WOD

Framework for Weather Forecasting

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Outline of this talk

* WOD overview
* Design philosophy
* Examples of applications
* Summary

WOD overview

WOD (Weather On Demand) is a distributed system for

* Gathering upstream weather data and observations
* Triggering scheduled or on-demand forecasts
  * Running WRF-Chem atmospheric model for forecasting
    * with, or without, 3D/4D-VAR data assimilation
* Processing data for medium to long-term storage
* Making results (obs and/or fcst) available via APIs
* Making data files available to customised post-processors

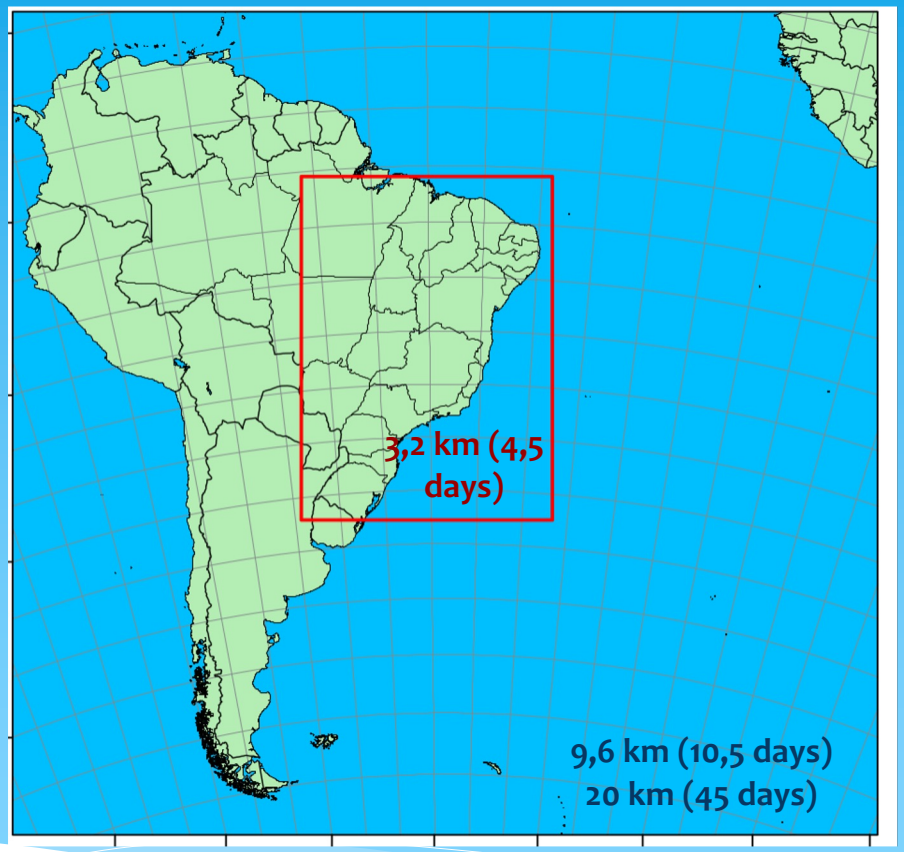
WOD overview

* Built around the WRF-Chem modelling system
* Initial and boundary data taken from global (CFS, GFS, and GEFS) and regional (RAP) models
* System installation is fast and highly automated
* Can be used to create conventional short- to medium-range weather forecasts for any location on the globe
* Can be used as a tool to provide input to other modelling systems, such as hydrological models
* A wide variety of post-processing options are also available

Design philosophy

* Based on **Open Source** components
  * **WRF/WPS** weather model and accompanying software
  * **Python** language and libraries
  * **Linux, PostgreSQL,** and **nginx** webservices
* **Event Driven**
  * Processing starts as soon as possible
  * Computing resources don't stand idle out of fear
* **Scalable** and **Resilient**
  * Just add computing nodes for increased throughput
  * Other nodes step in if one is removed

WOD applications



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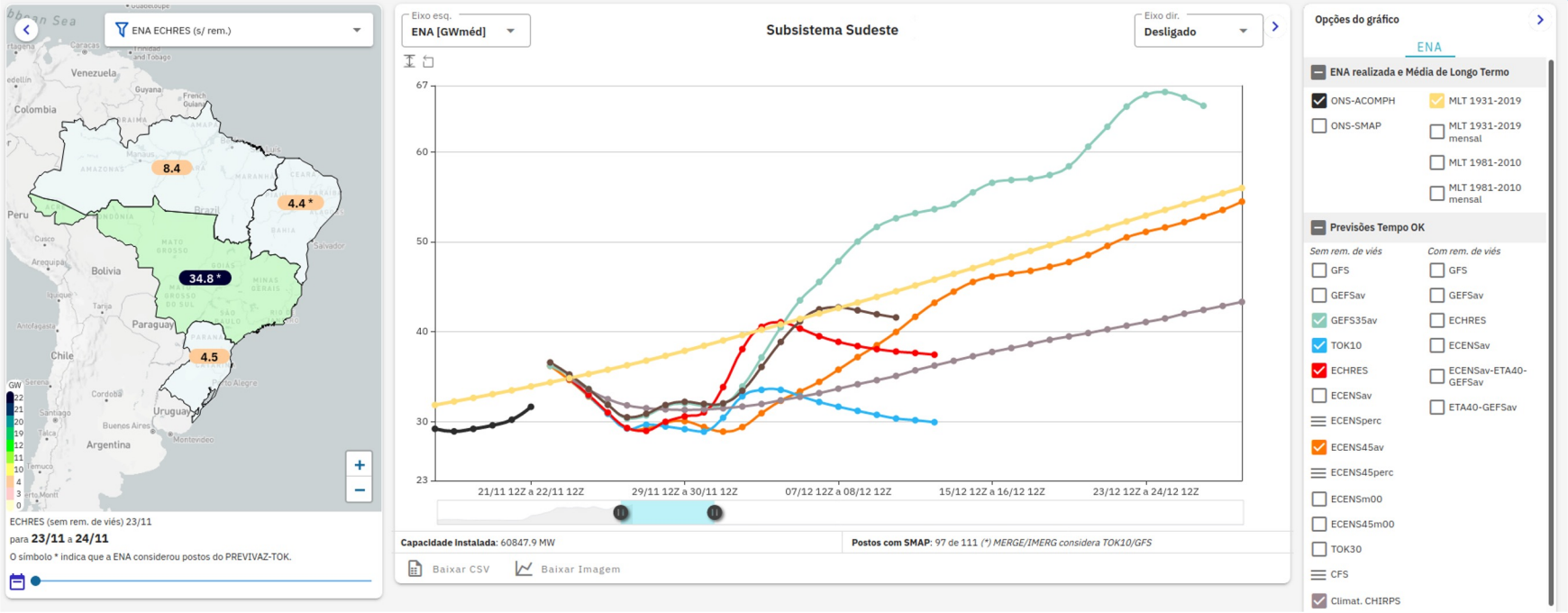
Energy trading



