Key scientific advances since the AR5?

- Beginning to recognise the limits of performance based weighting
- The emergence of interdependence based weighting schemes and recognition of their importance
- The understanding that PPEs and MMEs are not transitive
- The use of perfect models to perform out of sample testing
- Applying data assimilation approaches to paleo time series has advanced and has applications related to understanding decadal variability
Shortcomings, gaps and opportunities?

- **Shortcomings**
  - Metrics are not transitive, optimising one generally doesn’t provide benefits for others, not possible to optimise all metrics
  - The importance of tuning choices in confounding weighting
  - The recognition mean state weighting has pitfalls (e.g. tuning, arbitrary model assumptions etc)
  - The danger of performance weighting based on the right answer for the wrong reason ensuring you understand the mechanism
  - Currently no concrete recommendations for how to move beyond model democracy

- **Gaps**
  - Identifying the role of structural vs internal variability across MMEs

- **Opportunities**
  - Moving beyond mean state weighting, incorporating temporal variability into weighting schemes
  - The combination of weighting schemes and emergent constraint approaches
  - Knowledge transfer between the weighting scheme community and the DandA community
  - Use long time series records both historical and paleo to understand internal variability
  - Recommended weighting schemes for specific purposes
Long-term perspective?

• Moving beyond model democracy is a likely imperative
• Identifying the role of structural vs internal variability across MMEs
• Moving beyond mean state weighting, incorporating temporal/spatial variability into weighting schemes
• The development of a statistical methodology/strategy to account for multiple chains of influence, orthogonal uncertainties
• Better documentation that tracks model interdependence
• What does it mean for models to be interdependent, moving beyond error covariance and model lineage
• Assessing model interdependence by examining simpler idealised problems, toy models, idealised experiments etc