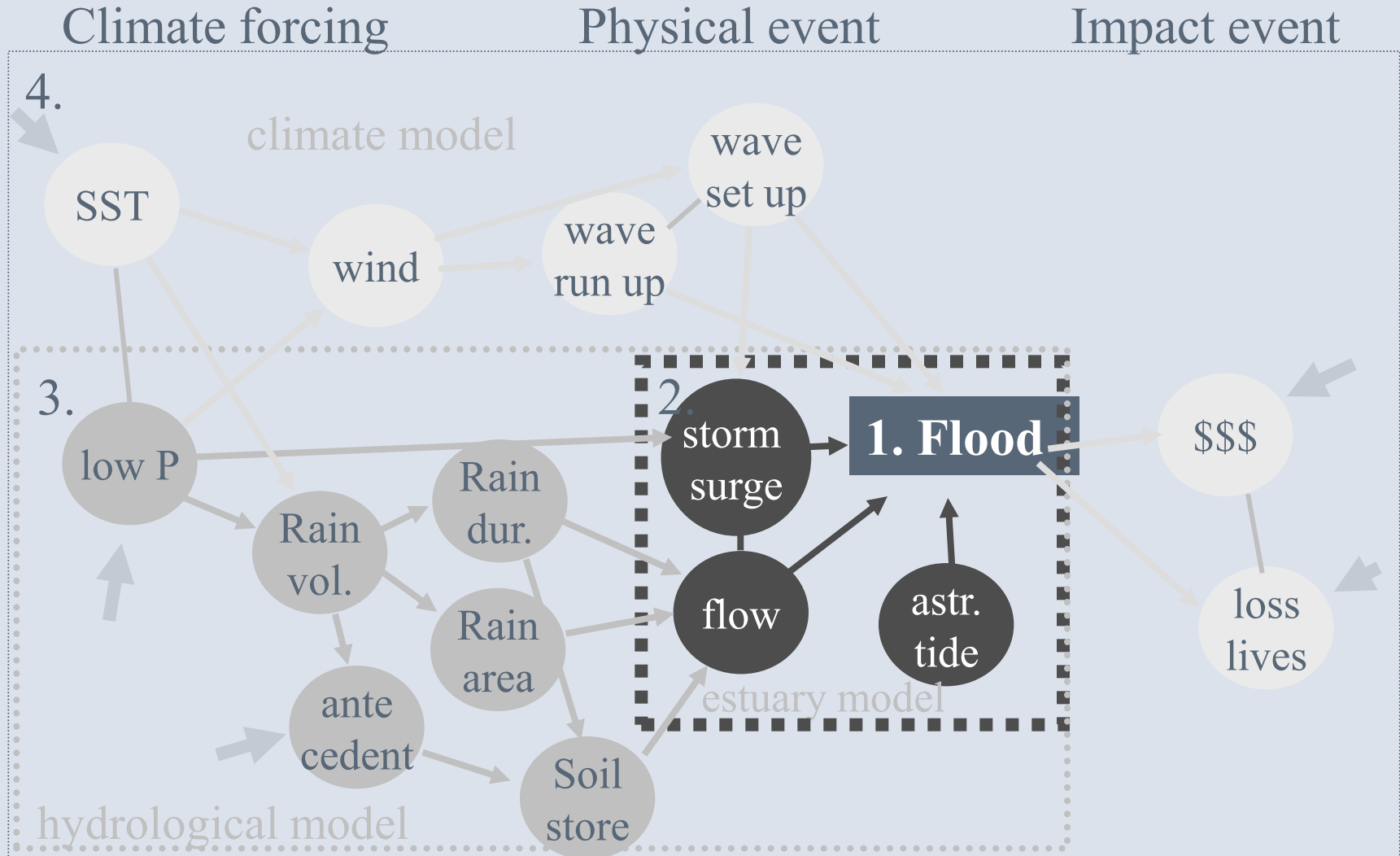
3. Accounting for non-stationarity in the rainfall-runoff transformation

The increasing complexity of quantifying risk



4. Accounting for non-stationarity in the climate forcing

The increasing complexity of quantifying risk



5. Accounting for other (non-climatic) factors

The challenge of addressing compound extremes

- Almost all extremes of importance to society are compound, consisting of multiple interacting processes occurring at various spatial and temporal scales
- Both *catchment change* and *climate change* are challenging many conventional methods for quantifying the risk of extremes
- Need to think about methodology to identify which *processes* and *interactions* are important for any given situation
 - and then ensure we can model those processes and interactions

Acknowledgements

- This project is supported by the CSIRO Adaptation Flagship Collaboration Fund.
- Thanks also to the following individuals for contributing to this work:
 - Michael Leonard, Alope Phatak, Martin Lambert, Bart van den Hurk, Kathleen McInness, James Risbey, Doerte Jakob