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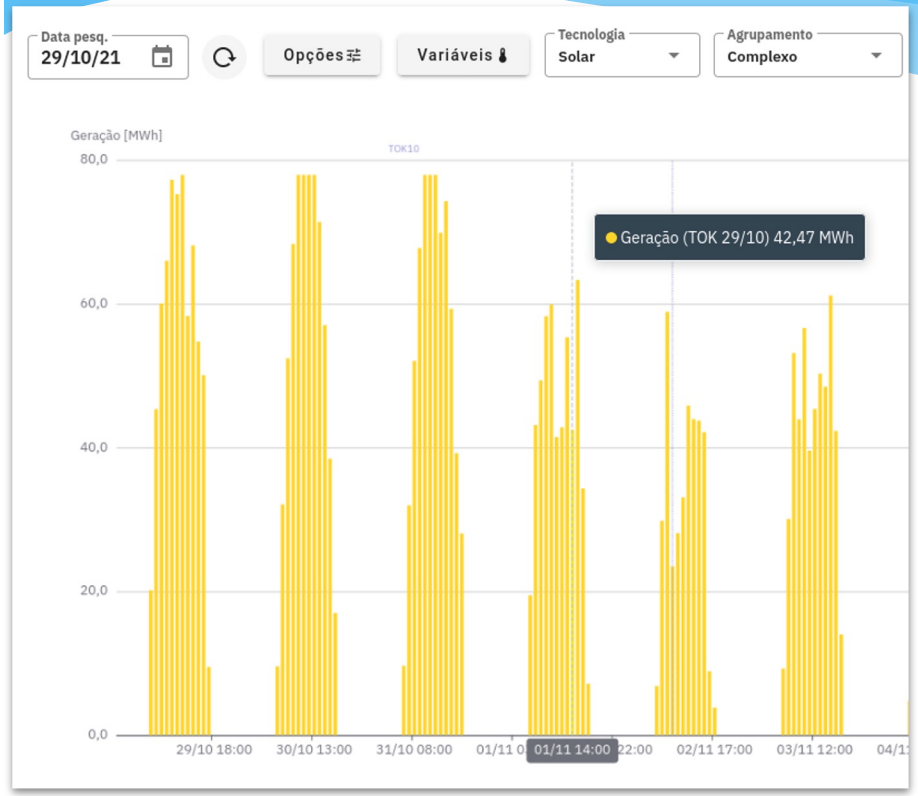
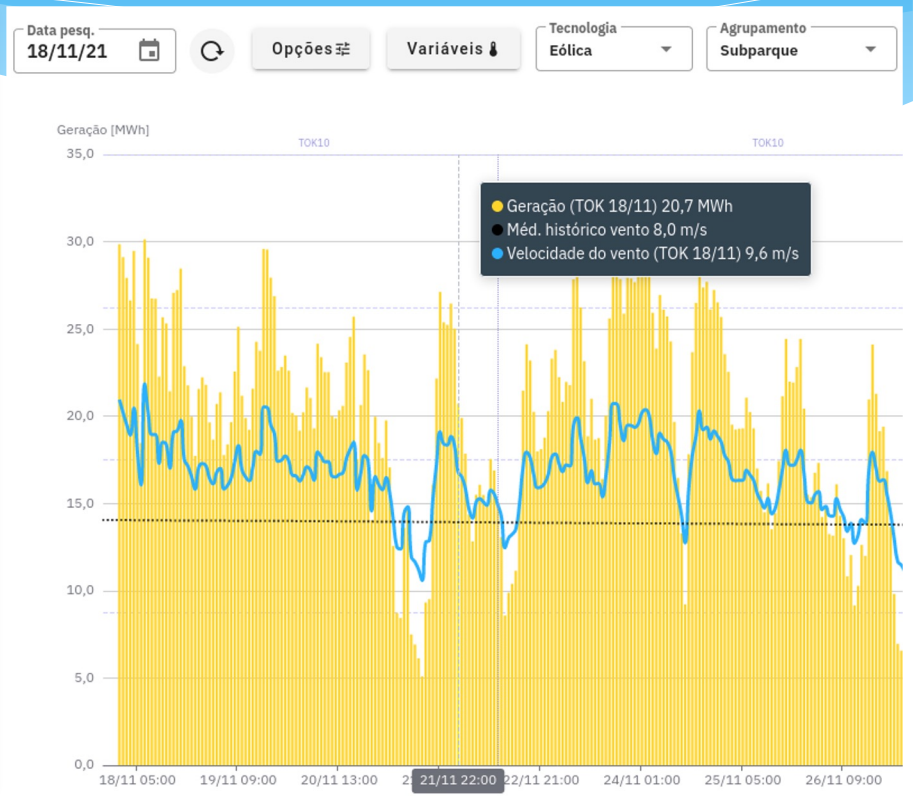
Solar- and wind-energy production forecasts





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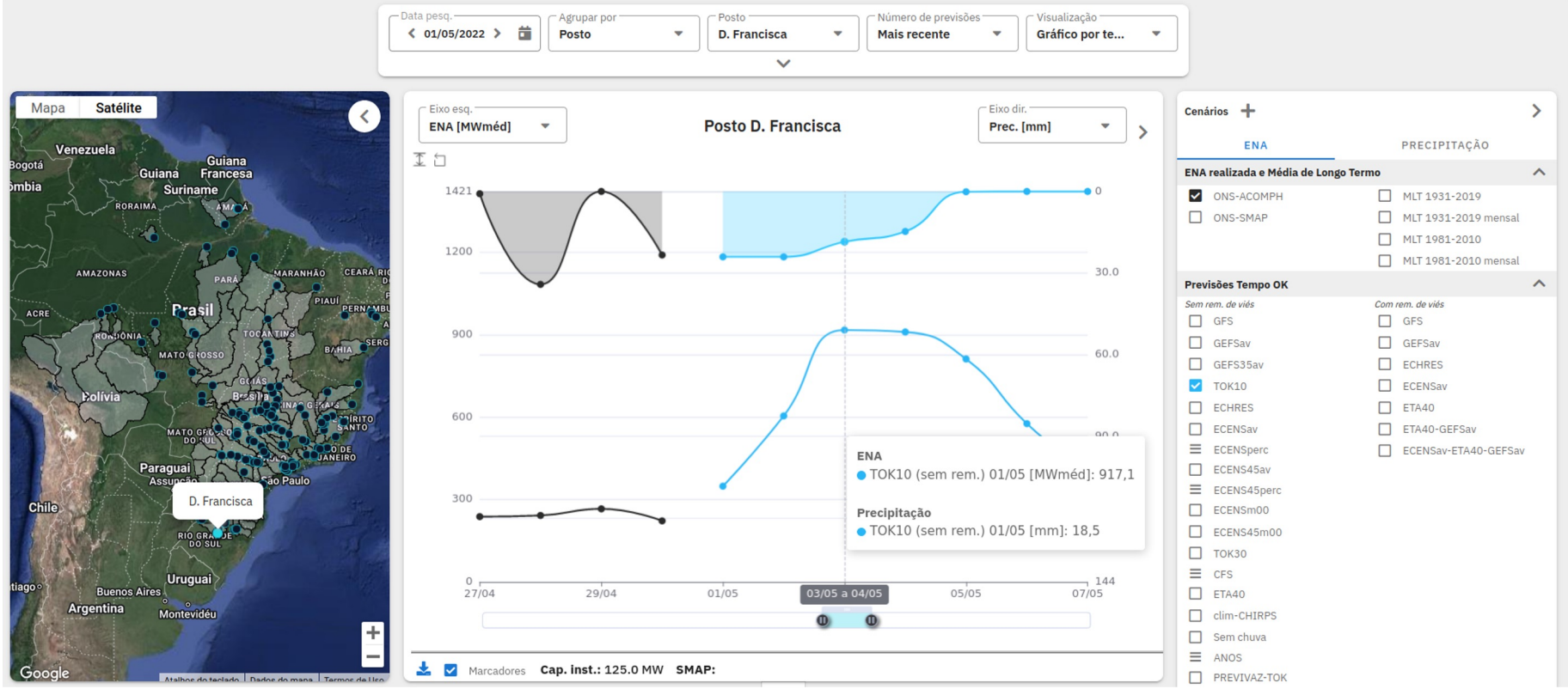
Hydro-power production forecast



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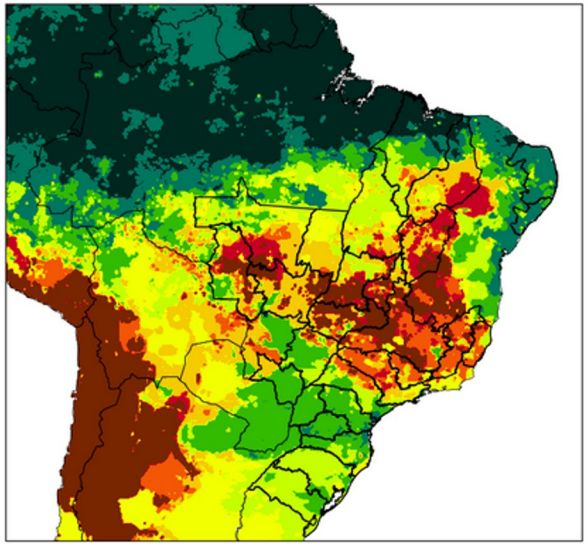
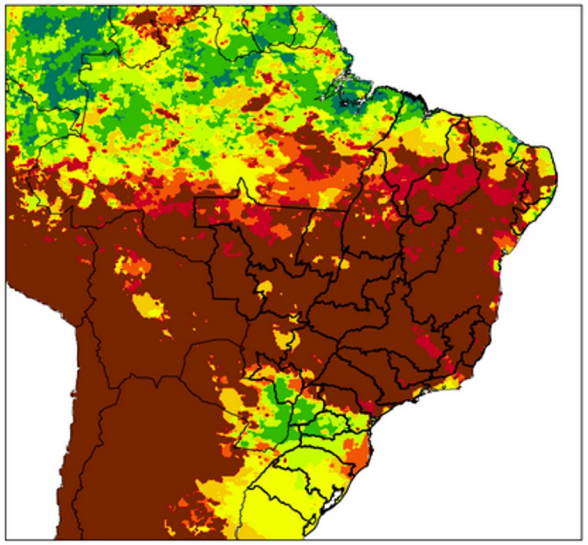
Agro commodities trading: Drought forecast

