

# An evaluation of the relationships between MÉRA derived wind speeds and SW radiation and large-scale atmospheric pressure patterns

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MÉRA workshop



OÉ Gaillimh  
NUI Galway



Coláiste na Tríonóide, Baile Átha Cliath  
Trinity College Dublin  
Ollscoil Átha Cliath | The University of Dublin



**ervia**



# Climate variability impact on renewable energy resources

- Challenges
  - Intermittency of resources on medium to long timescales
    - Leading to volatility of renewable power generation and energy prices;
    - High costs for energy grid balancing.
- Opportunities
  - Efficient dimensioning of power and storage facilities to long term temporal and spatial variability of resources;
    - Including regional and international power transmission requirements.
  - Predictability of average production conditions some months ahead? (Dunstone et al. 2016)

# Large-scale pressure anomalies patterns esipp



Energy Systems Integration  
Partnership Programme

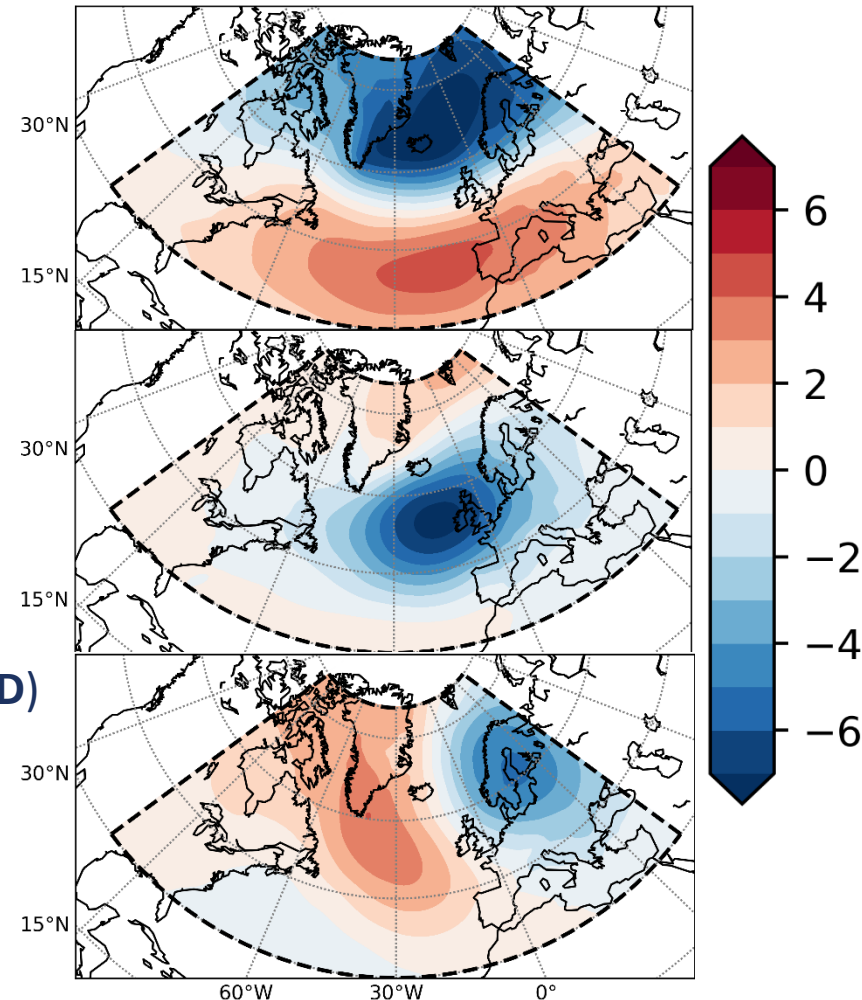
## North Atlantic Oscillation (NAO)

- Dominant large-scale pressure anomalies pattern in the Euro-Atlantic sector;
- Stochastic;
- Impact several meteorological variables relevant to renewable energy.

