Understanding the Differences in the Sub-seasonal Predictability of Stratospheric Extreme Events

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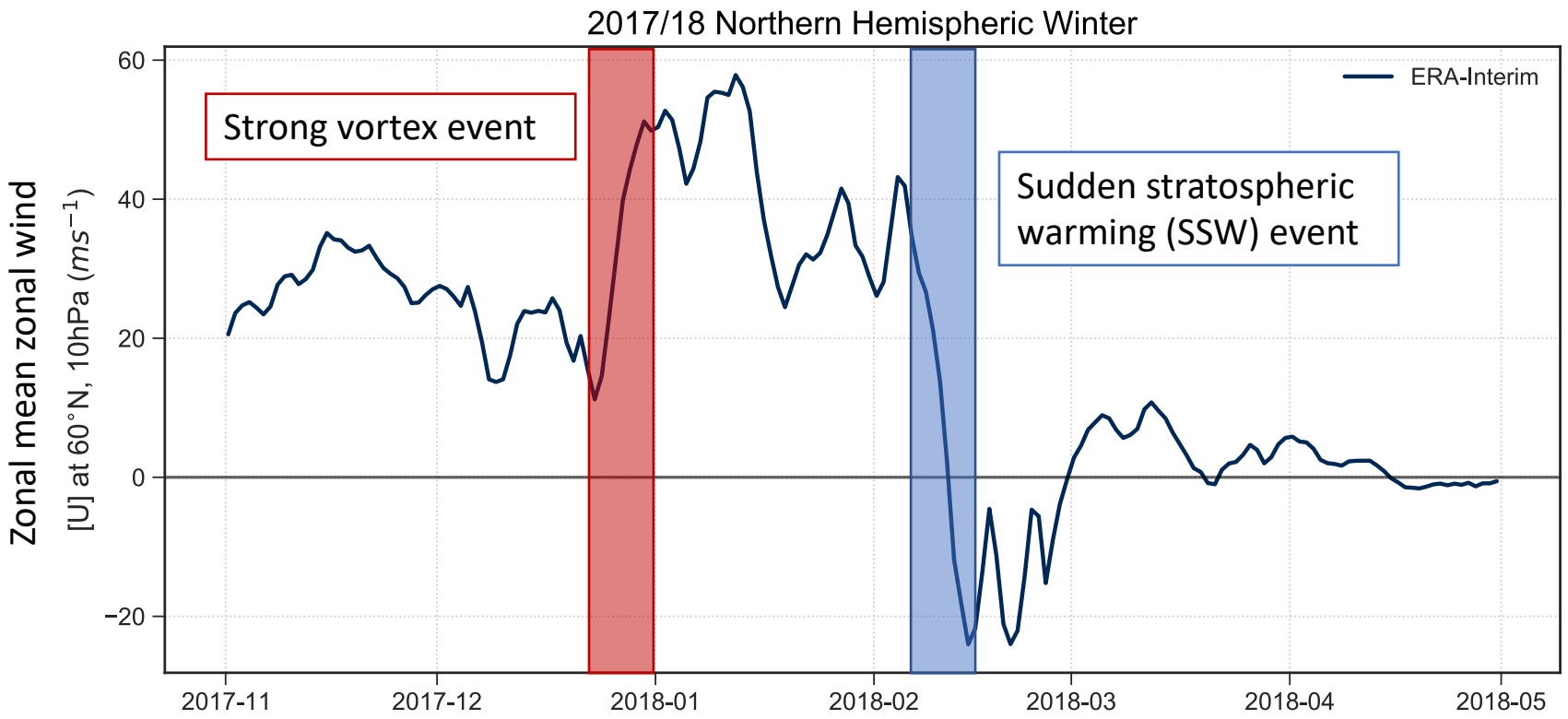
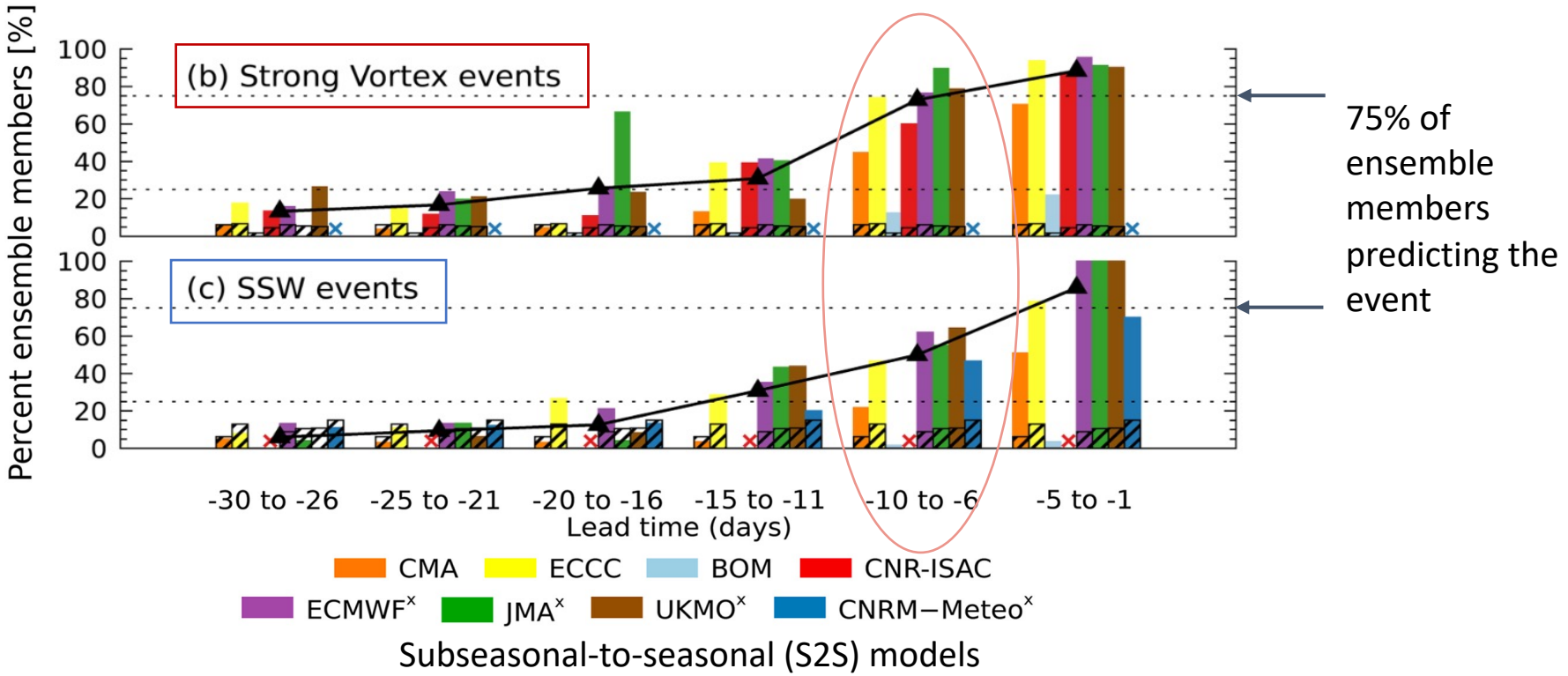
Extreme stratospheric events are often the focus of predictability studies