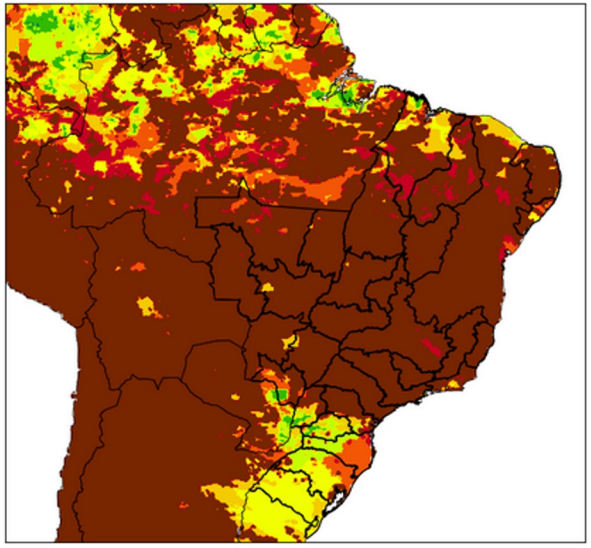
limiar: 1 mm



limiar: 15 mm



limiar: 30 mm



No. of days until precipitation exceeds limit

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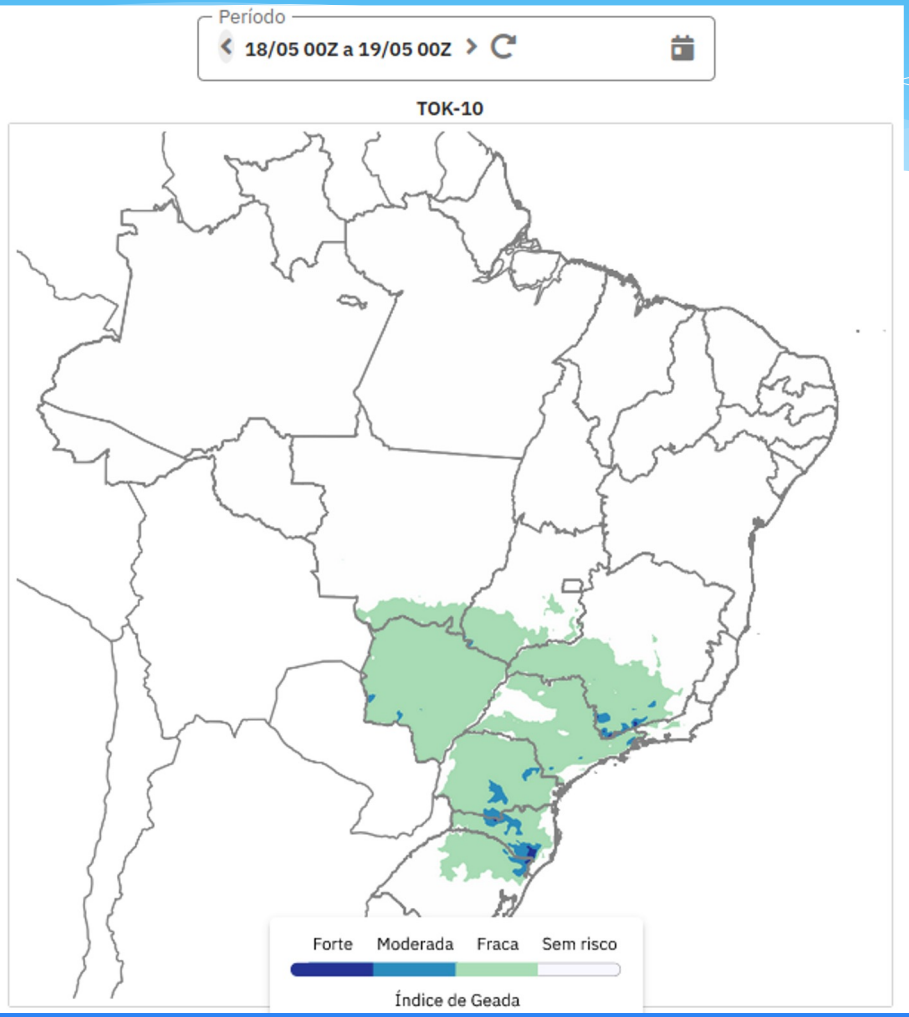
Agro commodities trading: Frost forecast



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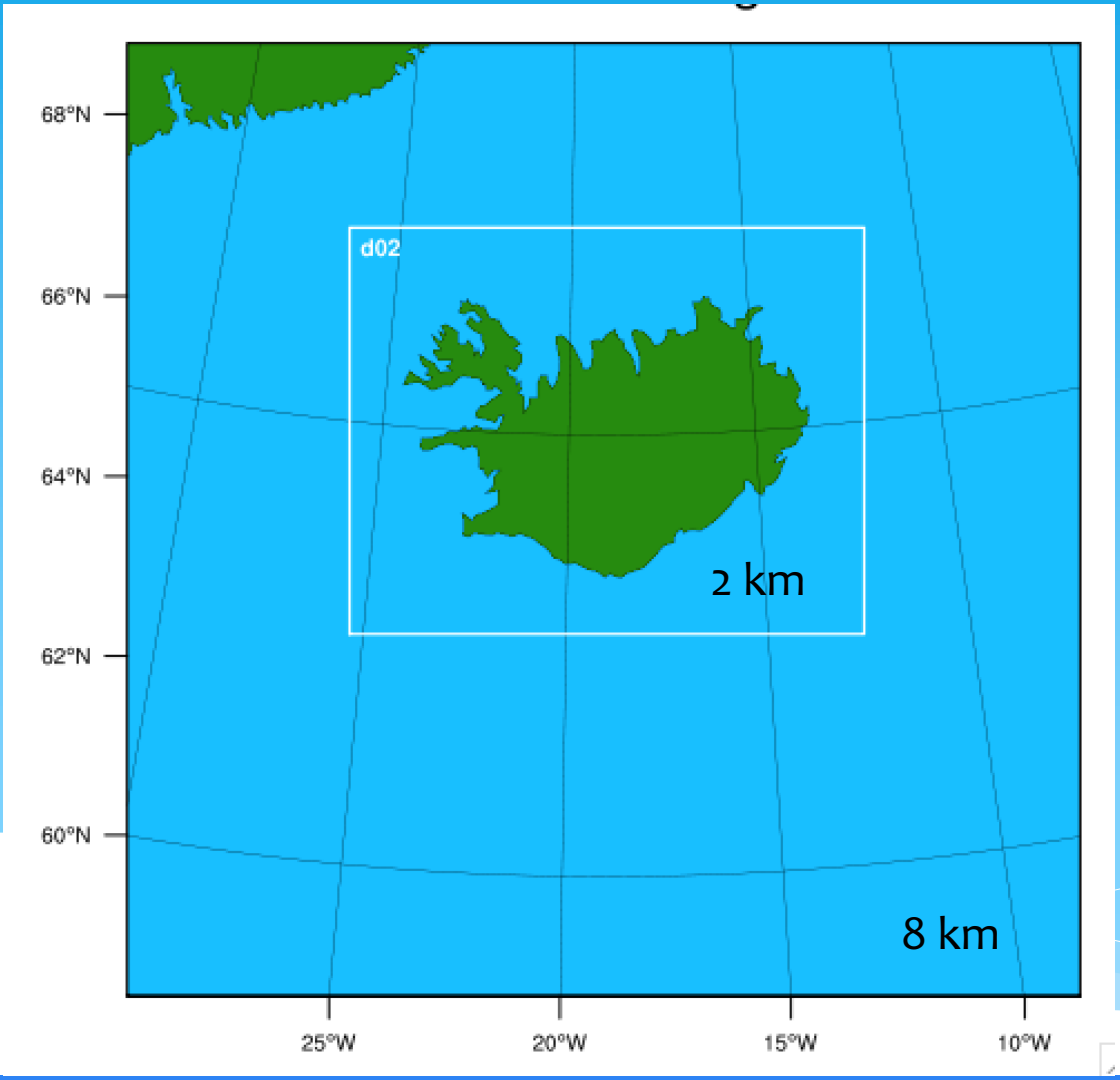
WOD applications – data assimilation