## East Atlantic pattern (EA)

## Scandinavian pattern (SCAND)

All plots after this refer to the  
winter DJF season  
Period: **Winters 1982-2008**



Sea level pressure anomalies patterns  
as derived from ERA-interim reanalysis

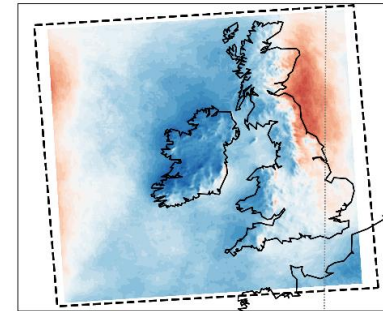
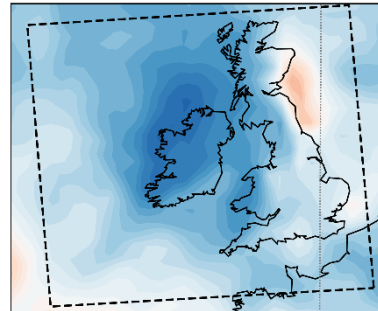
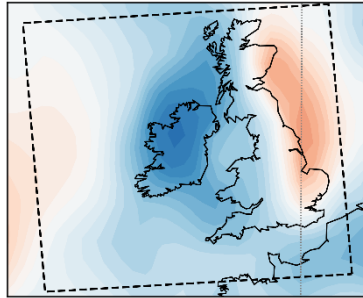
# Correlation maps – SW radiation

ERA

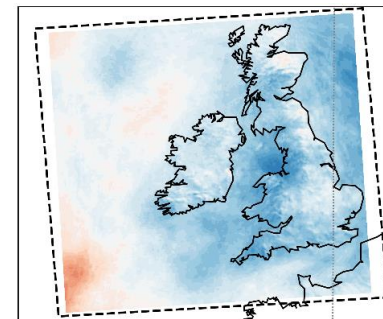
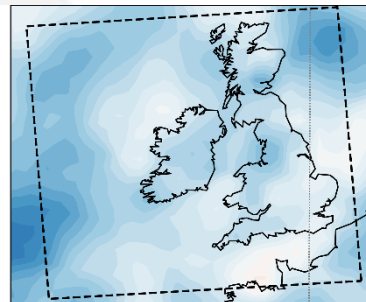
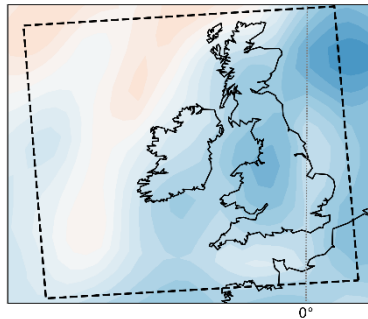
MERRA-2

MÉRA

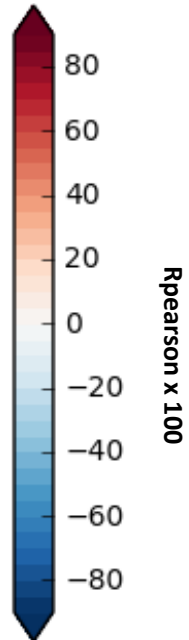
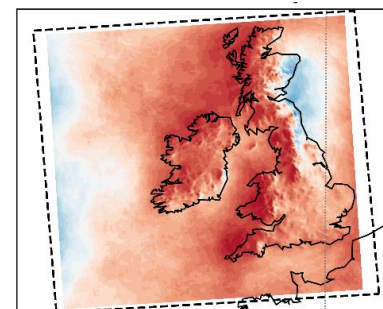
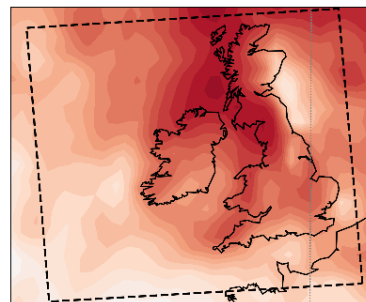
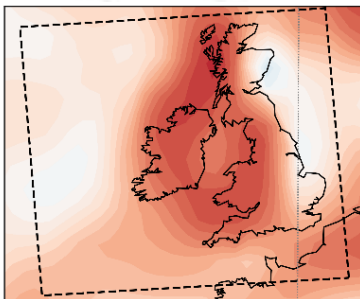
NAO



