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Shortwave Radiation in Reanalyses: Skill Scores and Spatial Patterns

Eadaoin Doddy

MÉRA workshop: 17-05-2018

Reanalysis datasets

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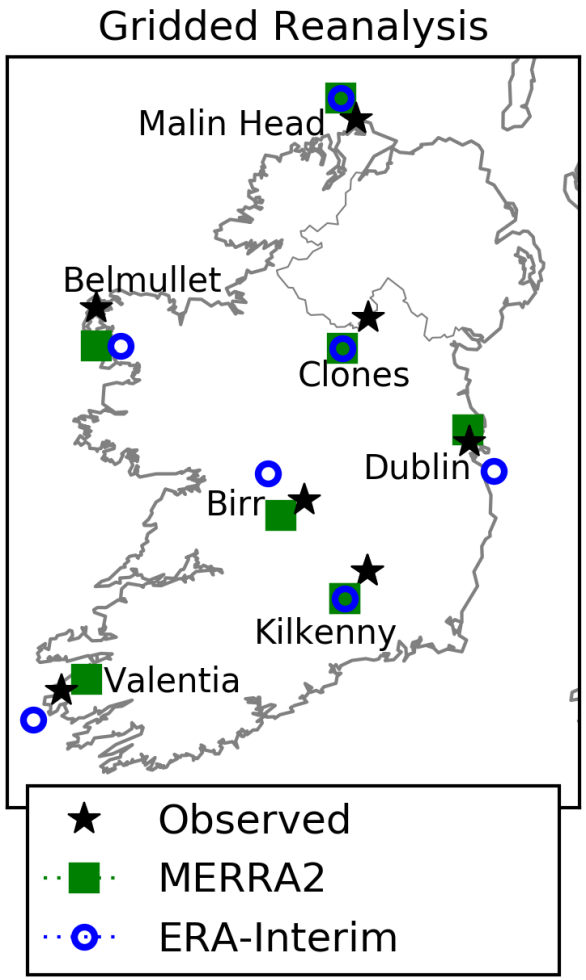
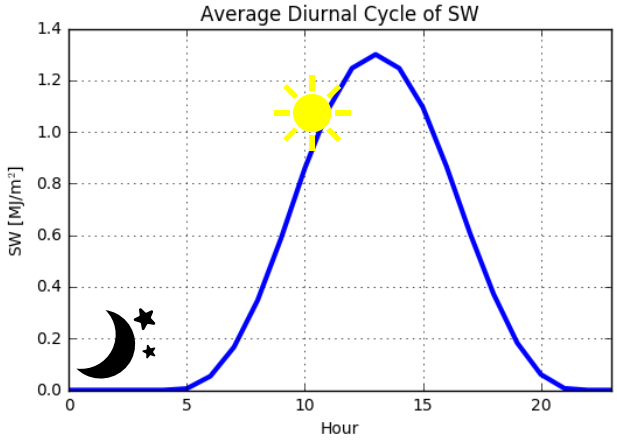
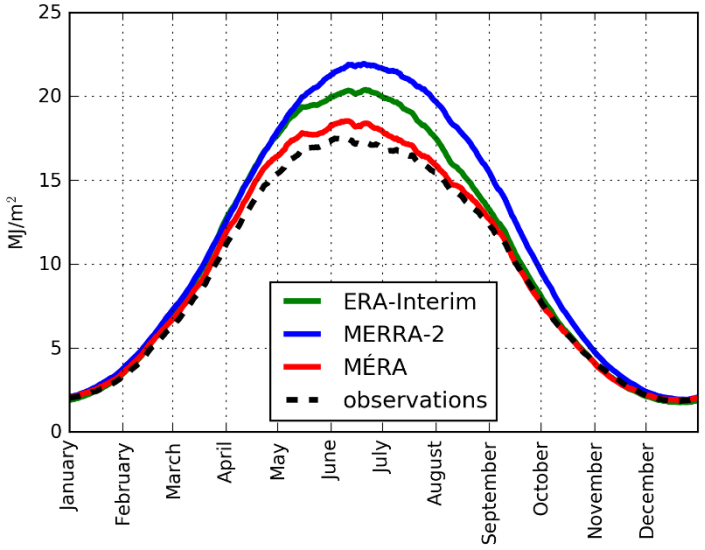
Reanalysis product	Provider	Spatial resolution	Years covered
MÉRA	Met Éireann	2.5km x 2.5km	1981 - present
ERA-Interim	ECMWF	0.75° x 0.75° (~78km)	1979 - present
MERRA-2	NASA	0.5° x 0.625° (~ 50km)	1979 - present



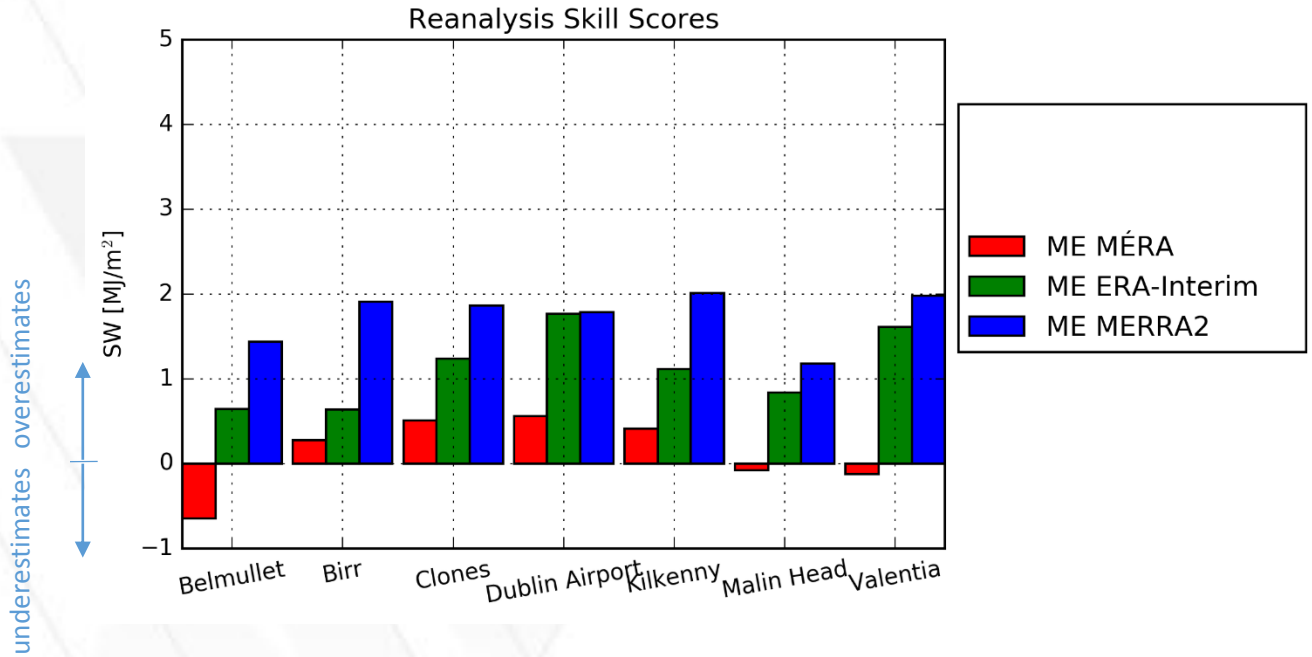
Common validation period: 1982-2007

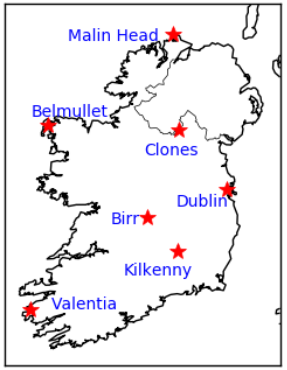
Shortwave radiation (SW)