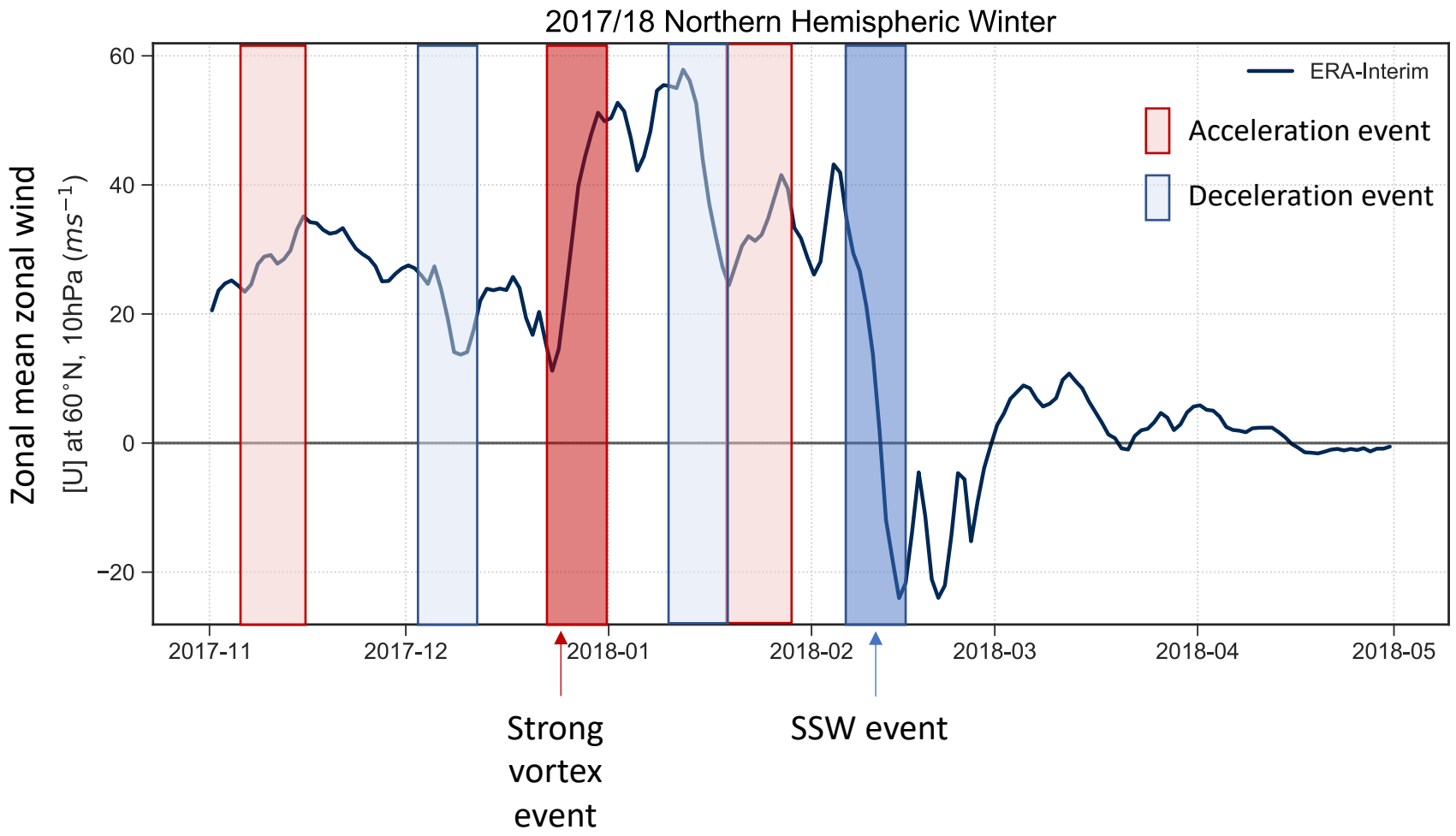
- Have downward surface weather impact
- Better event prediction potentially improve surface weather prediction