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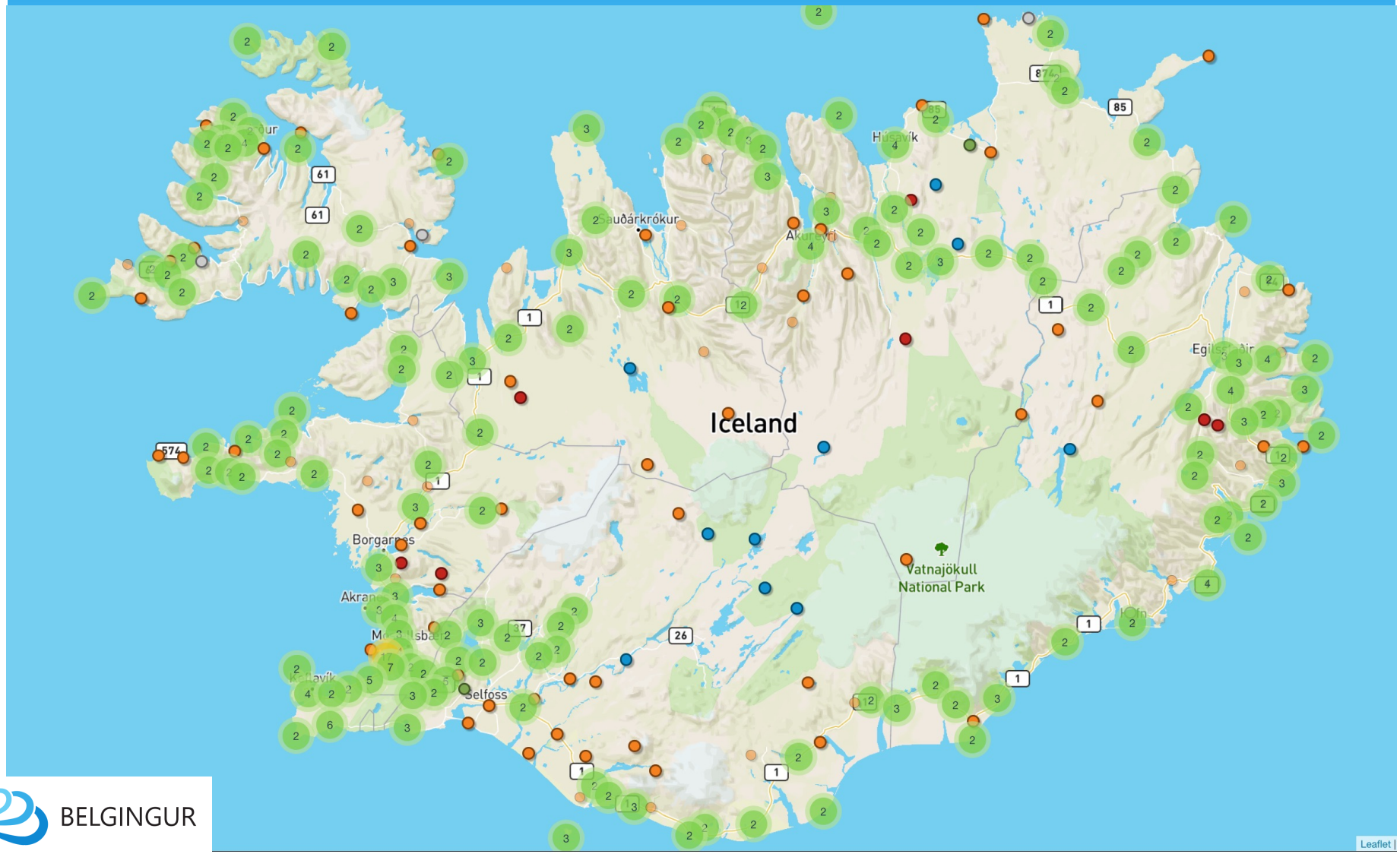
WOD overview – observational network



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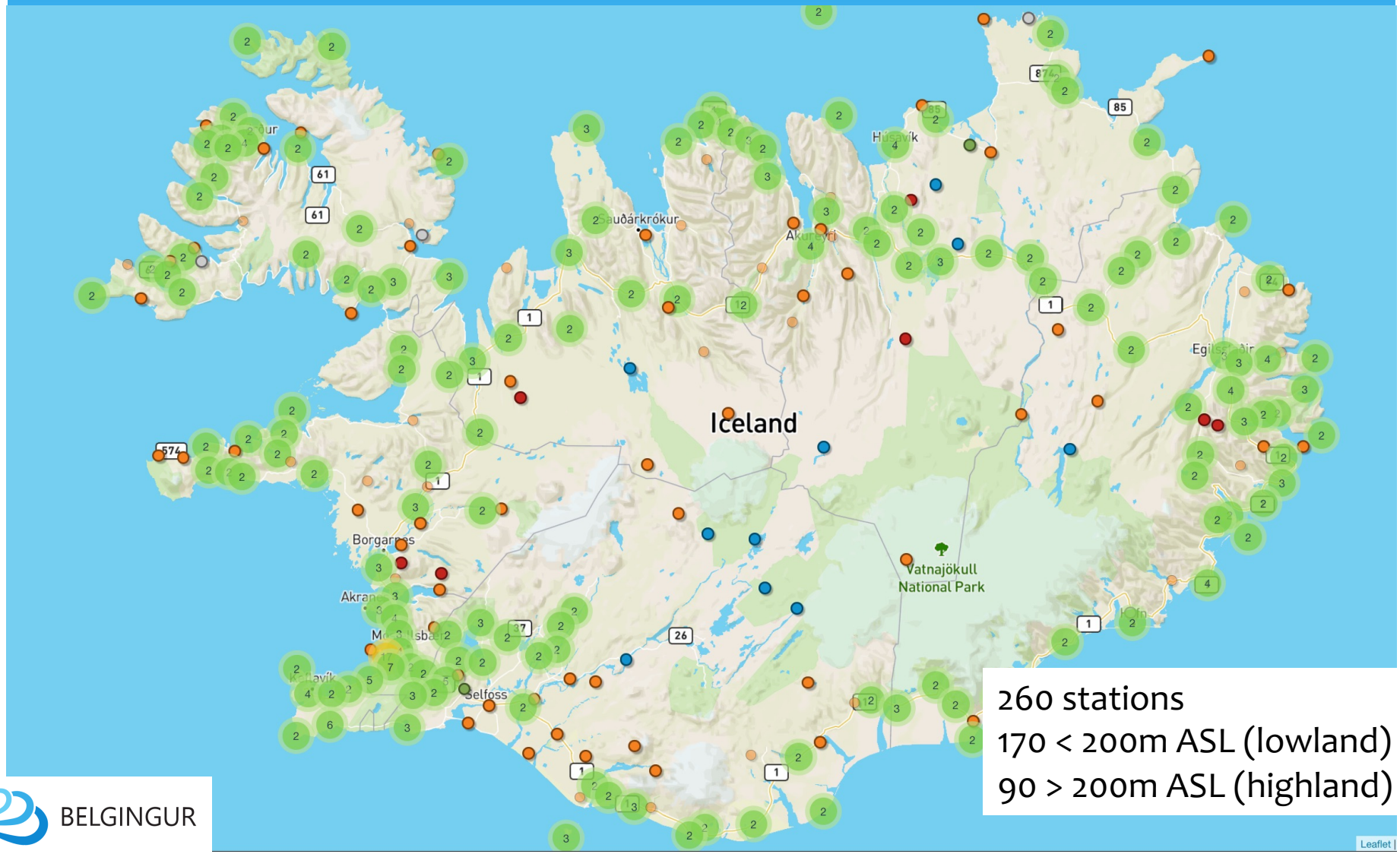
WOD overview – observational network



260 stations
170 < 200m ASL (lowland)
90 > 200m ASL (highland)