EA



SCAND

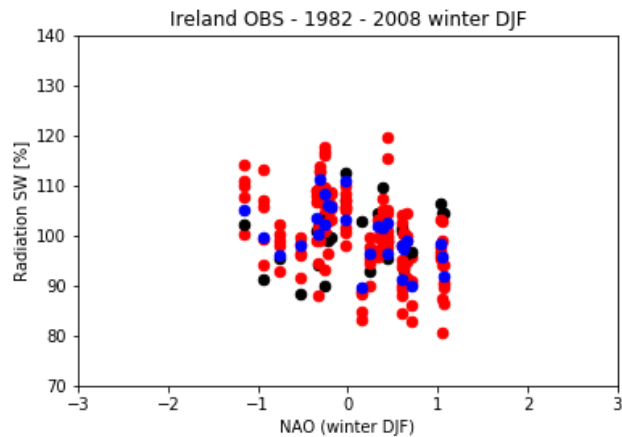
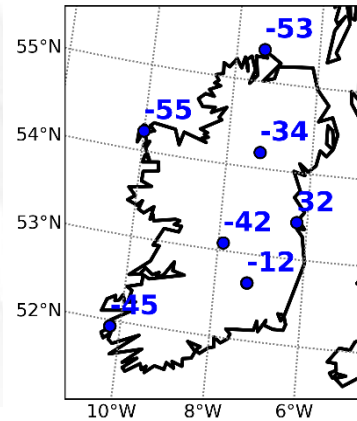
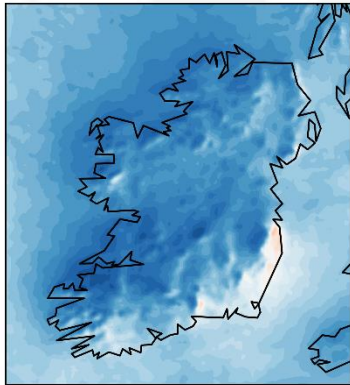


# Correlation maps – SW radiation

**NAO**

**MÉRA**

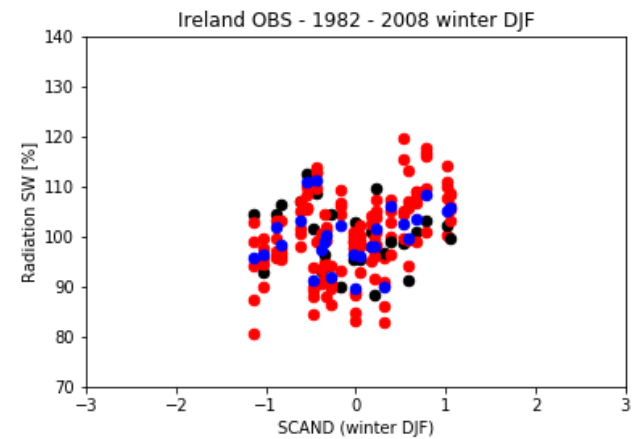
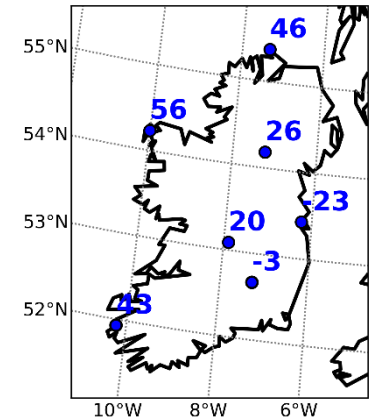
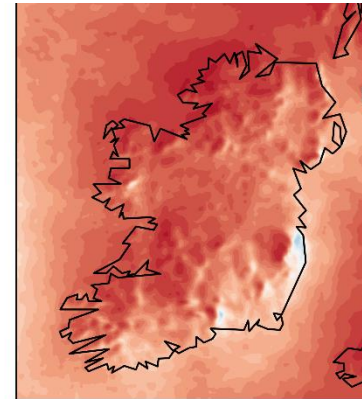
**Observations**