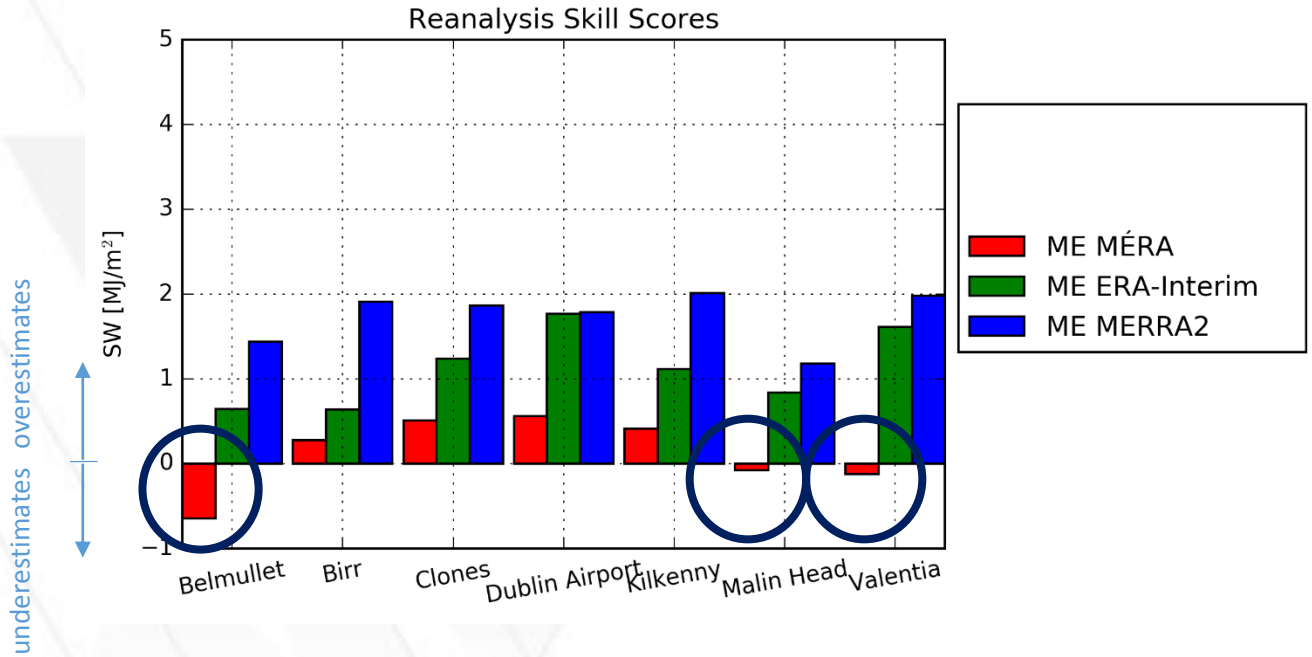


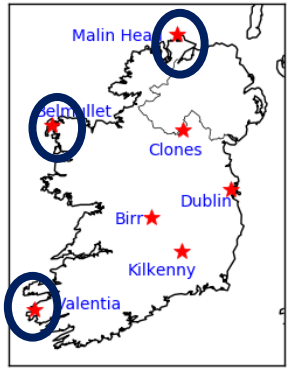
Shortwave radiation (SW) skill scores



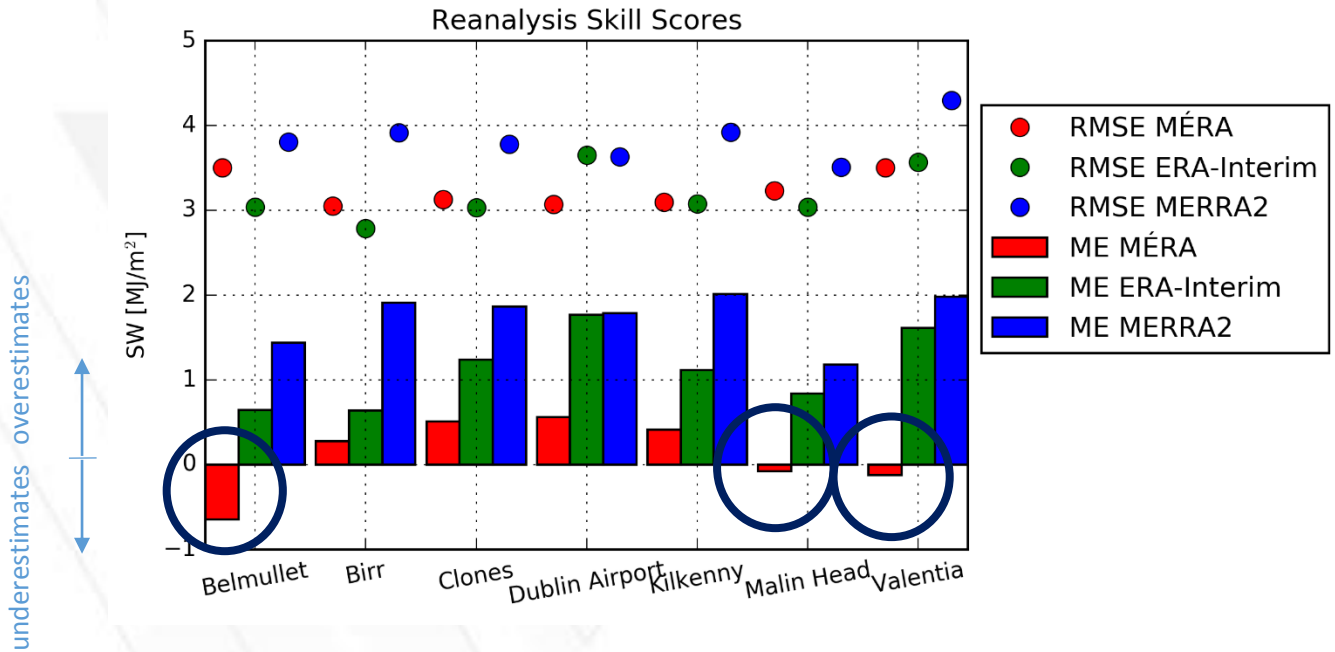


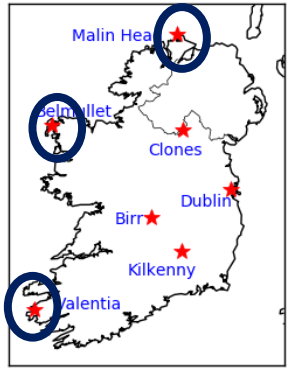
Shortwave radiation (SW) skill scores



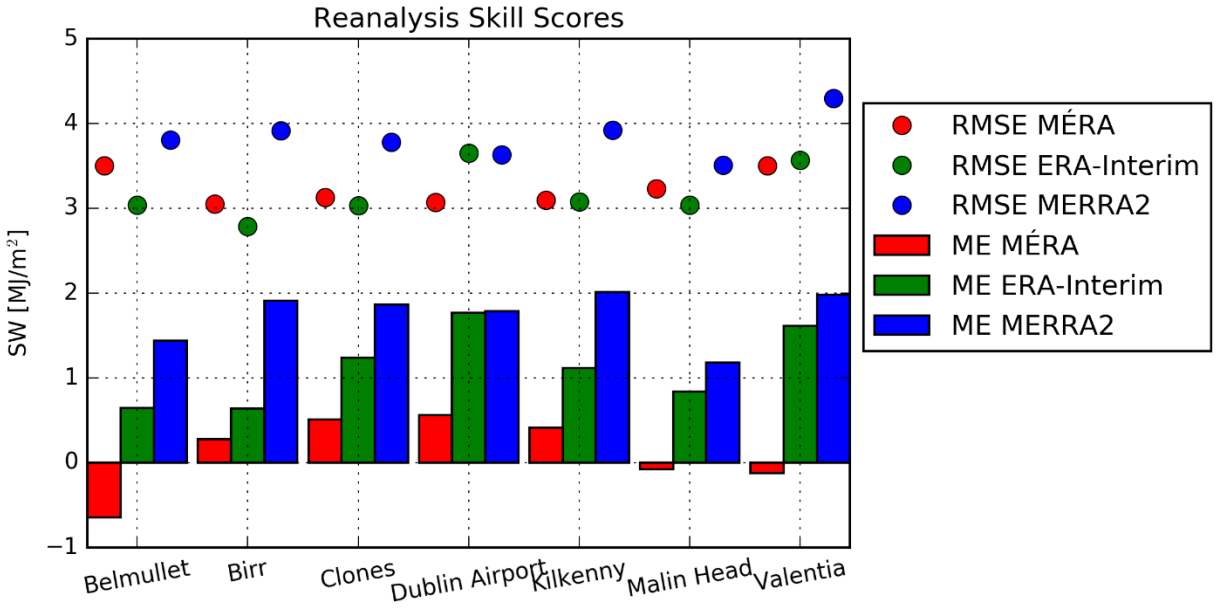


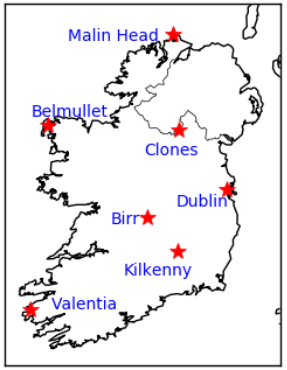
Shortwave radiation (SW) skill scores





Shortwave radiation (SW) skill scores





	ME [MJ/m²]	RMSE [MJ/m²]	Anomaly Correlation Coefficient (ACC)	Pearson's Correlation
MÉRA	0.13	3.23	0.77	0.91
ERA-Interim	1.12	3.17	0.71	0.93
MERRA-2	1.74	3.84	0.60	0.91

