

# Quantifying the effect of ICME removal and observation age on in-situ solar wind data assimilation

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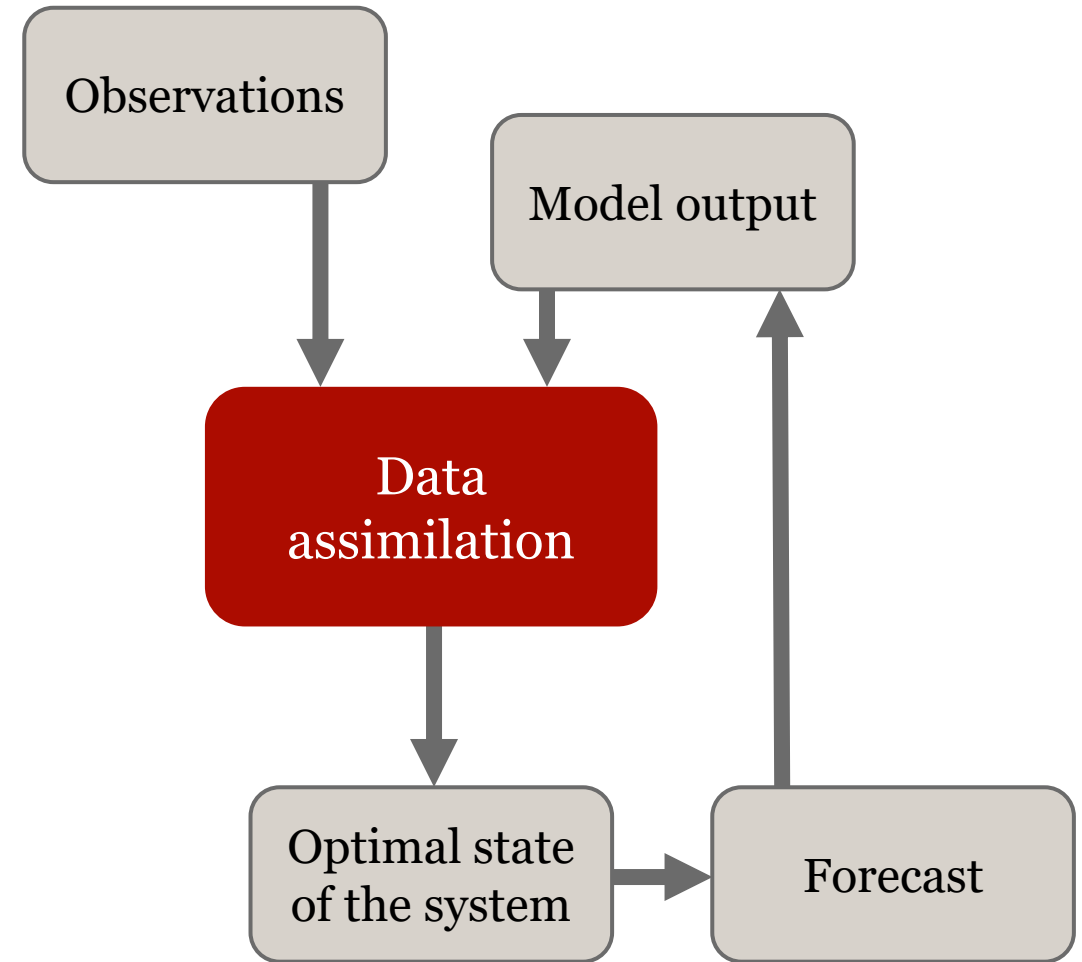
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**University of  
Reading**