**SCAND**

**MÉRA**

**Observations**





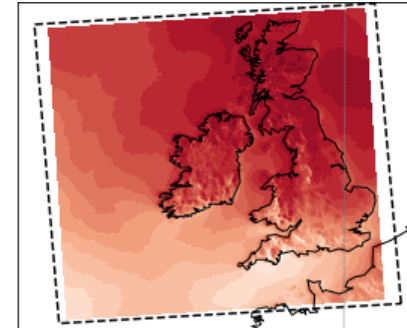
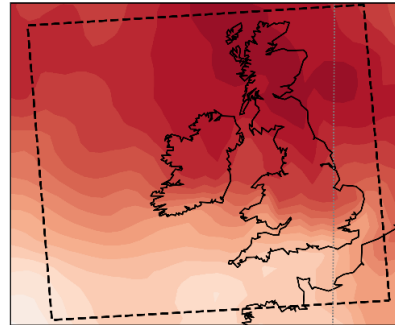
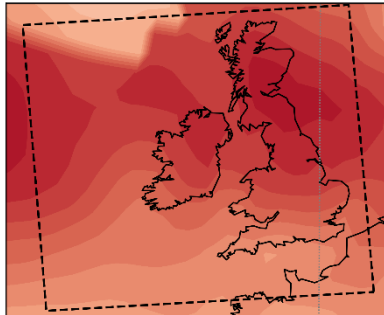
# Correlation maps – wind speed (h=10 m)

ERA-interim

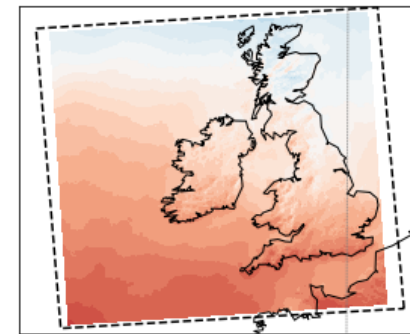
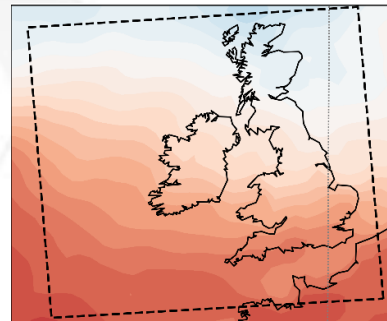
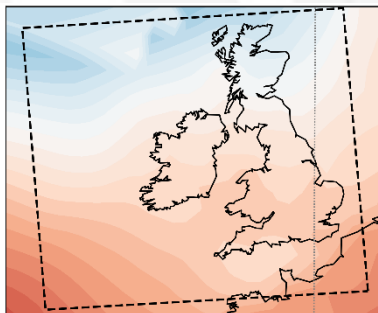
MERRA-2

MÉRA

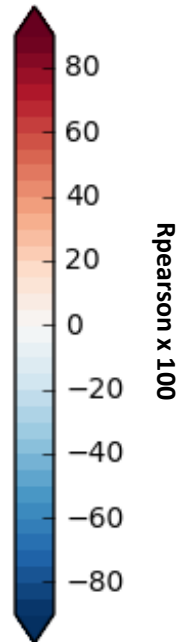
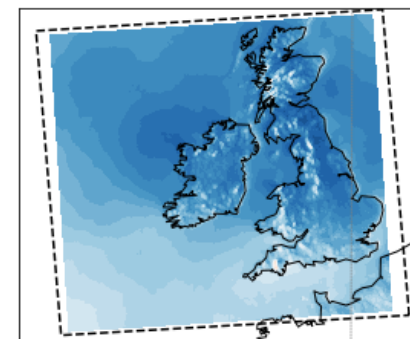
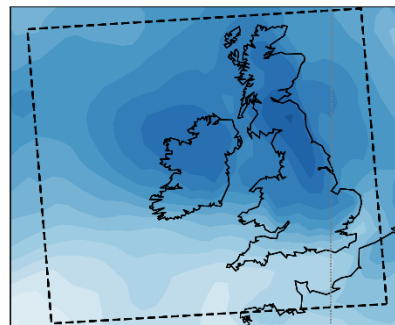
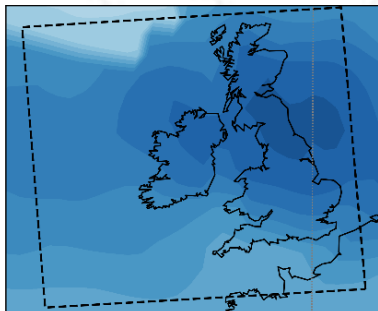
NAO



