

## INTRODUCTION

In February 2016, MERRA-2 was released by NASA as the successor to MERRA. It incorporates a number of stepwise advancements, including the assimilation of new and improved satellite observations not available to MERRA and ERA-Interim. As MERRA has been permanently discontinued, there is an urgent need to establish MERRA-2's suitability as a source of long-term reference data. To this end, outlined here is an evaluation of the performance of MERRA-2 for a number of sites across Scandinavia.

## MERRA-2 ADVANCEMENTS

- Next generation NASA Earth modelling system.
- Higher resolution grid (MERRA-2: 0.625 degrees x 0.500 degrees, MERRA: 0.667 degrees x 0.500 degrees).
- Incorporates substantially more satellite data than MERRA, including a number of new platforms unavailable to MERRA.
- Twenty-fold increased resolution in sea surface temperature and sea ice input data.
- Among the first reanalysis datasets with interactive aerosols – improved radiative forcing of atmosphere.

## METHODOLOGY

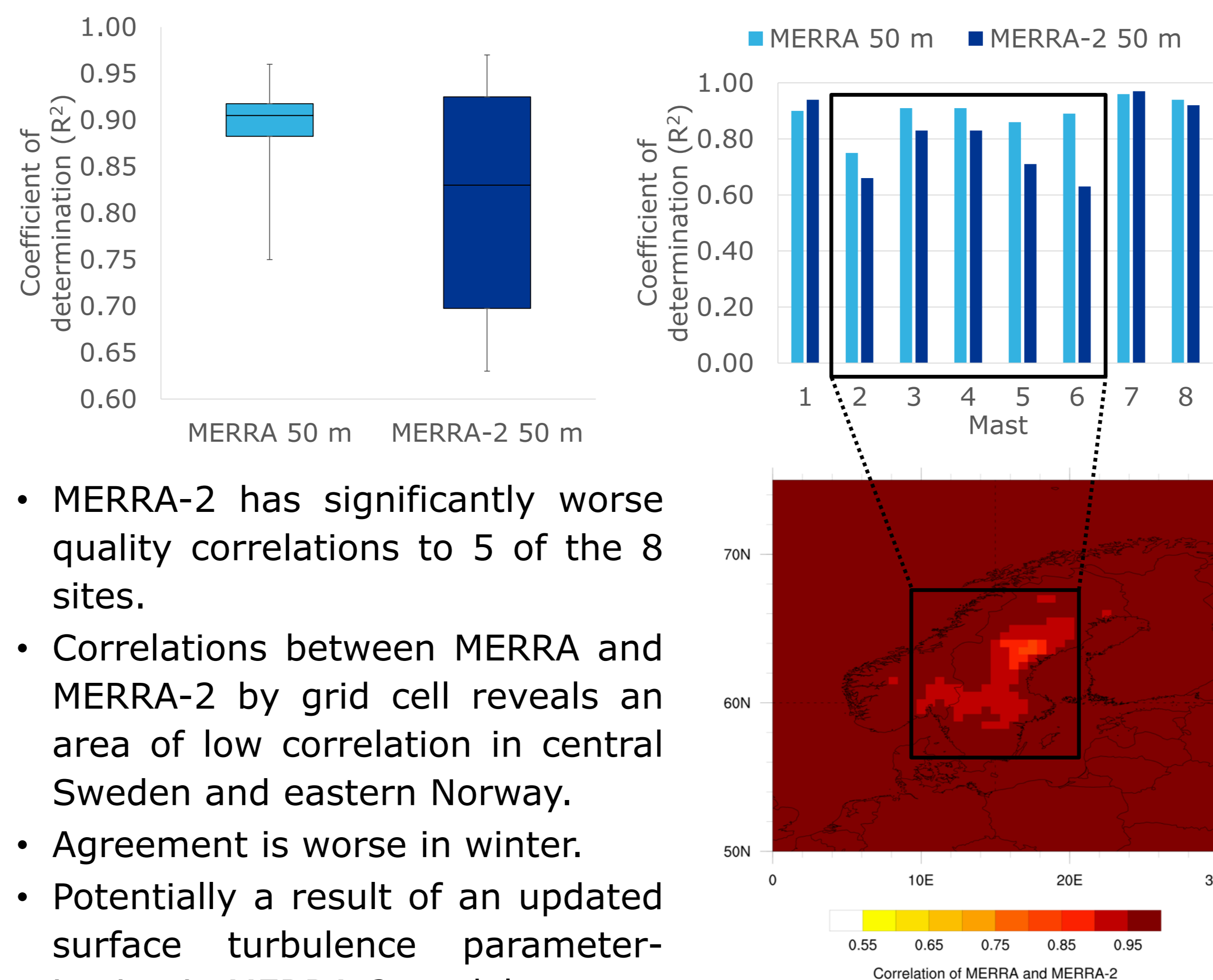
- 8 meteorological masts selected across Norway, Sweden and Finland.
- Correlations of wind speed conducted with MERRA and MERRA-2 on monthly/10-day averaging period.
- Quality of correlation compared through coefficient of determination ( $R^2$ ).
- Long-term trends compared and temporal consistency investigated through change point analysis.
- Alternative sources of reference data investigated, including MERRA-2 at 850 hPa and DNV GL's Virtual Met Data (VMD).