Shortwave radiation (SW) skill scores

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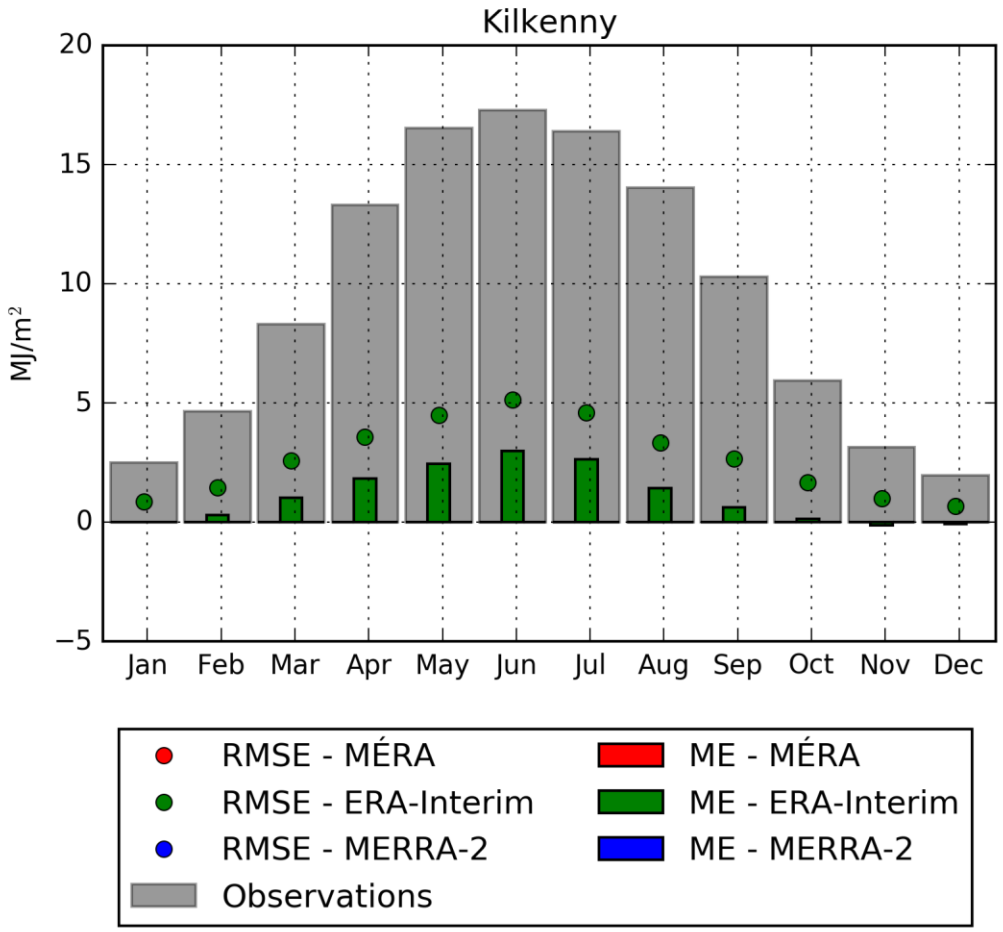

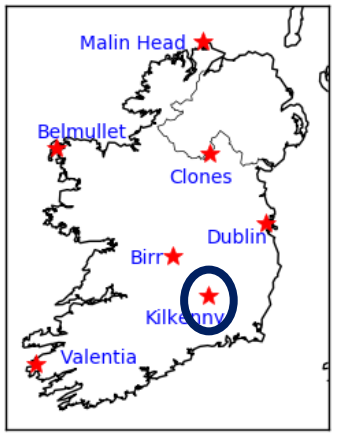

Shortwave radiation (SW) skill scores

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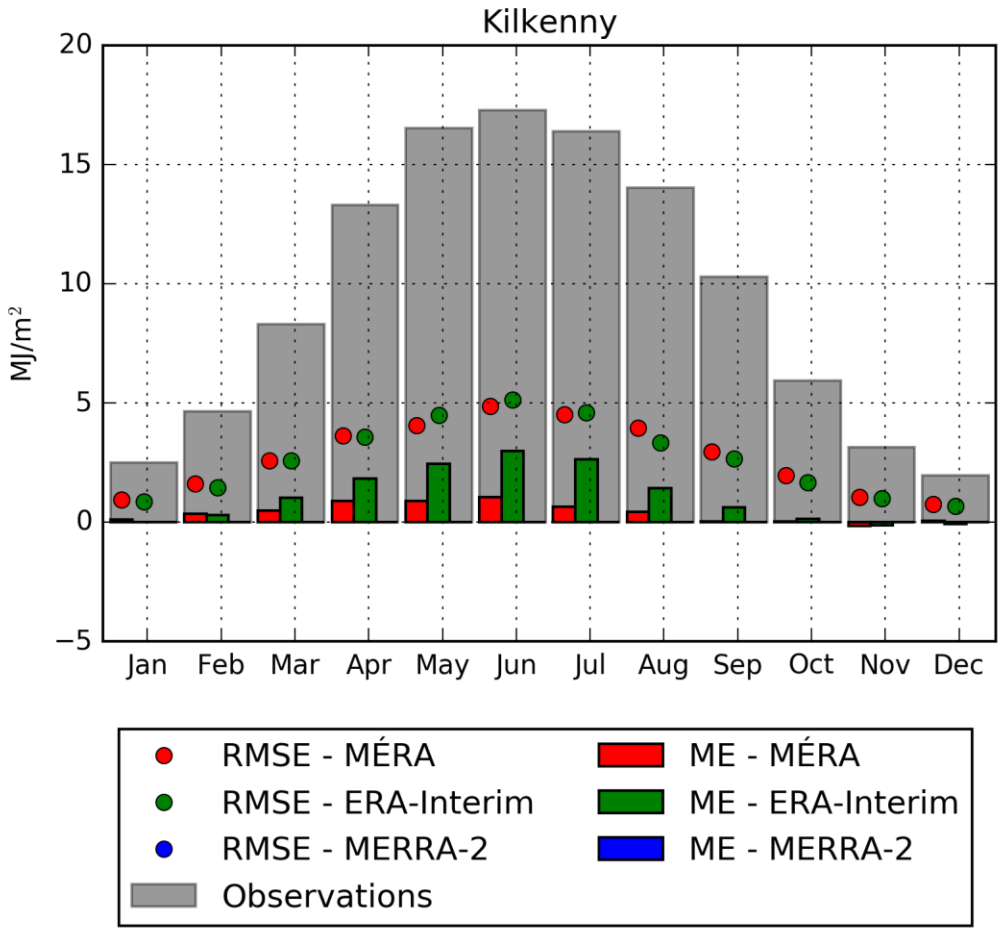