Motivation:
Why might strong vortex events be more predictable than SSW events?



Domeisen et al. (2020)

Extend event definitions to wind deceleration and acceleration events



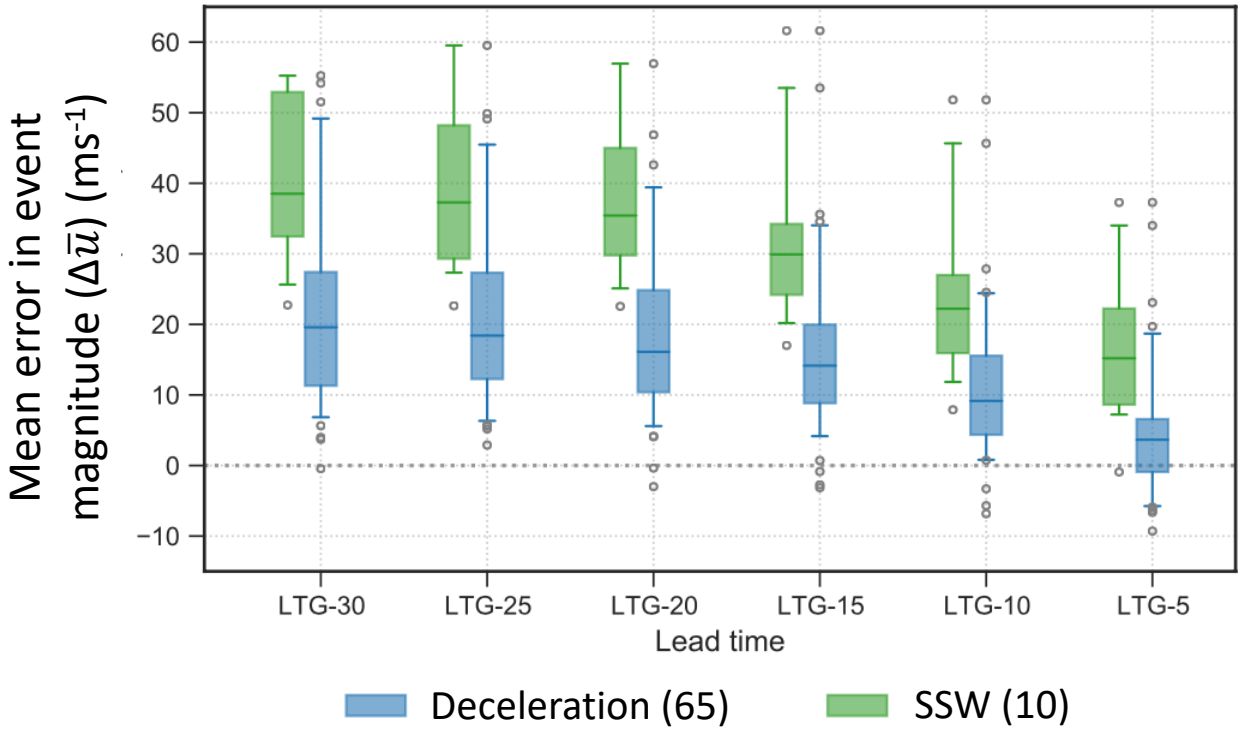
- ERA-Interim reanalysis
- 1998/99 – 2017/18 Nov-Mar