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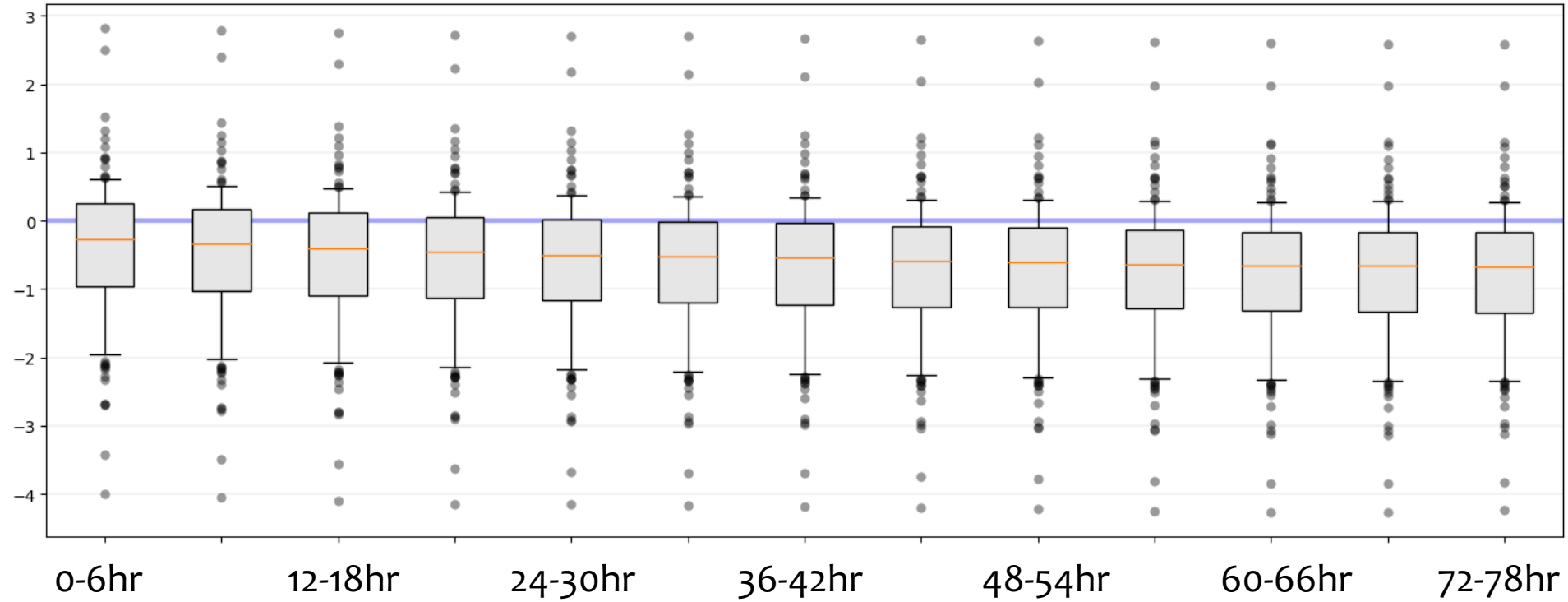
WOD overview – cold bias

3km res fcst Aug 2018 to Sep 2019



We know from experience that WRF has a history of cold bias for Iceland

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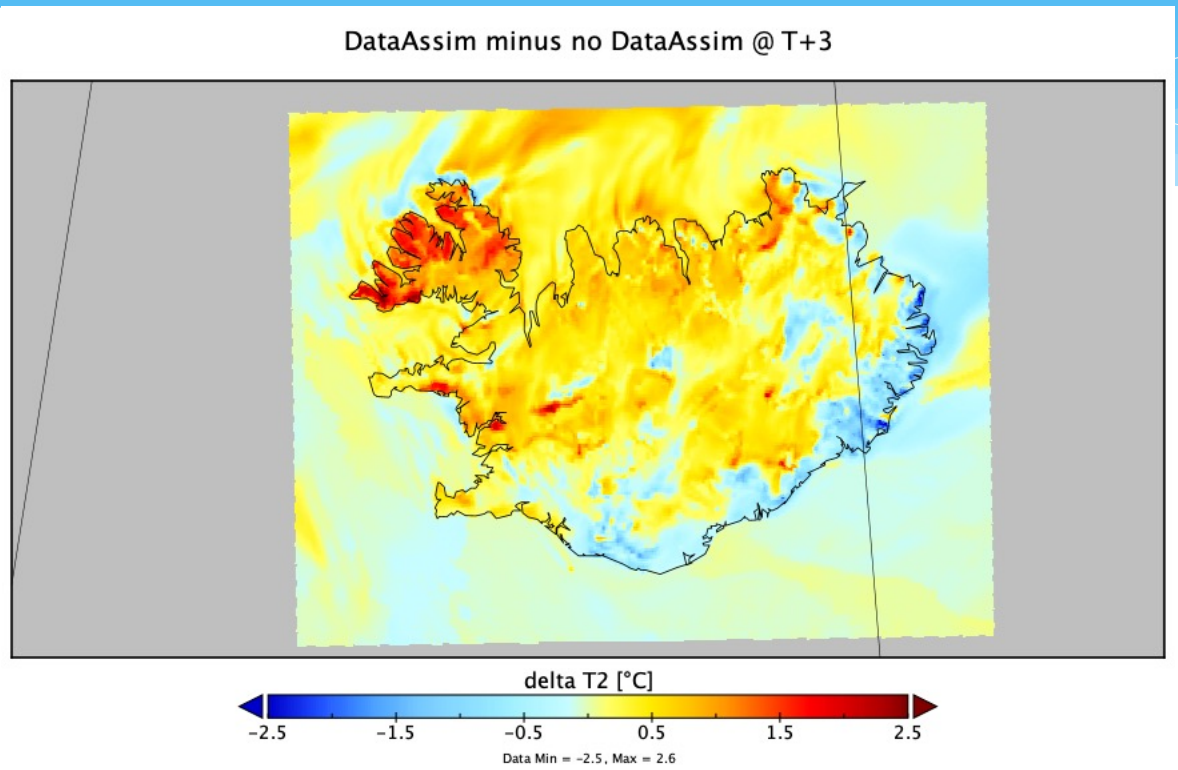
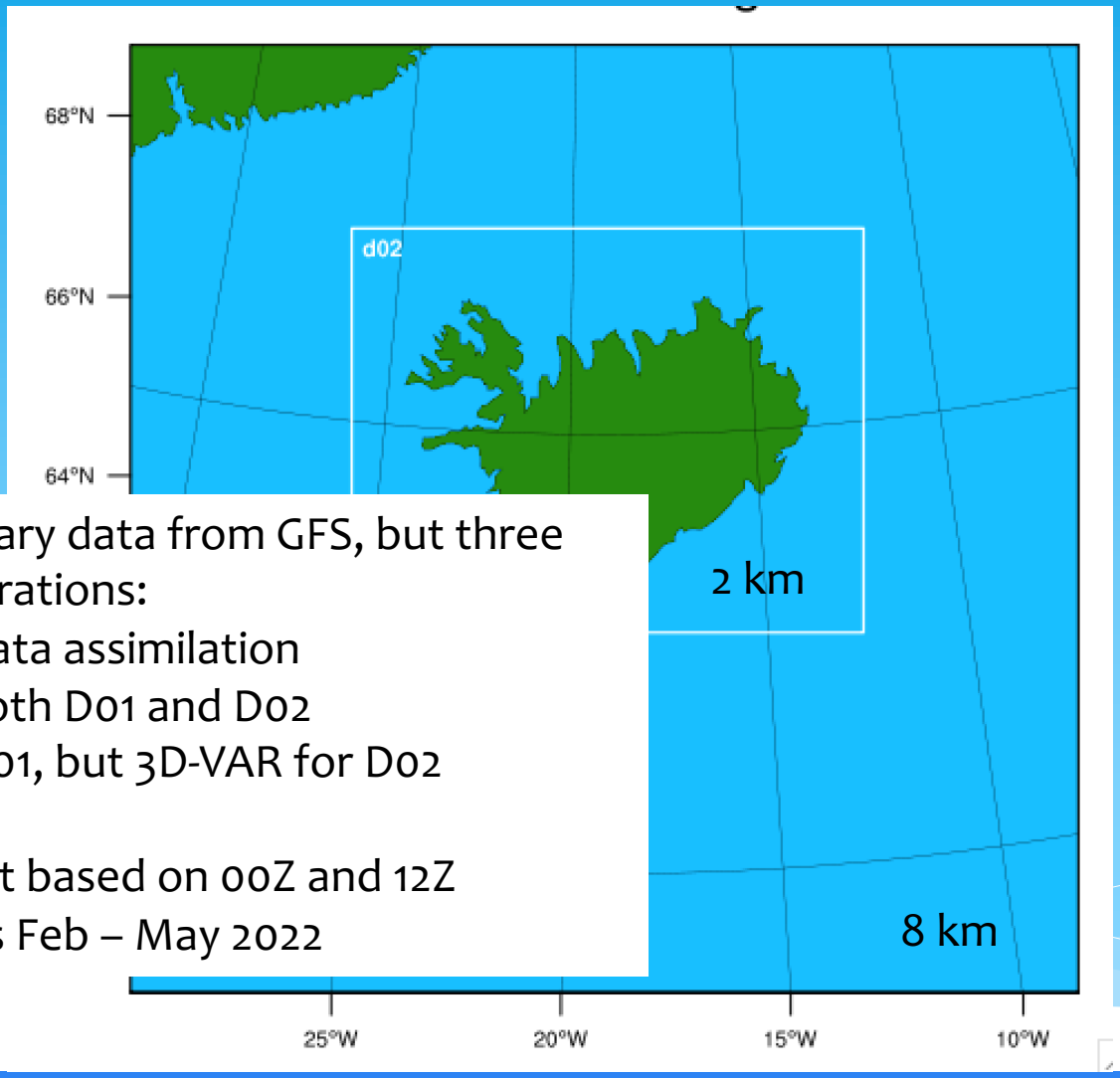
WOD overview – 3D-VAR