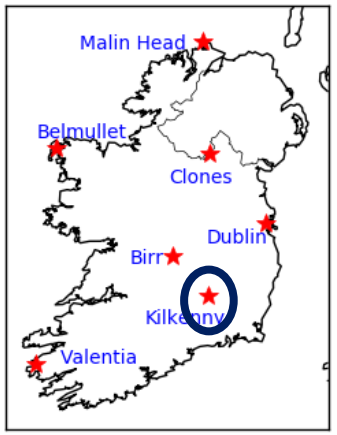

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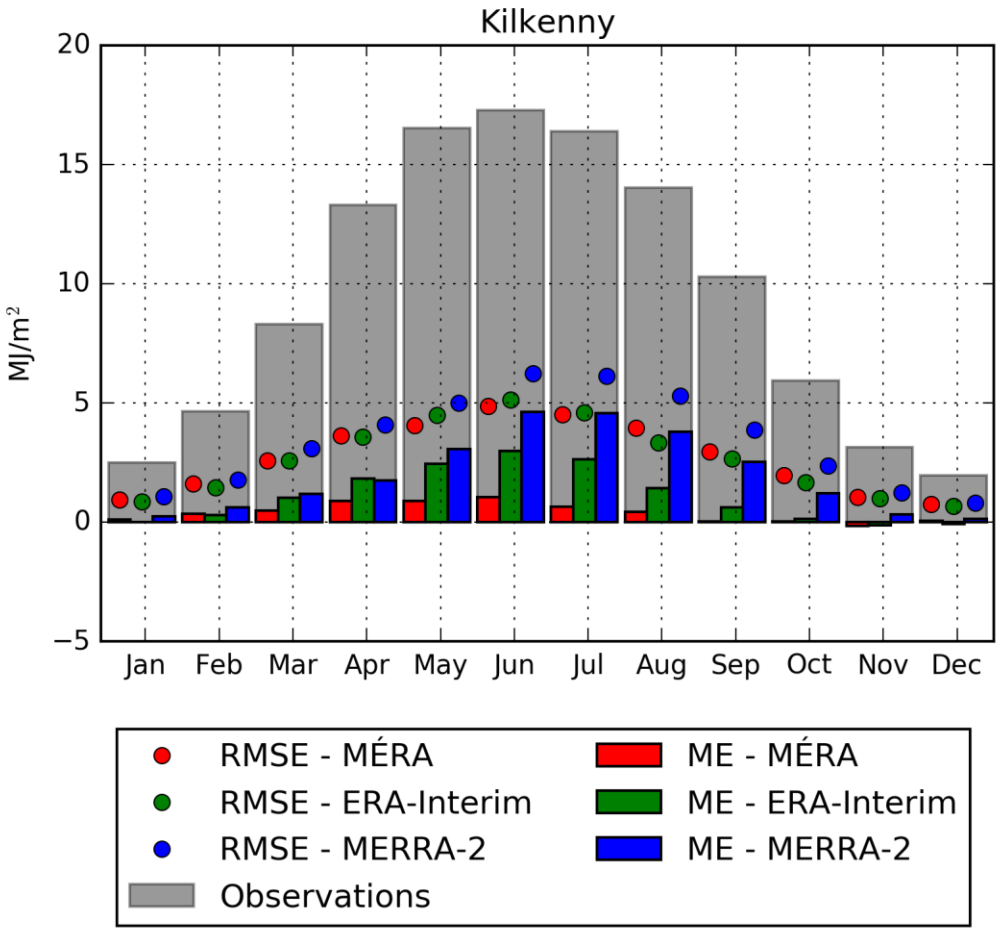

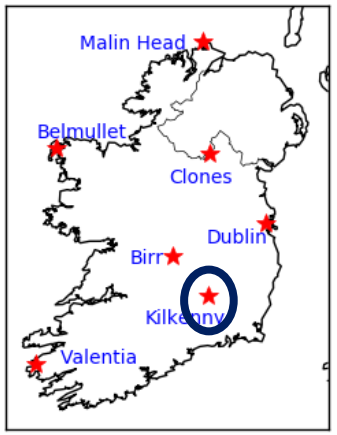

Daily SW spatial pattern

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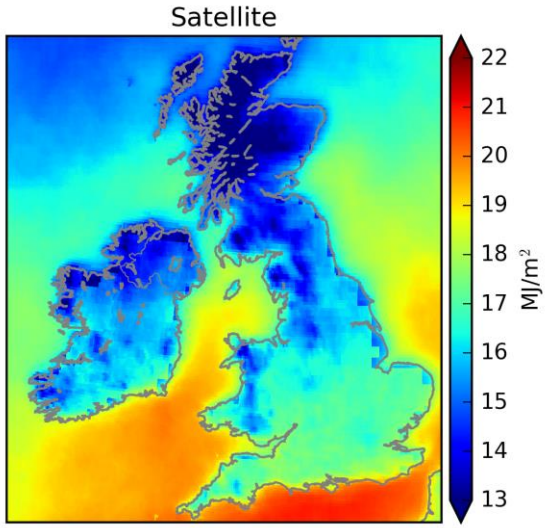
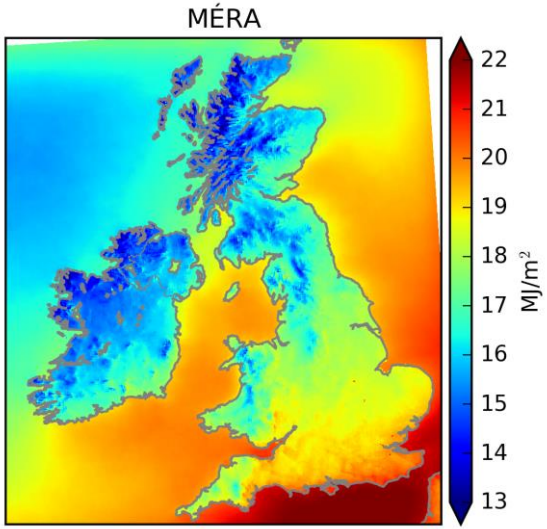
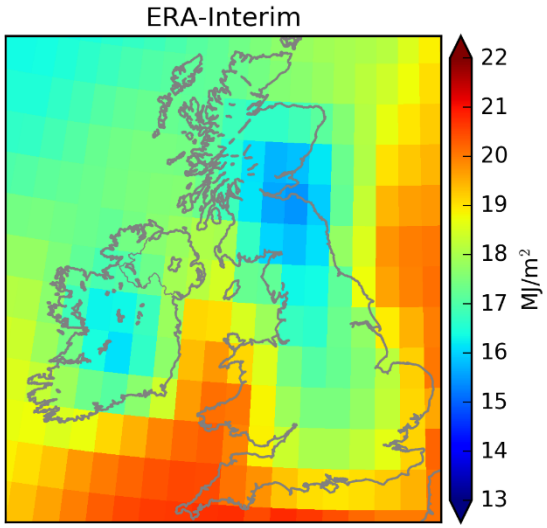
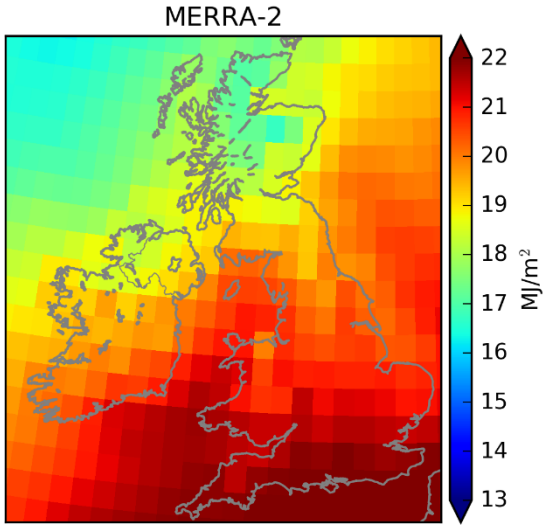