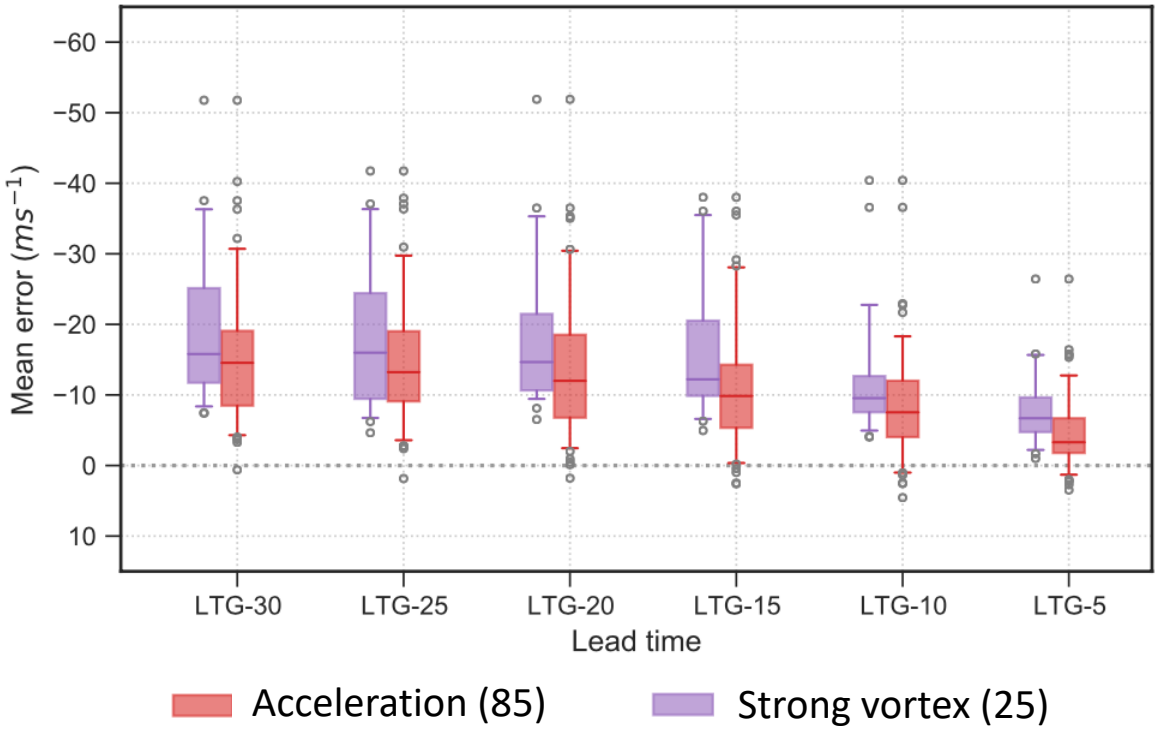
- 10-day event window
- Event magnitude ($\Delta\bar{u}$)
  - Wind difference between day 9 and 0