## The next era of global long-term reference data

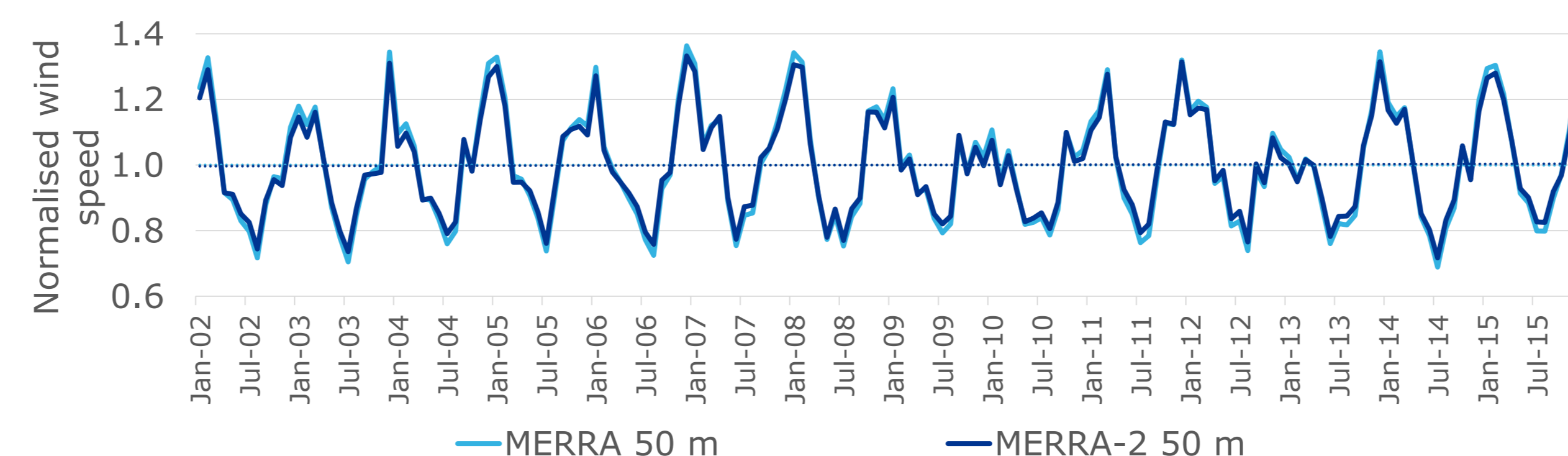
**Author:** Gemma Daron, Senior Engineer, Email: [gemma.daron@dnvgl.com](mailto:gemma.daron@dnvgl.com)