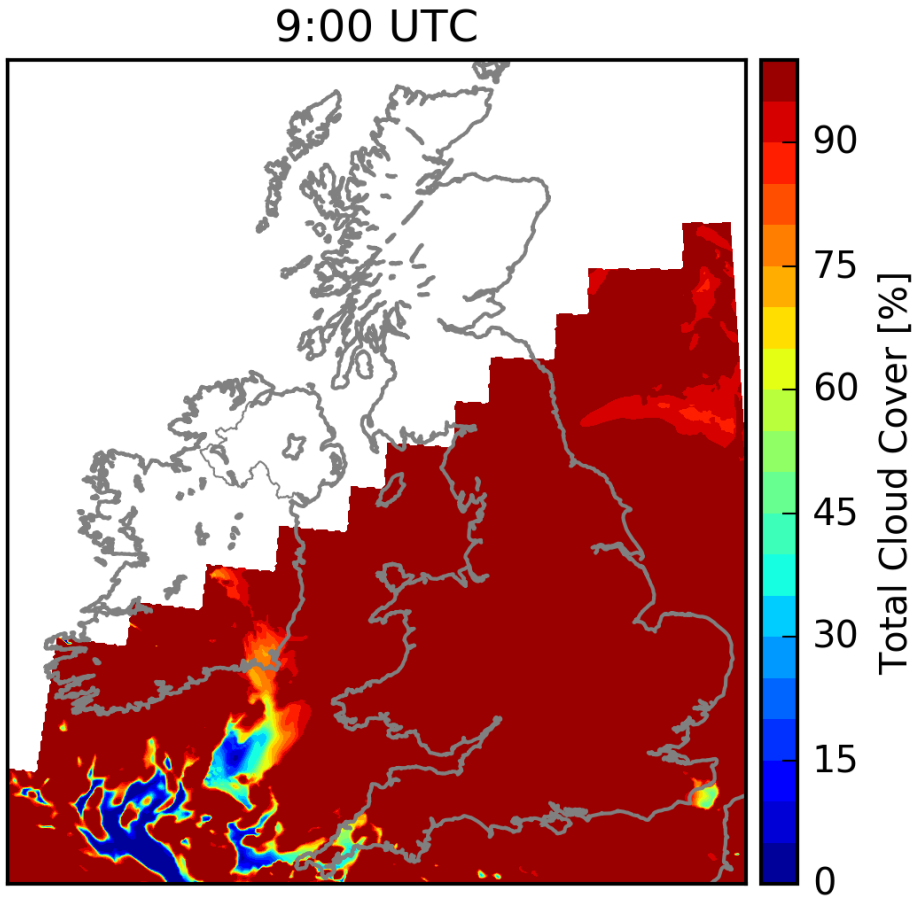
- North-south variation
- East-west variation (land/sea contrast)







‘Day Time Only’ Clouds



Daily mean cloud spatial pattern

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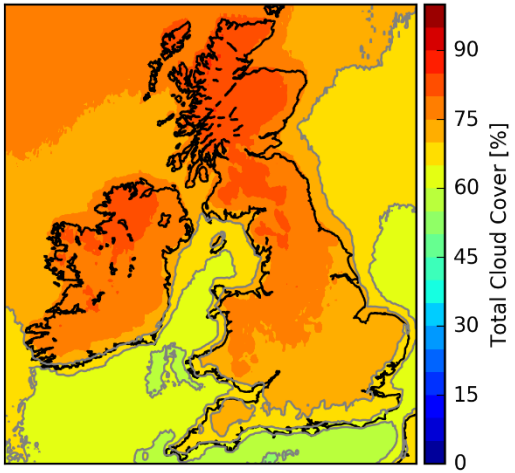
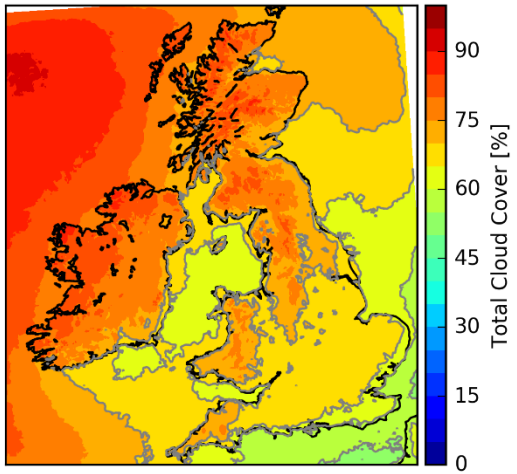
Satellite

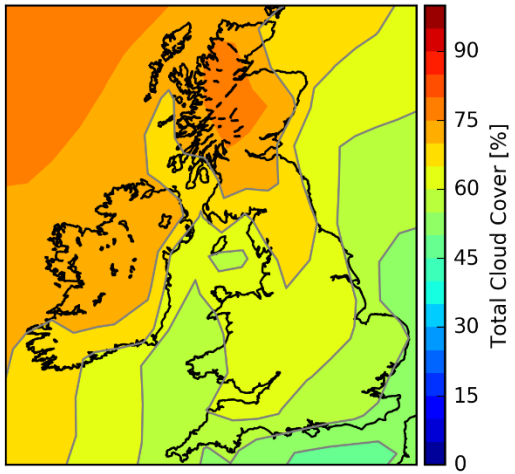


- East-west variation (land/sea contrast)
- Matches well with SW

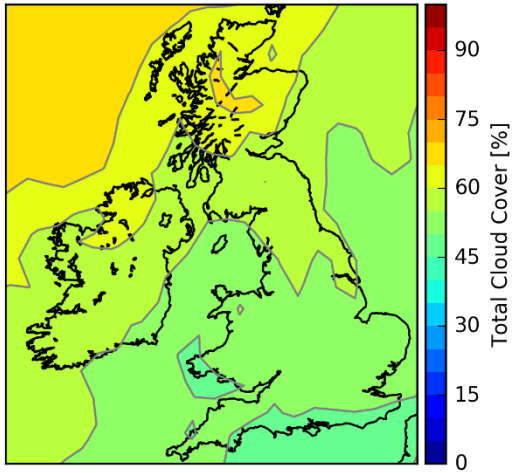
MÉRA



ERA-Interim



MERRA-2



Daily SW spatial pattern

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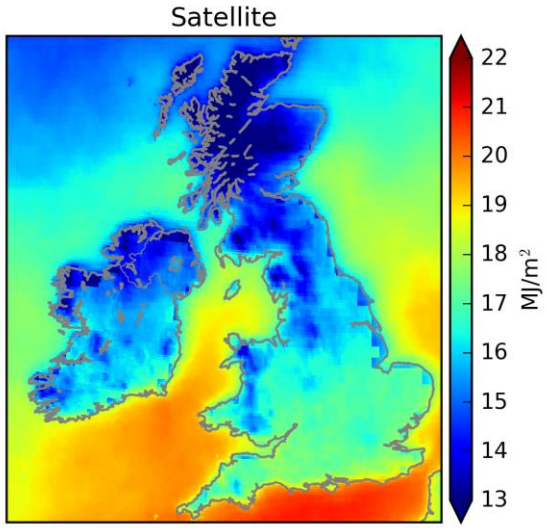

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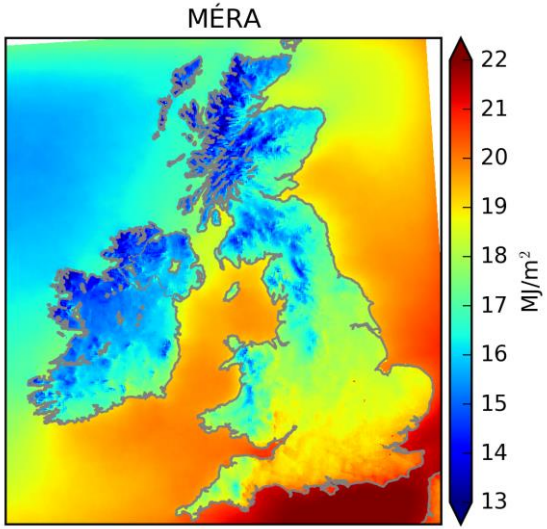