$$\Delta\bar{u} = \bar{u}(t=9) - \bar{u}(t=0)$$

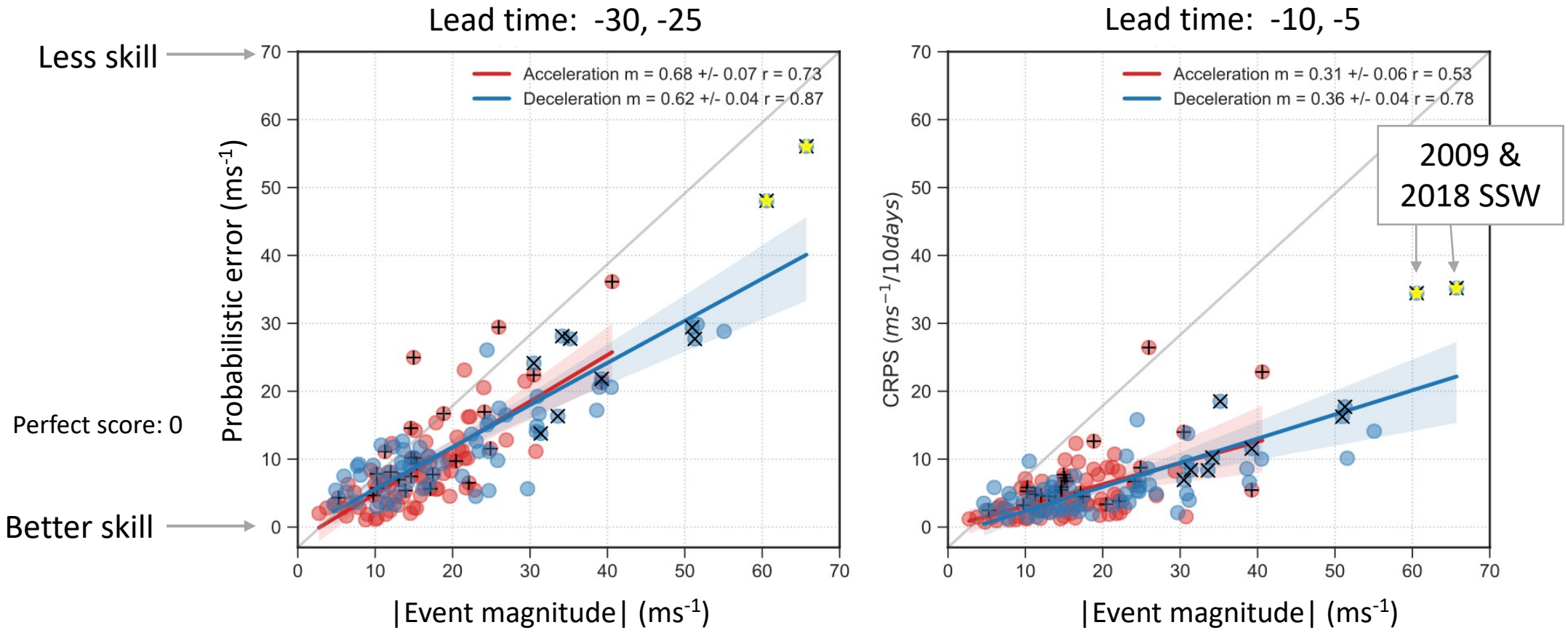
➡ How predictable are the events in the ECMWF model?