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## MERRA VS MERRA-2 50 m surface dataset

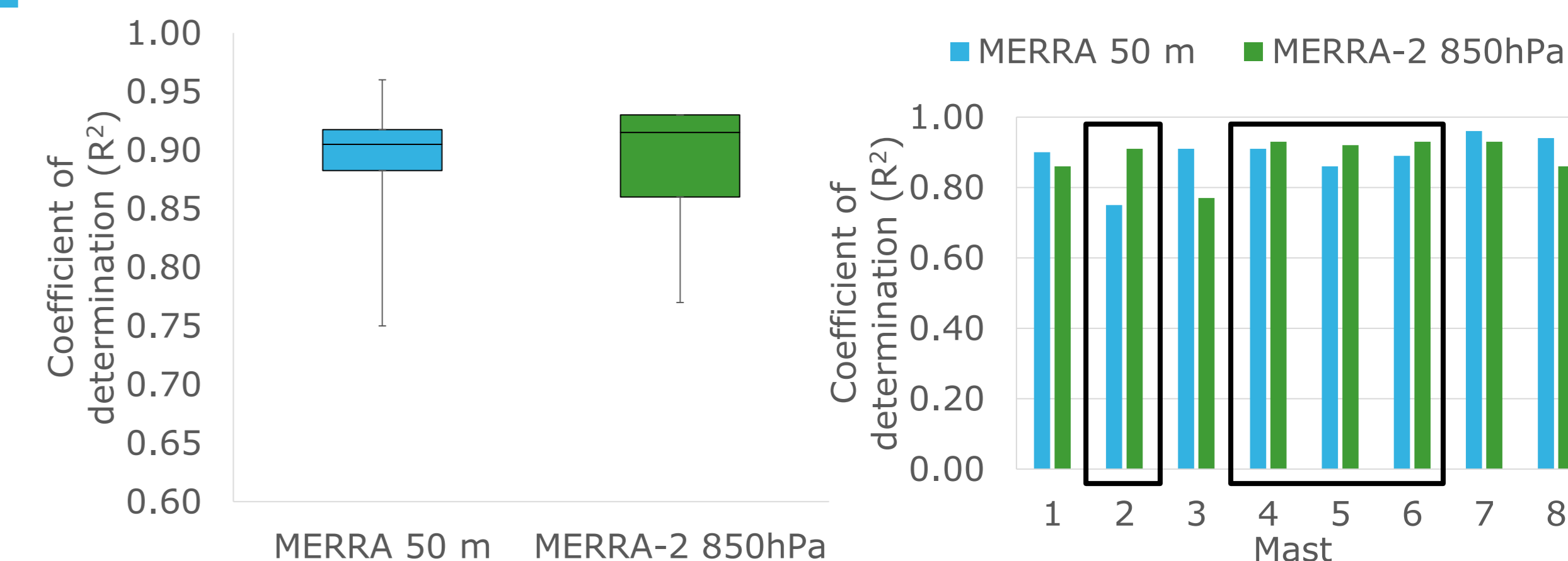


- MERRA-2 has significantly worse quality correlations to 5 of the 8 sites.
- Correlations between MERRA and MERRA-2 by grid cell reveals an area of low correlation in central Sweden and eastern Norway.
- Agreement is worse in winter.
- Potentially a result of an updated surface turbulence parameterization in MERRA-2 model.
- Similar long-term trends in MERRA/MERRA-2 over Scandinavia.
- MERRA-2 exhibits temporal consistency since January 2002.