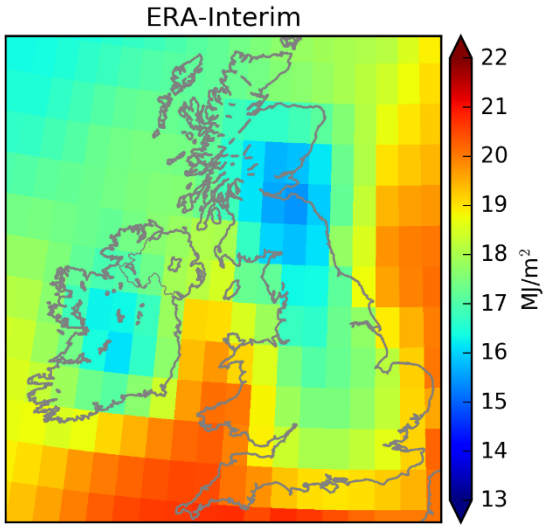

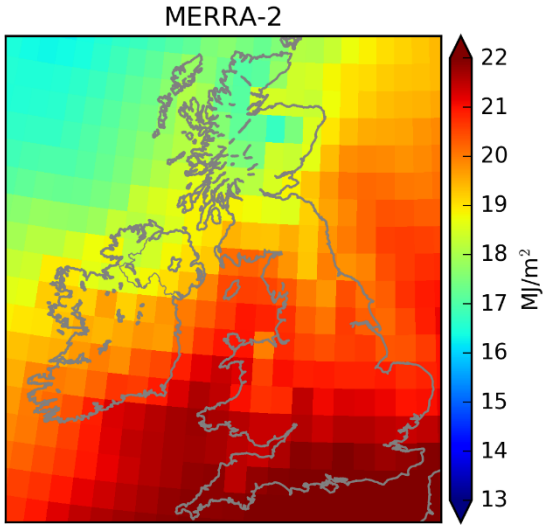

Post-processing

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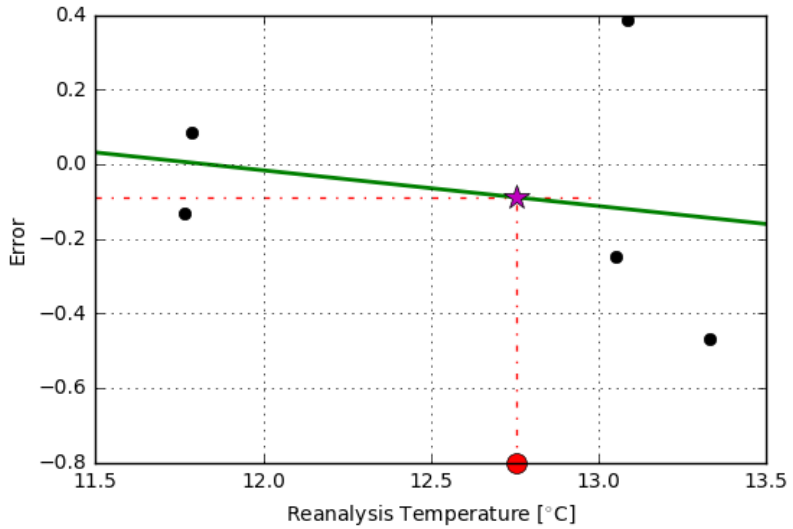
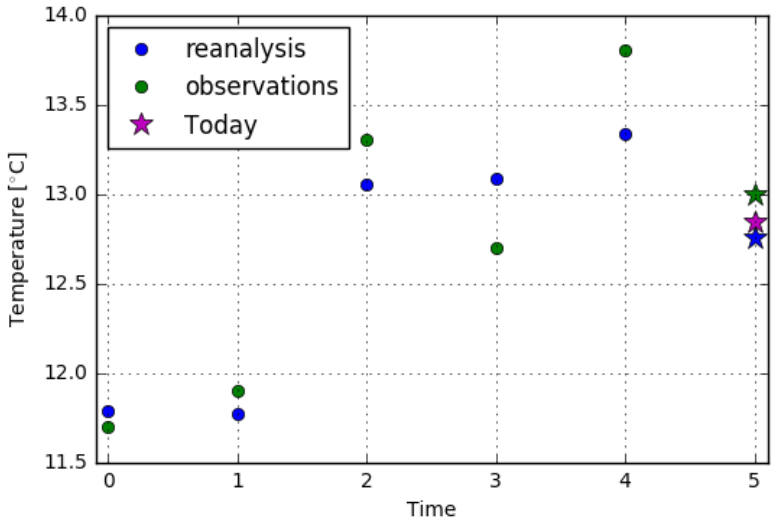
- Adaptive Linear Least Squares (LLS) Method





Improvement with post-processing

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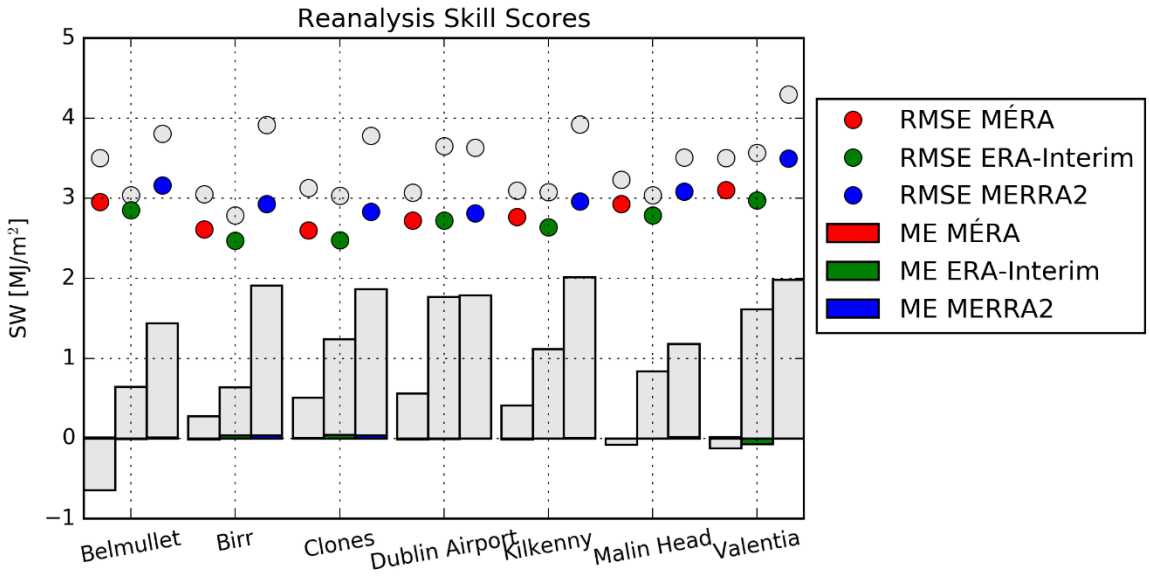

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Improvement with post-processing