Initial tests were promising



Things are heating up

WOD applications – data assimilation



Initial and boundary data from GFS, but three different configurations:

1. Control, no data assimilation
2. 3D-VAR for both D01 and D02
3. 4D-VAR for D01, but 3D-VAR for D02

Compare 12hr fcst based on 00Z and 12Z analysis, period is Feb – May 2022

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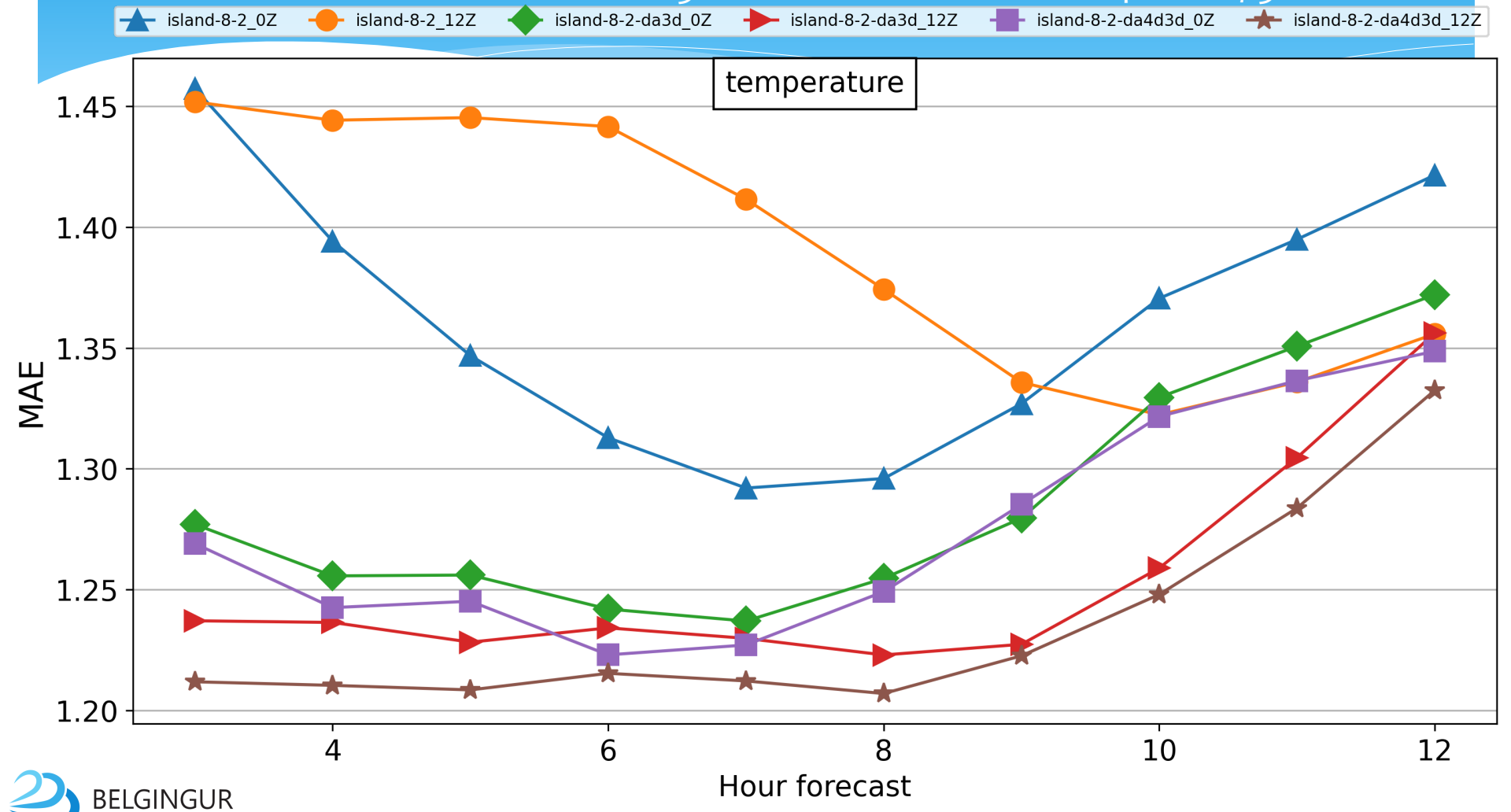
WOD overview



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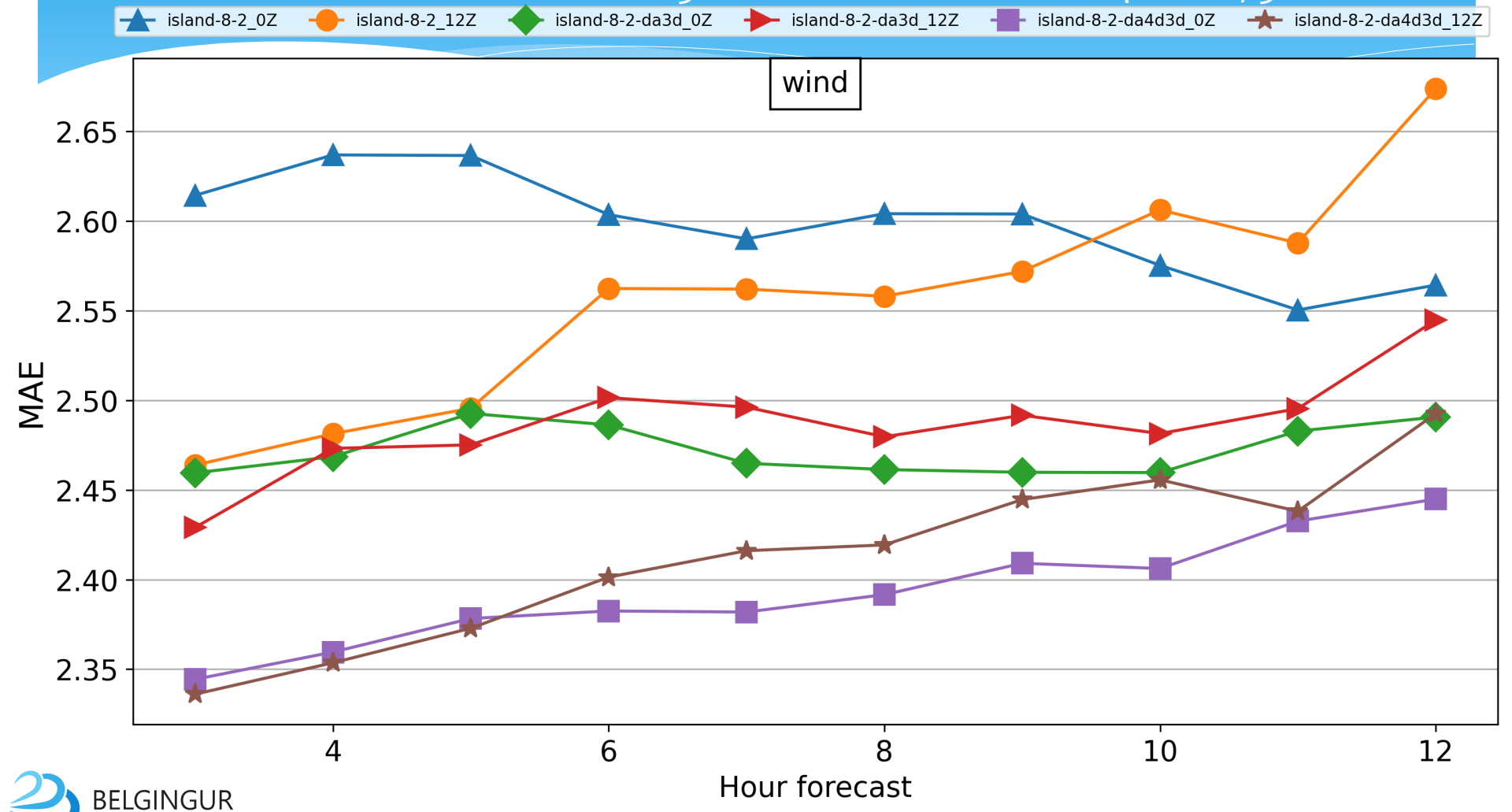
WOD overview