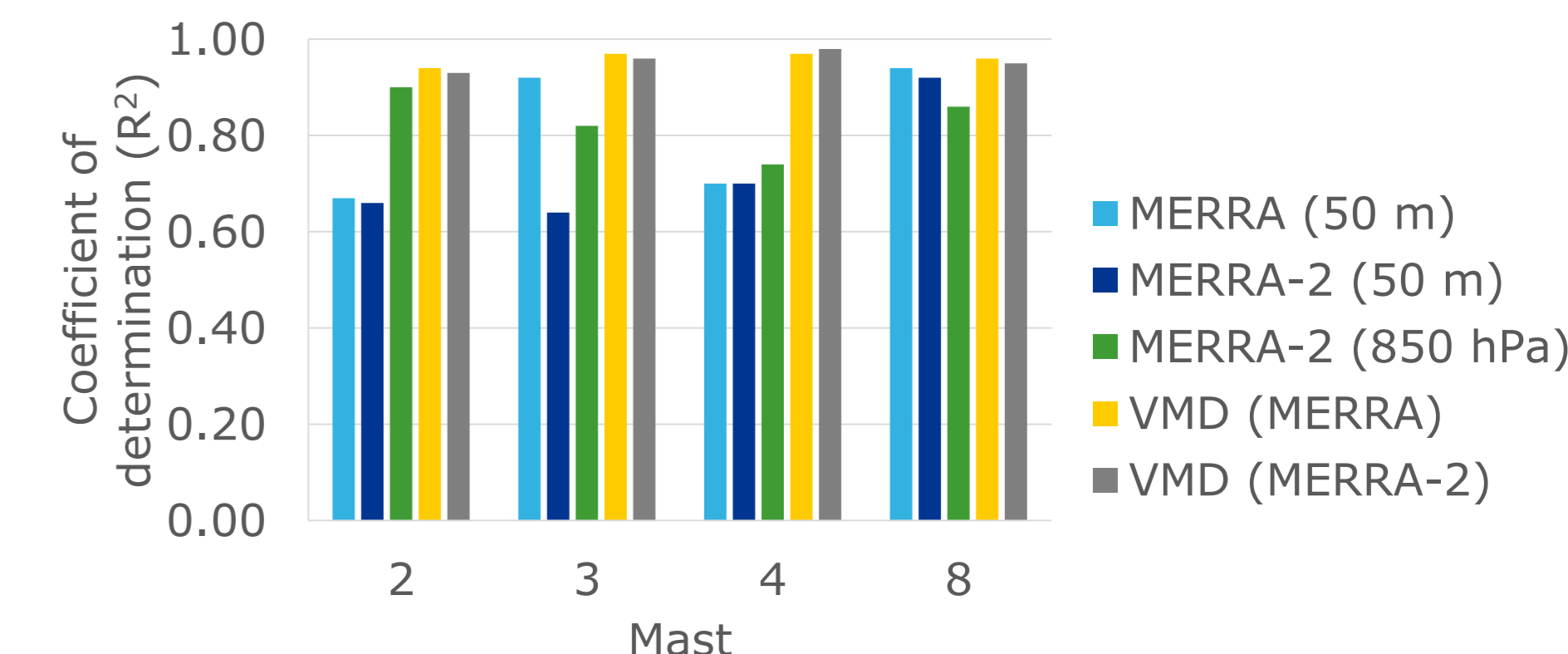


## REVIEW OF ALTERNATIVES

- MERRA-2 850 hPa provides improvement at four of the sites.
- Most improvement seen at high elevation sites.



- DNV GL's VMD generated at four of the sites for a one year test period based on MERRA and MERRA-2.
- Improvement in correlation quality seen at each site.



## CONCLUSIONS

- Correlations with the MERRA-2 50 m dataset worse than MERRA for sites in central Sweden and eastern Norway.
- This change may be a result of an updated surface turbulence parameterization in MERRA-2 model.
- In this region, MERRA-2 850 hPa data can improve correlations, particularly at high elevation sites.
- Virtual data products, such as DNV GL's VMD can provide further improvement.
- MERRA-2 exhibits temporal consistency since January 2002.