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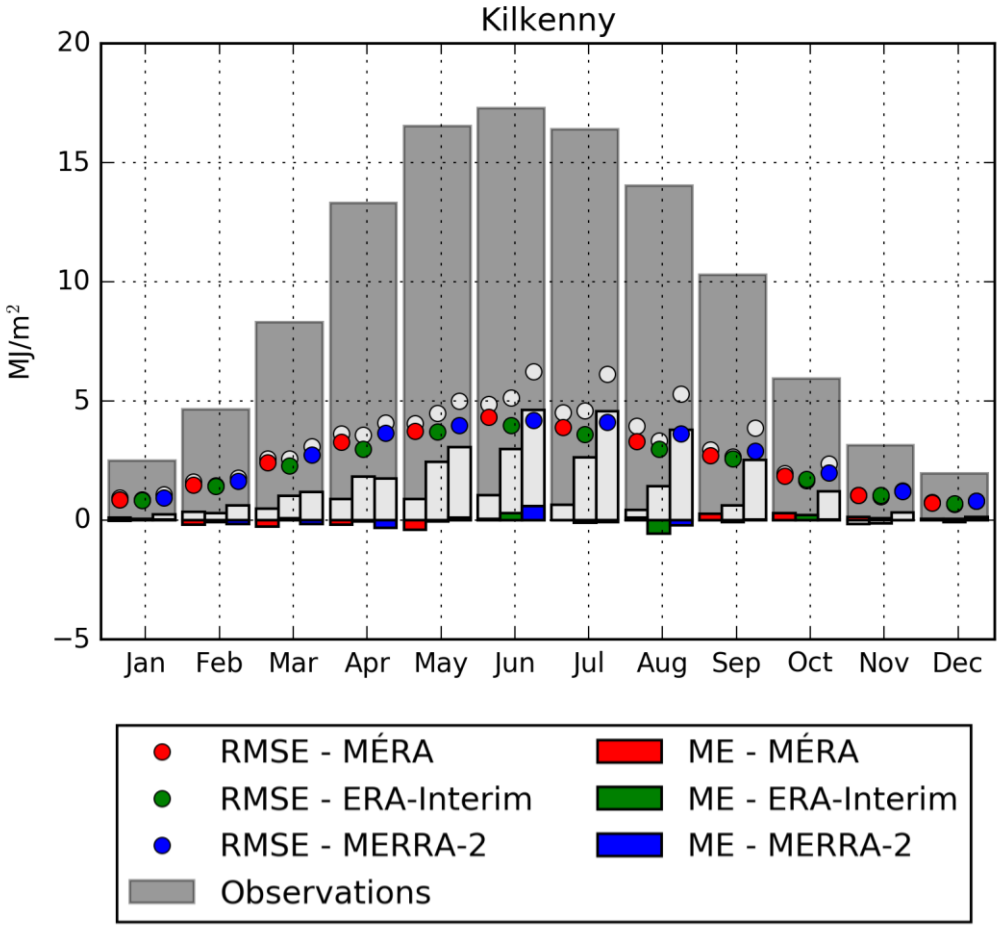
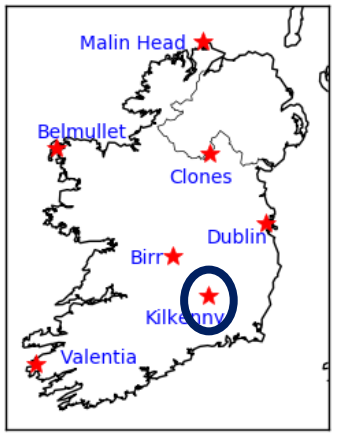
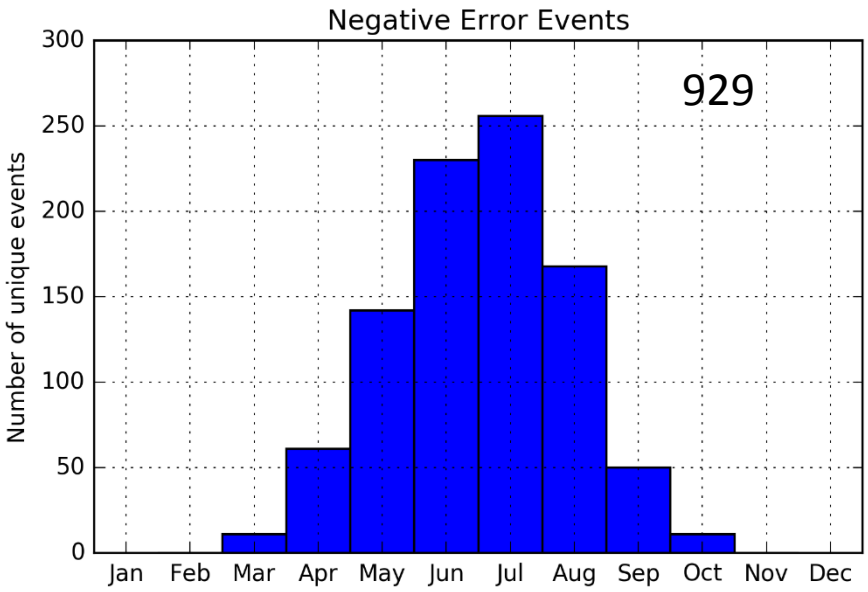


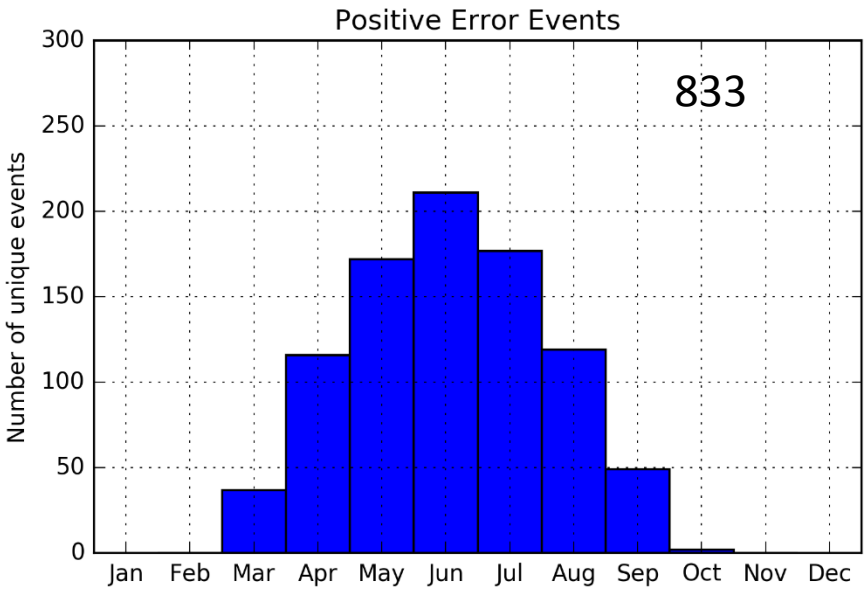


Large SW Error Events - MÉRA

Model underestimates SW



Model overestimates SW



- Most large errors only occur at one station at a time
- No large error events in winter
- 93 events overlap both categories

MSLP

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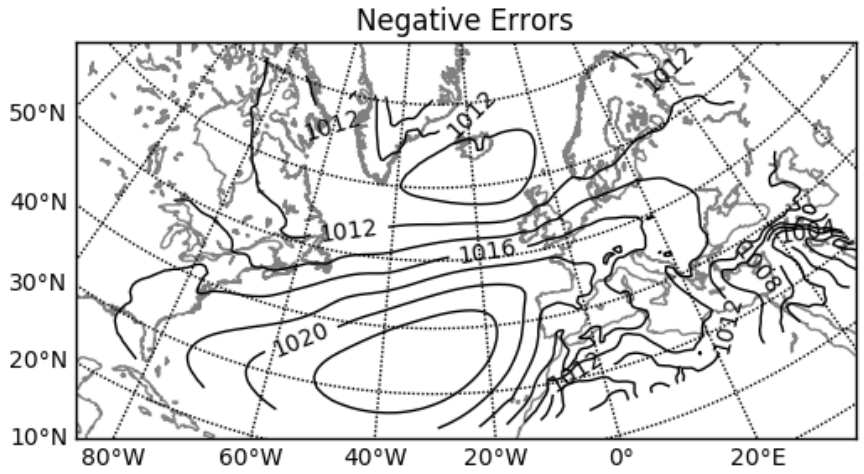