Wind deceleration events
less predictable than acceleration events



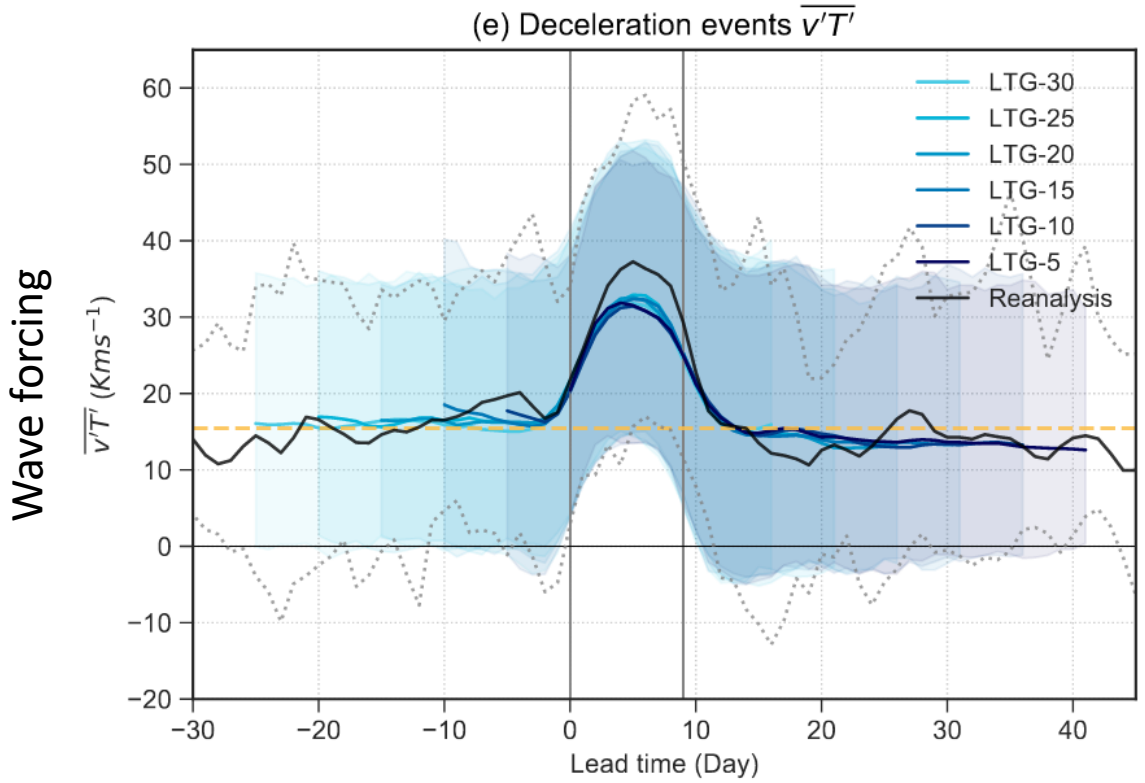


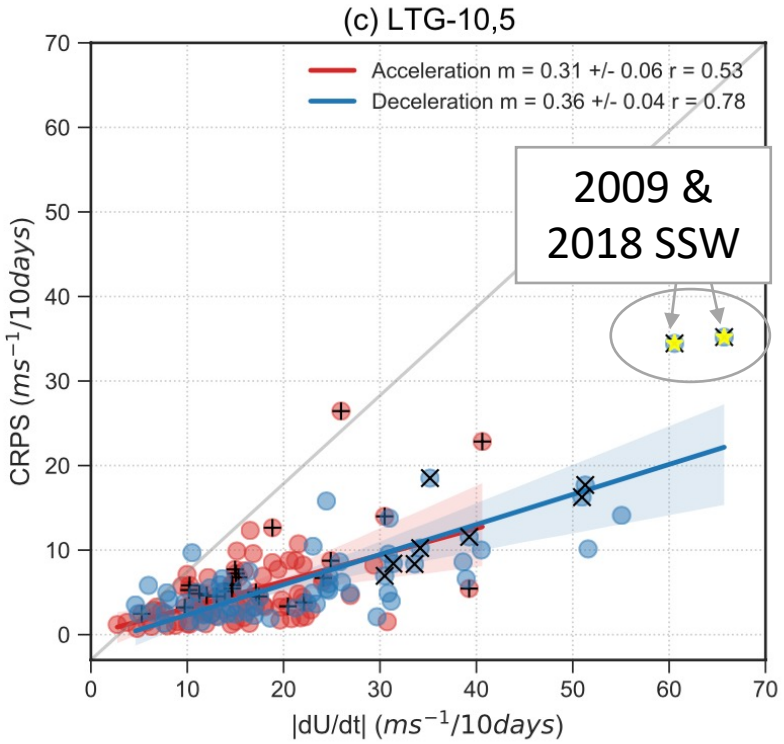
Predictability of events largely dependent on magnitude



- Close to linear relationship: the stronger the event magnitude, the larger the error
- Extremely strong magnitude events show larger errors – 2009 & 2018 SSWs

Model shows limitation in producing strong wave activity anomalies





- Model underestimates anomalies during deceleration events
- Might explain extremely strong magnitude events being less predictable

Conclusions

- Extreme stratospheric events show
  a close to linear dependence of predictability on event magnitude
- Very strong magnitude events deviate this linear dependence,
  are even less predictable
- ECMWF model shows limitation in producing
  extremely strong wave activity

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