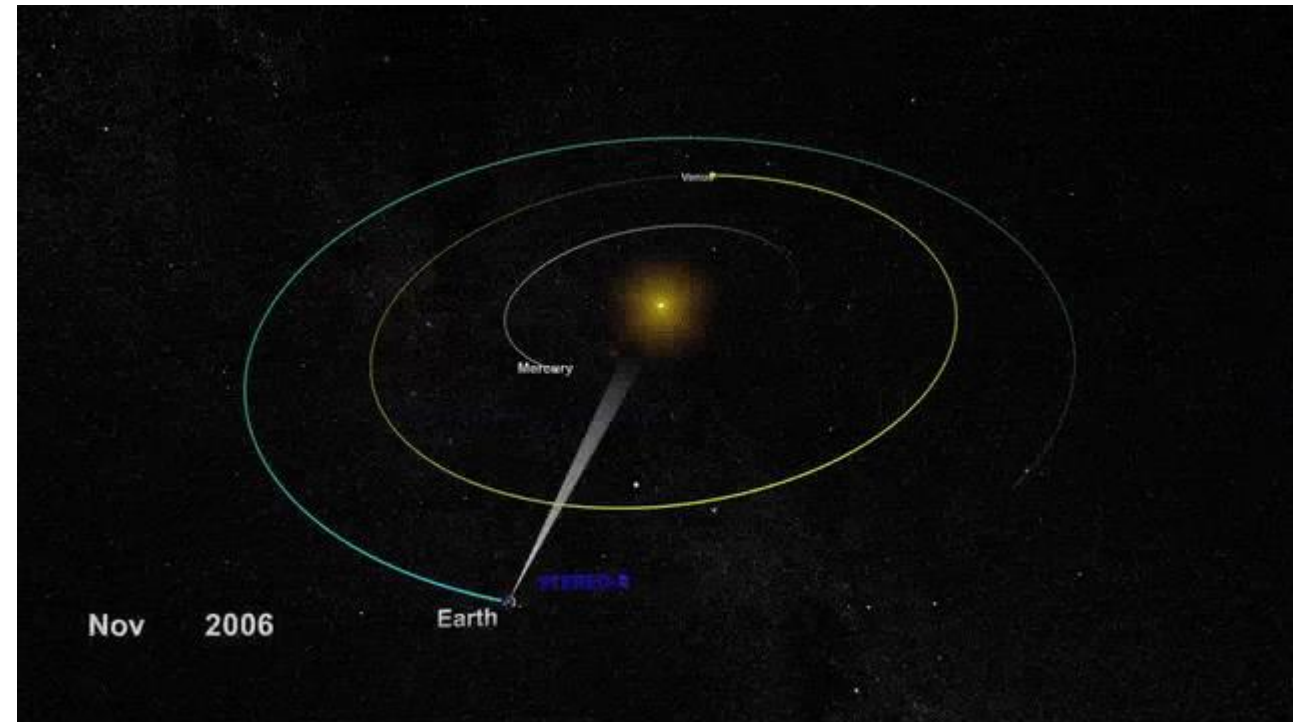
# Solar wind and data assimilation

- Data assimilation (DA) combines model output and observations to form an optimum estimation of reality
- Led to large improvements in terrestrial weather forecasting
- Under used in space weather forecasting