CTRL 3D-VAR 4D-VAR / 3D-VAR



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WOD overview

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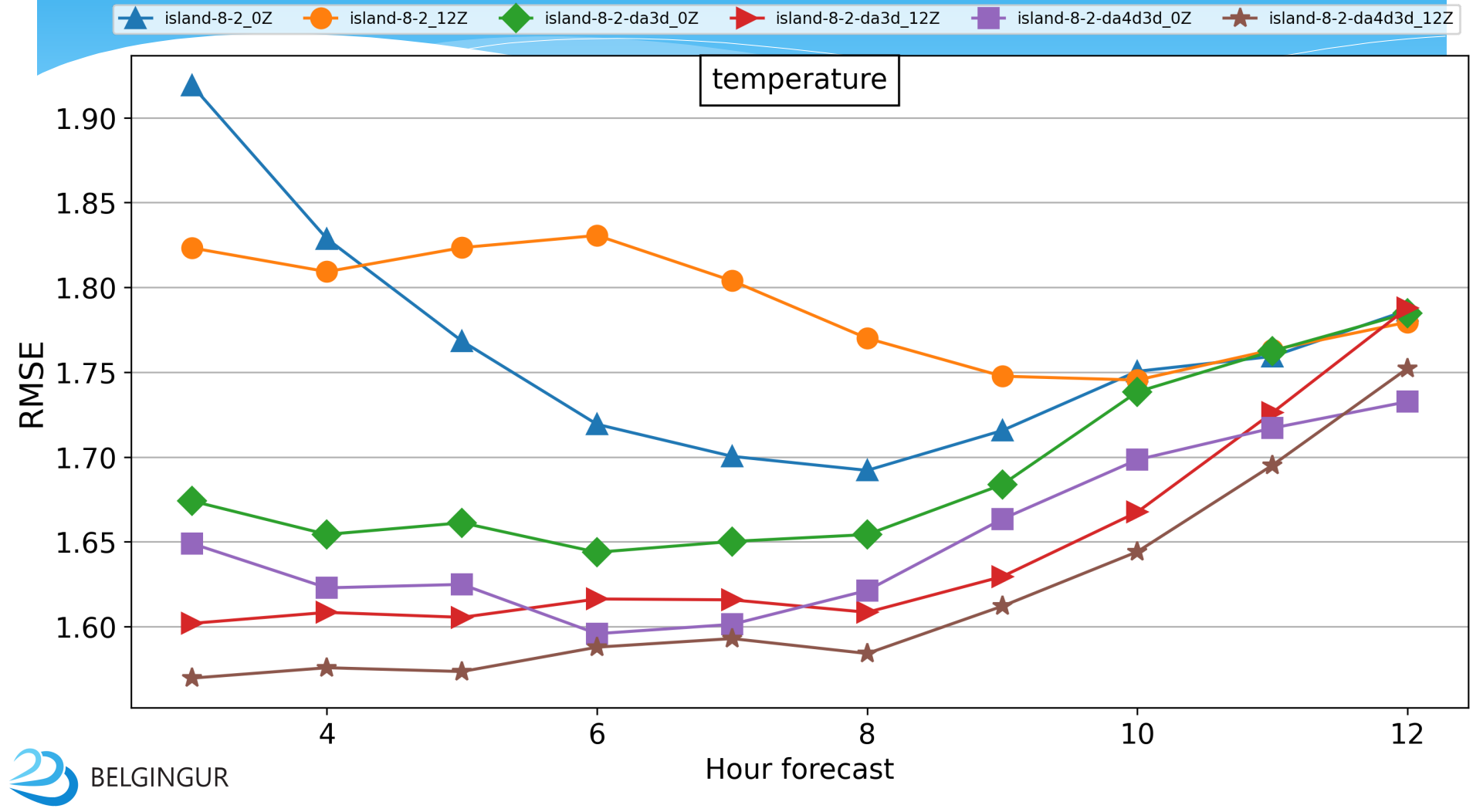

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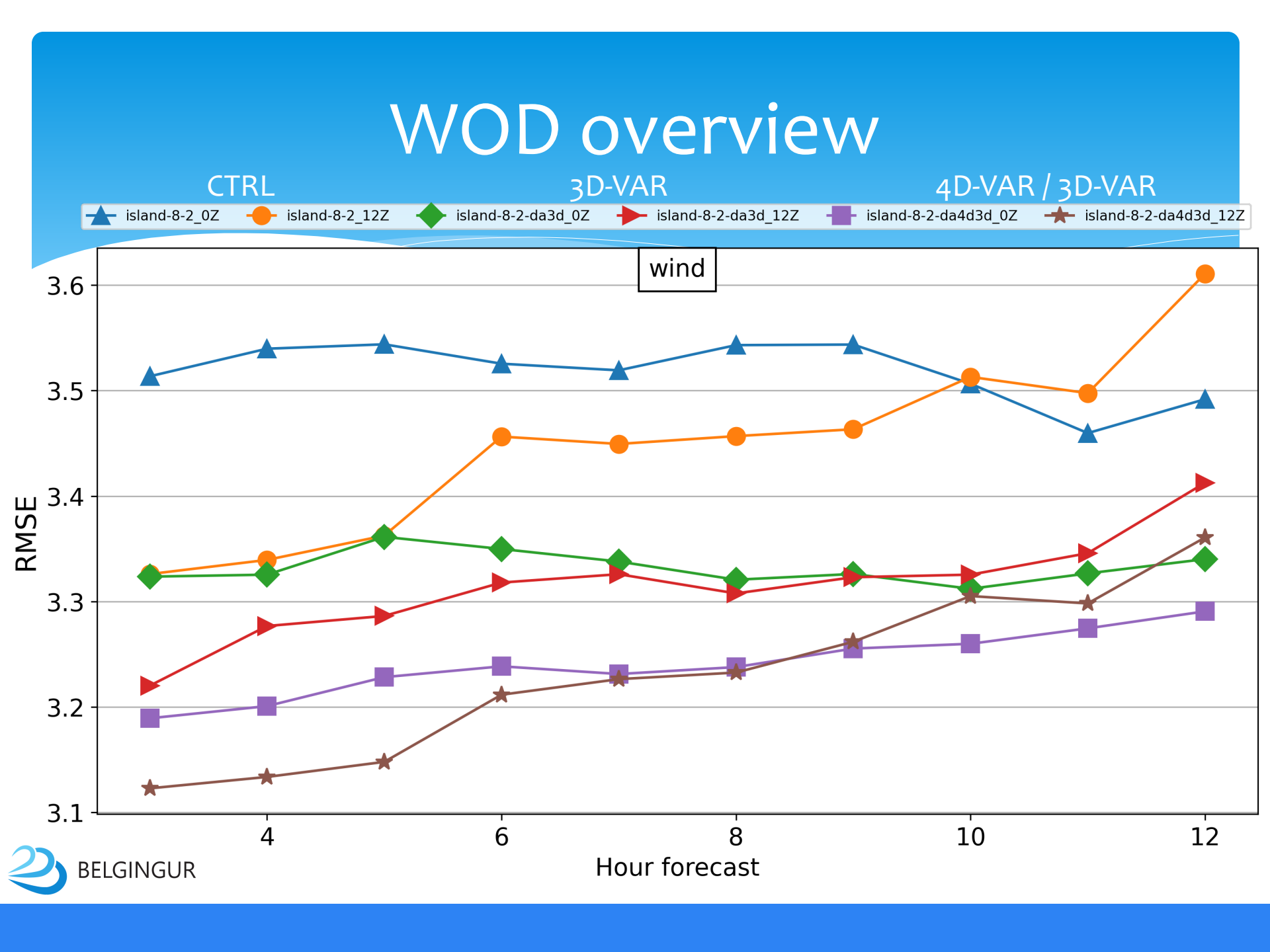
WOD overview

