



## Observed and simulated (CMIP5 and CMIP6) early- to latewinter evolution of North Atlantic atmospheric variability and links to the ocean

Tom Bracegirdle, EGU, May 2020



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- Winter (DJF) 20<sup>th</sup> century multidecadal variability weaker in CMIP5 historical runs compared to 20<sup>th</sup> Century Reanalysis (20CRv2c) (Bracegirdle et al., 2018, GRL).
- Similar results are evident from an initial subset of CMIP6 models (coloured asterisks). UK Met office models in green (HadGEM3-GC31-LL) and (UKESM1-0-LL).
- It appears that models exhibit a too weak atmospheric response/coupling to Atlantic SST variability (AMV) (e.g. Simpson et al., 2018)
- Key challenge difficult to evaluate statistical significance and mechanistic explanations on multidecadal timescales

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Observed inter-annual jet strength index (JSI) – SST correlations



Data sources: SST from HadSST1, JSI from 20CRv2c



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#### Comparing observed and simulated JSI vs SST correlations

- Correlations of JSI vs SPG SST inter-annual variability are generally weaker in the 16 UKESM1-0-LL historical simulations compared to 20CRv2c.
  - This is most apparent for SPG SST leading (lagging) JSI in Dec (Jan, Feb, Mar).
- Discrepancies are smaller for JSI vs sub-tropical SST (right-hand 4 plots below).
- The lag correlations suggest too weak SST persistence of JSI-driven SST in mid-late winter and too
  weak JLI link to autumn SST SPG SST anomalies.



# Broader context and current questions

- Can these results help to explain differences between observed and simulated multi-decadal variability?
  - The link to the SPG region may be key, since it exhibits stronger multi-decadal variability than sub-tropical Atlantic (e.g. Simpson et al., 2018).
- To relate the results from inter-annual variability to multi-decadal variability, it will be important to develop a mechanistic understanding. Potentially relevant previous research includes:
  - Contrasting early/late winter impacts of remote SSTs on the NAO (e.g. King et al., 2018; Peings and Magnusdottir, 2014).
  - The effect of jet speed is more important than latitude in terms of NA ocean response (Ma et al., 2020).

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 UKESM1 performs broadly well in terms of winter-mean jet stream dynamics (Robson et al., 2020), so it will be important to evaluate a range of CMIP6 models.





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