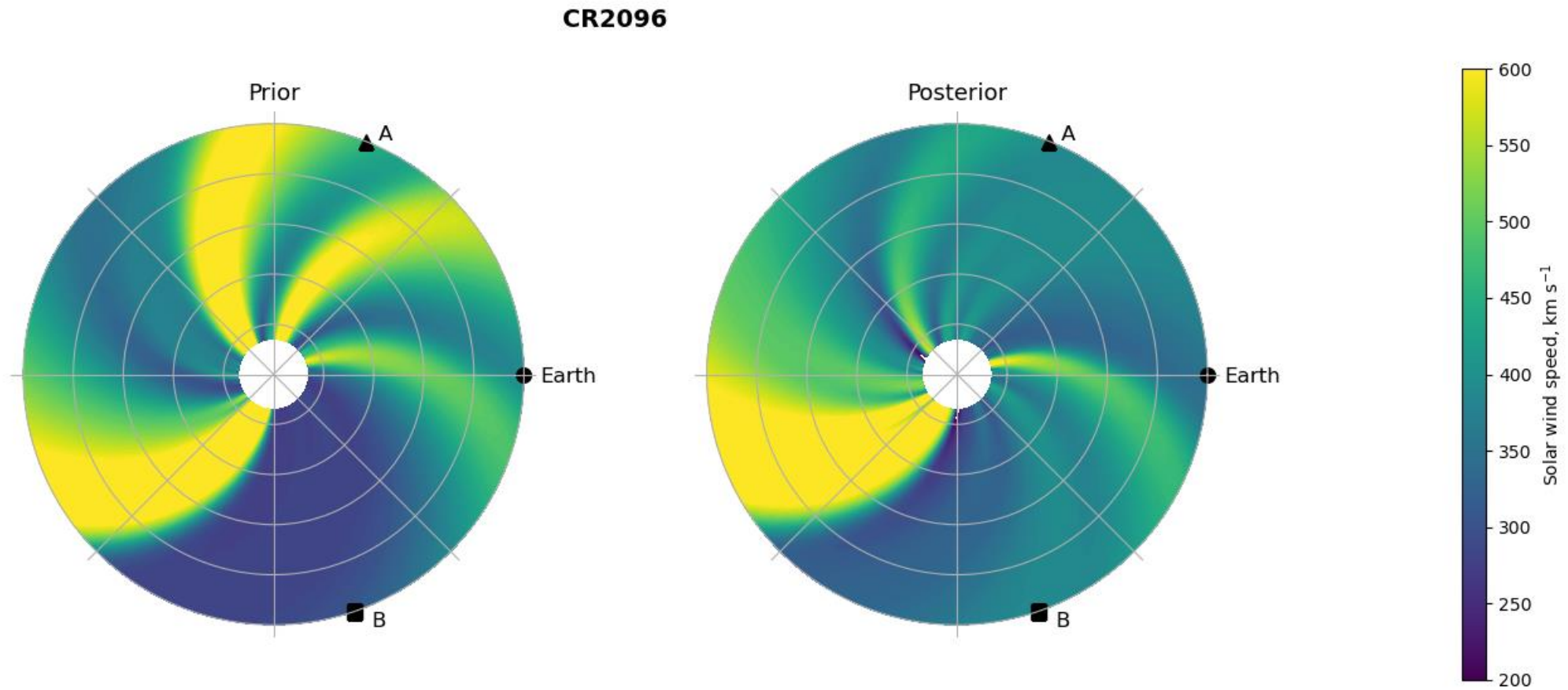


# BRaVDA scheme

- Burger Radius Variational Data Assimilation scheme (Lang and Owens, 2019)
- Uses solar wind propagation model and observations from STEREO spacecraft and OMNI dataset
  - 3 sources of observations
  - Spacecraft observations can be assimilated together or individually
- Reconstructs solar wind in 27-day windows from 30 to 215  $R_s$