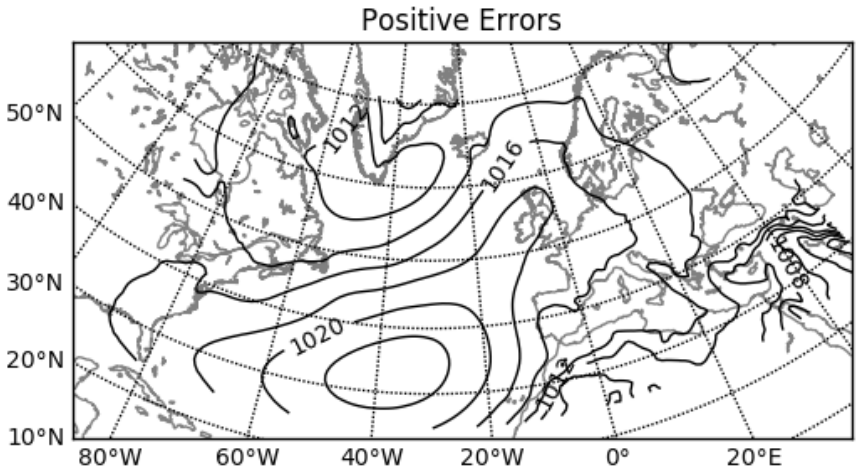

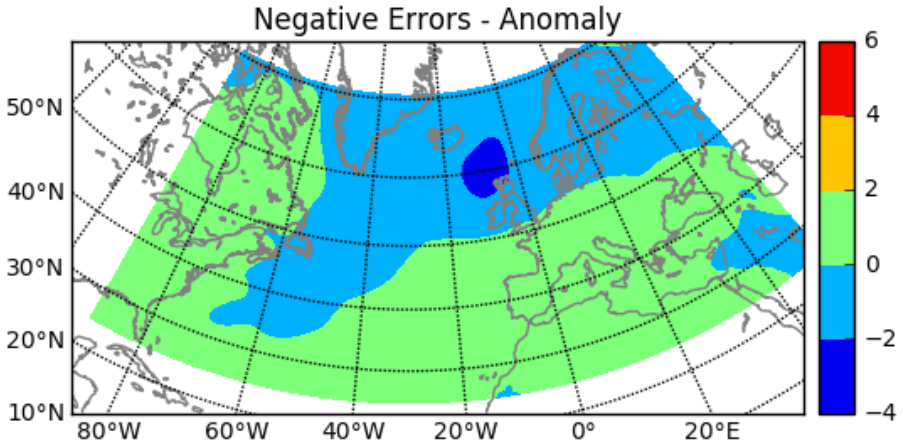

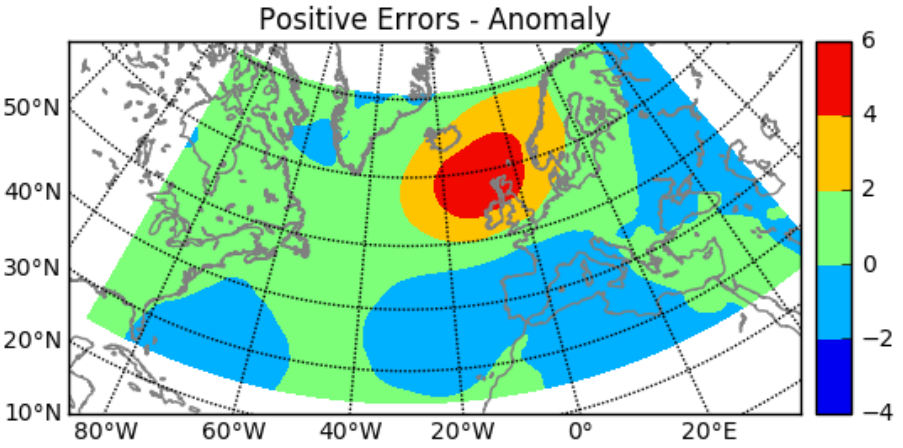

- ERA-Interim data

Temperature 500hPa

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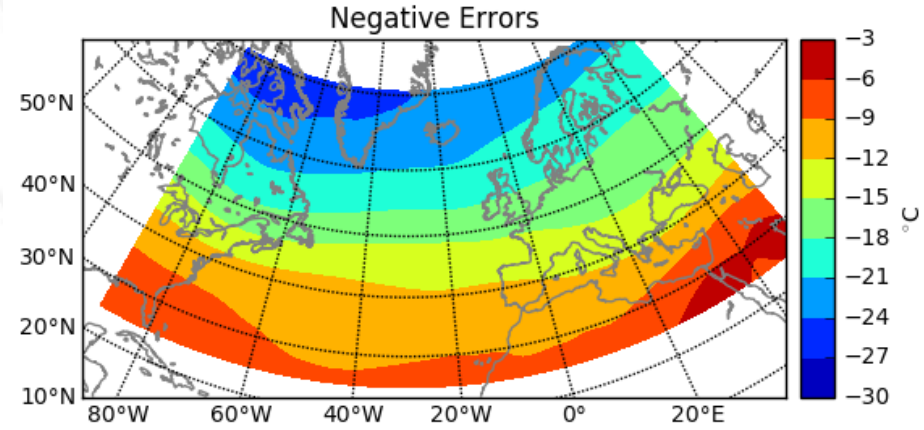

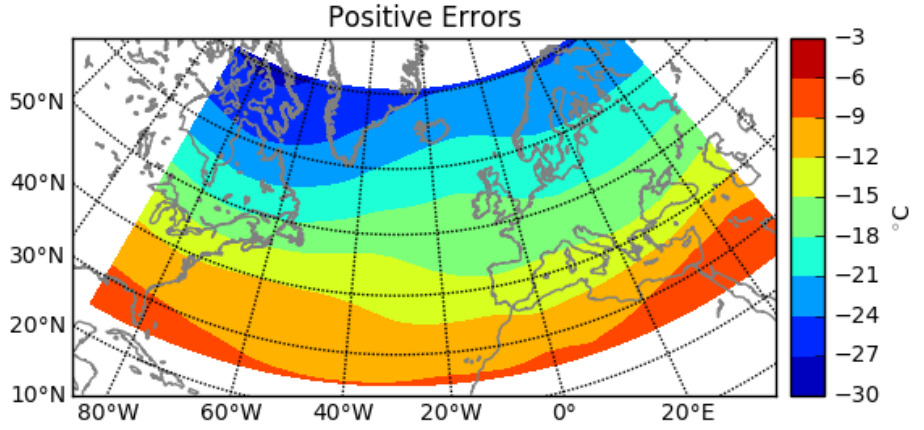

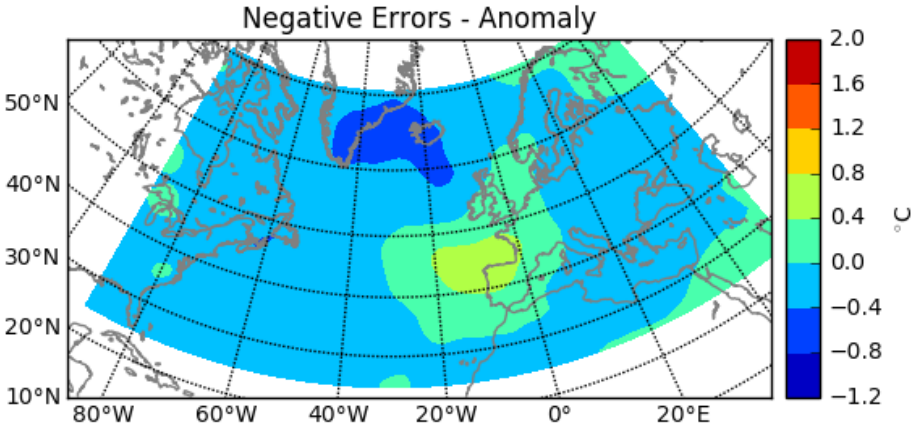

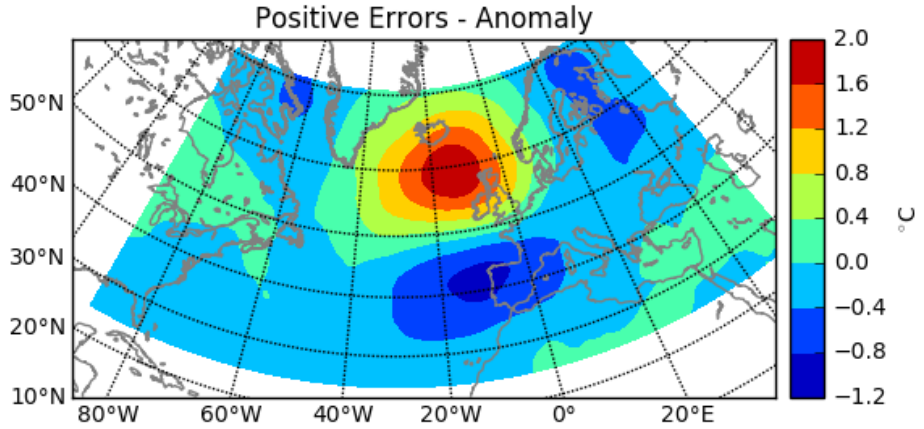

- ERA-Interim data

Summary

- MÉRA generally has better skill scores.
- A simple post-processing technique reduces systematic errors in all reanalyses.
- MÉRA captures the spatial variability of SW best.
- **Future work:**
  - PCA analysis.
  - Adaptive spatial multivariate post-processing for renewable energy.

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