CTRL 3D-VAR 4D-VAR / 3D-VAR



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WOD overview

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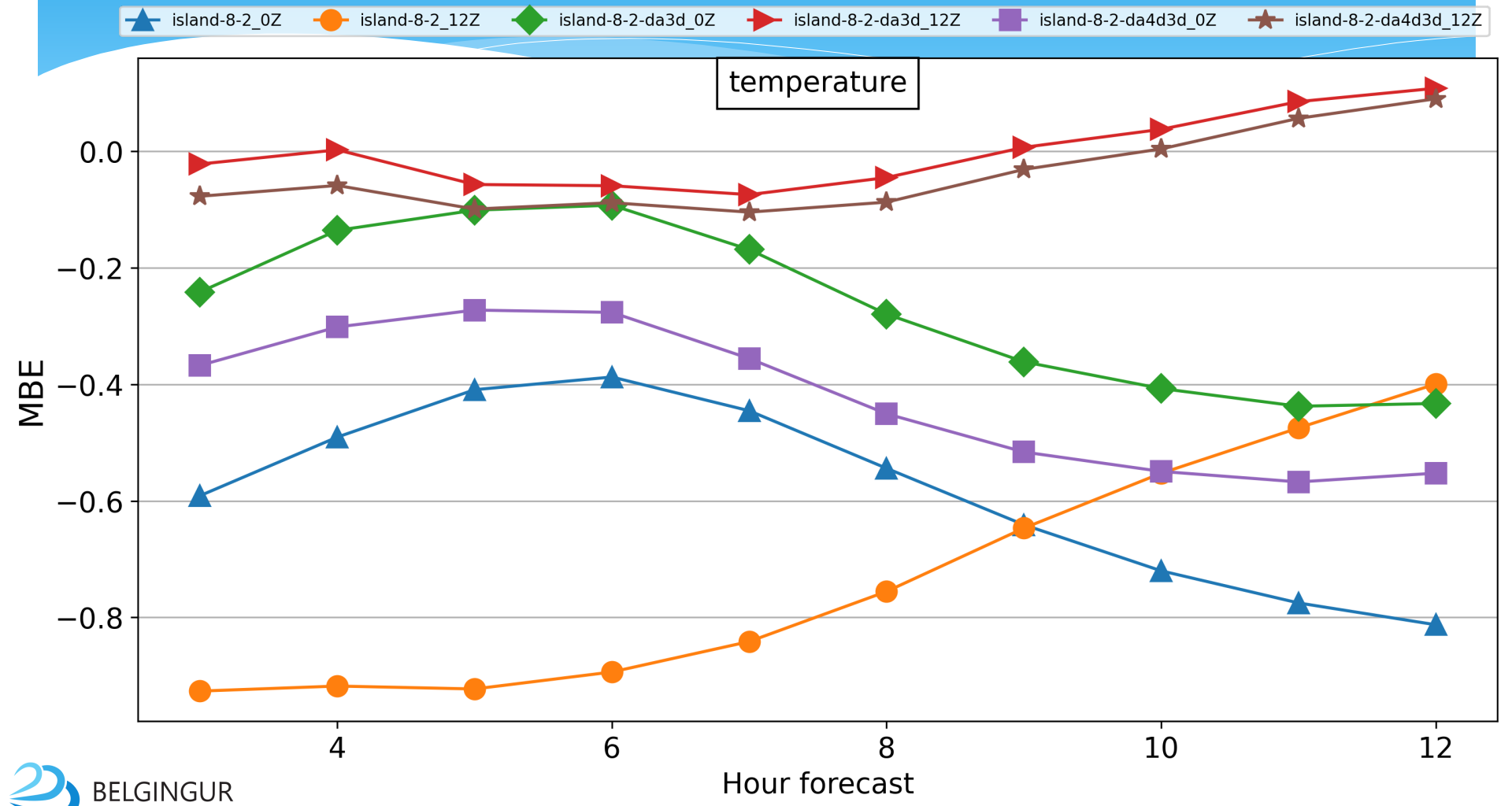

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WOD overview

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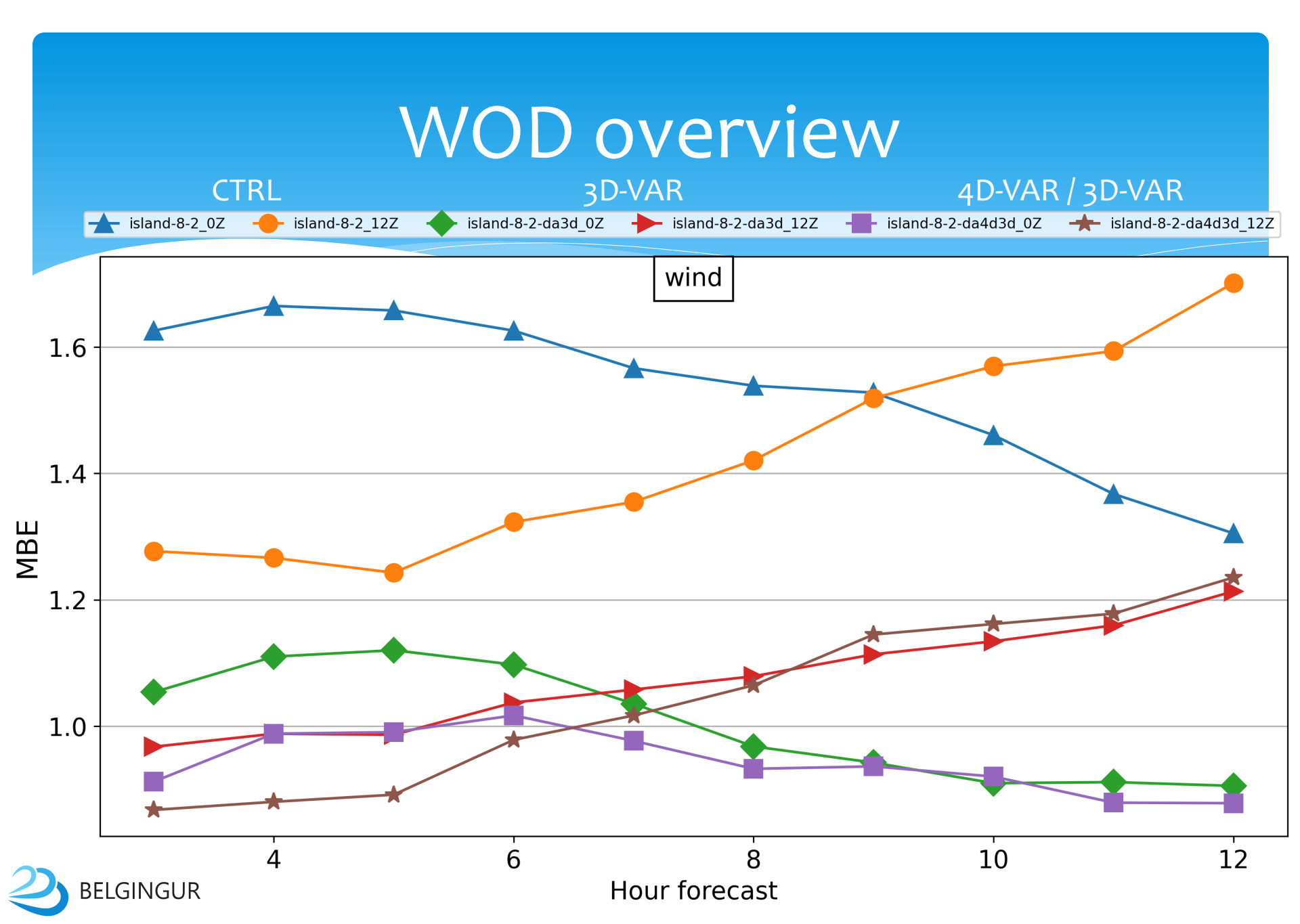

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Summary

* The WOD system can be used to create conventional short- to medium-range weather forecasts for any location on the globe
* Originally designed to meet the needs of NMHs that have limited resources and little experience in running operational forecast systems
* It is based on **Open Source** components
* It is **Event Driven**
* It is **Scalable** and **Resilient**
* Use of variational data assimilation shows promising results
* Output can be used as input into other decision support software