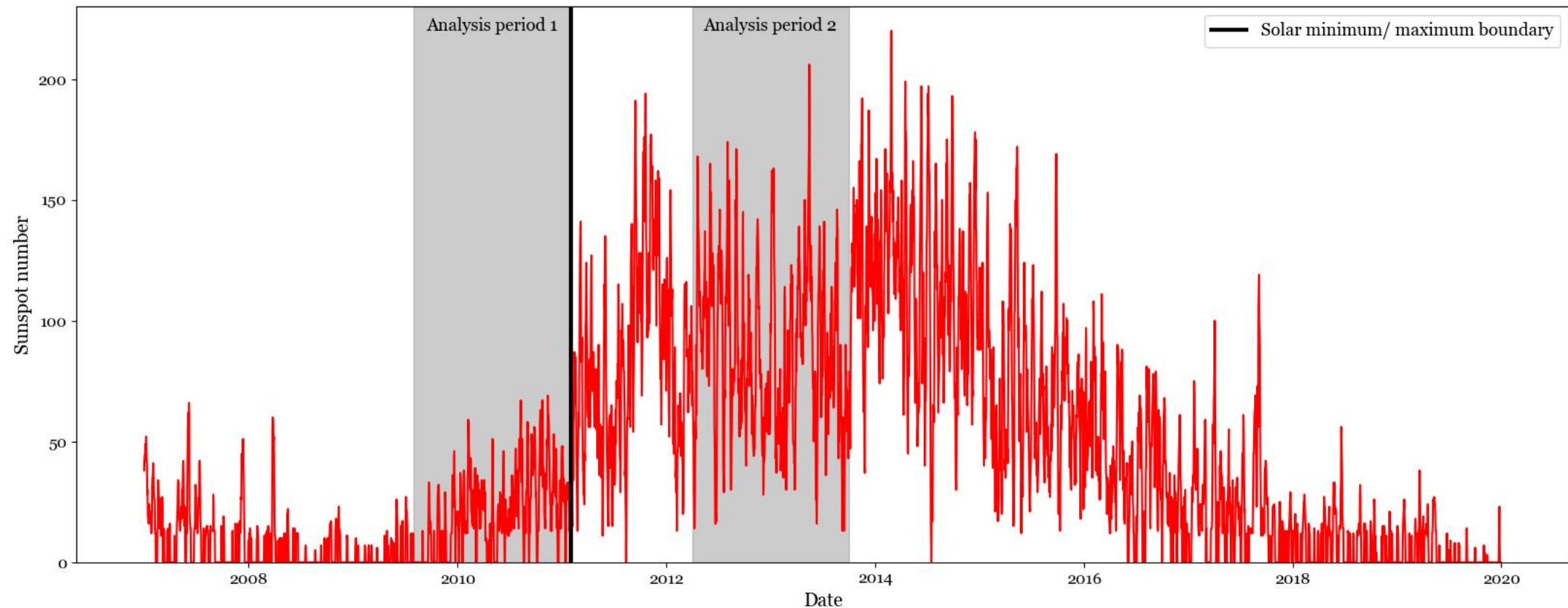


# Example of the effect of DA



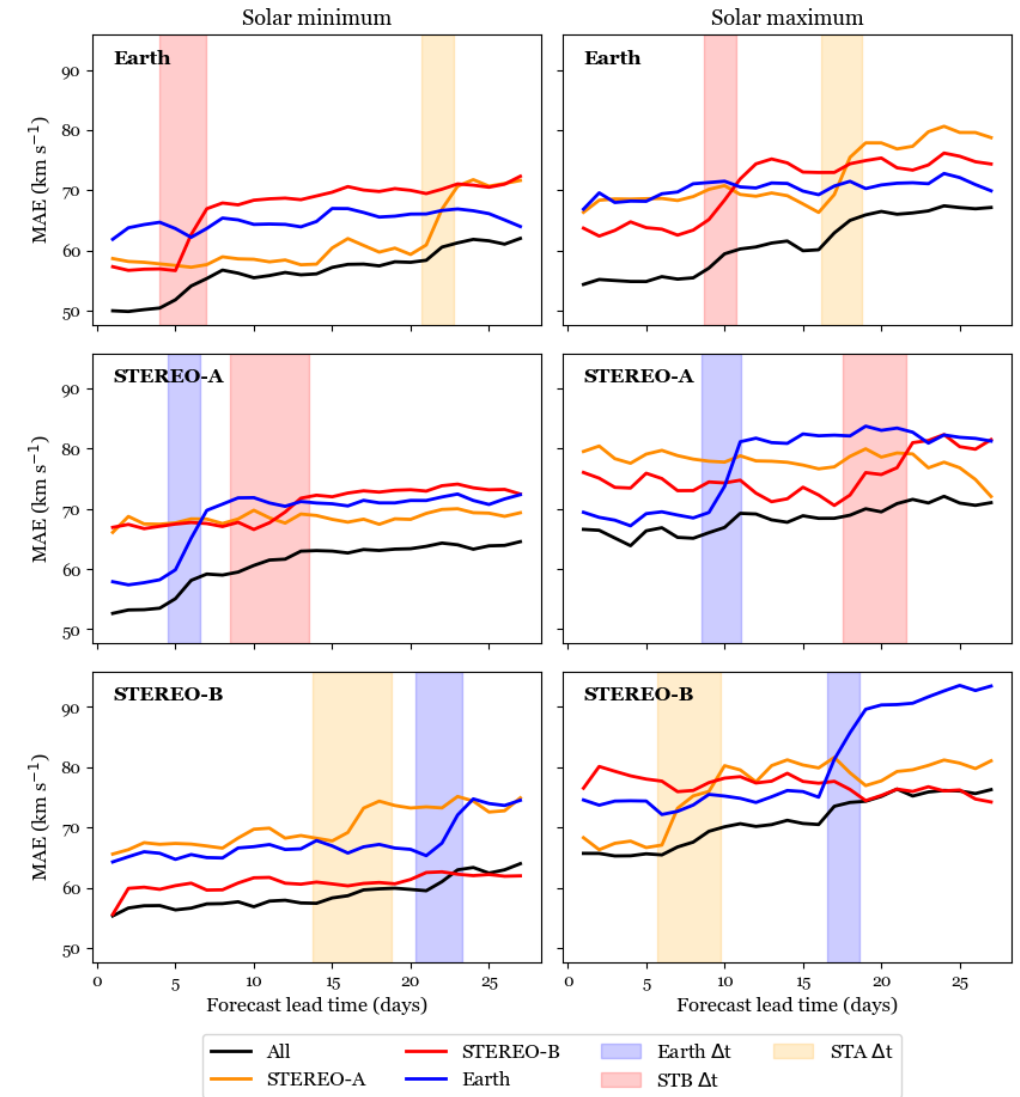
# Extended analysis periods

- Two analysis periods – solar minimum and solar maximum



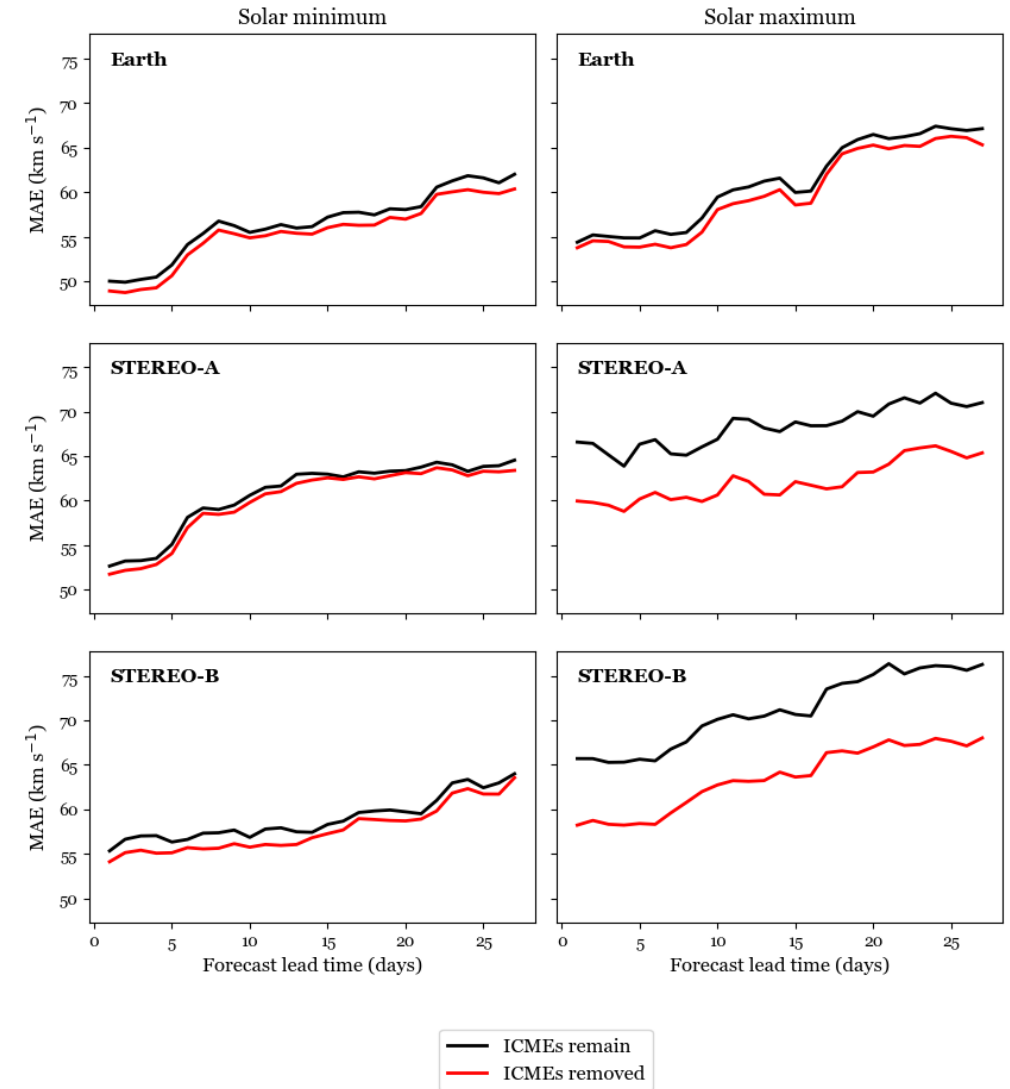
# Age of observations

- Increase in error when forecast lead time exceeds corotation time
  - Assimilation of individual spacecraft
- Due to age of observations
- Almost always, better to assimilate multiple spacecraft than single spacecraft



# ICME removal

- BRaVDA has no knowledge of ICMEs, so observations are treated as the steady-state solar wind
- ICMEs could produce false streams in the solar wind reconstruction or false alarms in the forecast
- Removed from the DA input time series and linearly interpolated over



# Conclusions

- Data assimilation is in early development stages for space weather forecasting
  - Our implementation has improved solar wind forecasts
- Looking at 3 years of forecasts:
  - Large impact from observation age
  - Removing ICMEs improves forecast accuracy
- Better to assimilate multiple spacecraft observations rather than single spacecraft observations

# Thank you

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# References

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