EA



SCAND

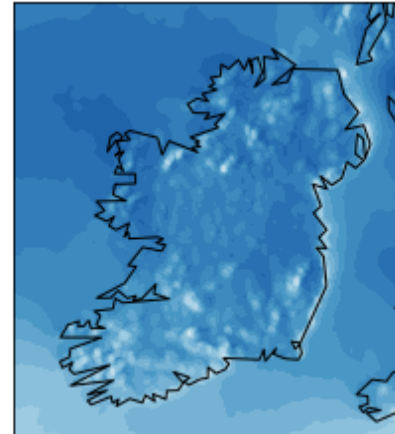
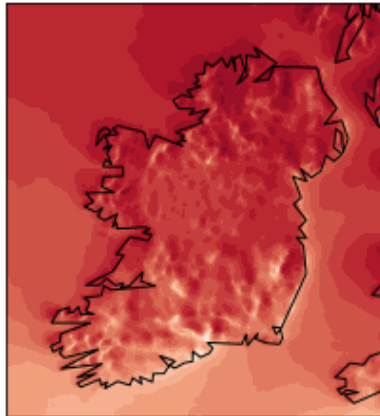


# Correlation maps – wind speed

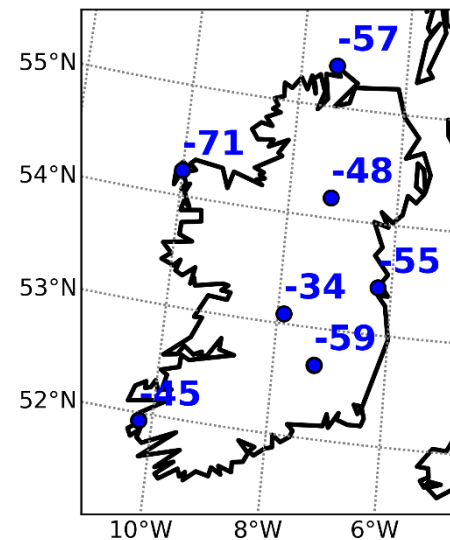
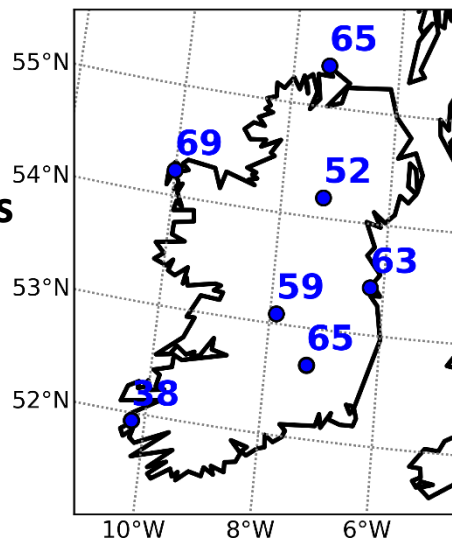
NAO

SCAND

MÉRA

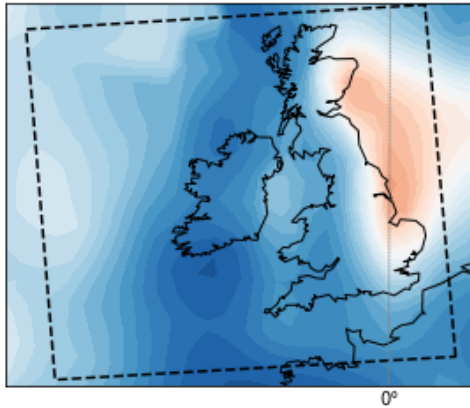


Observations

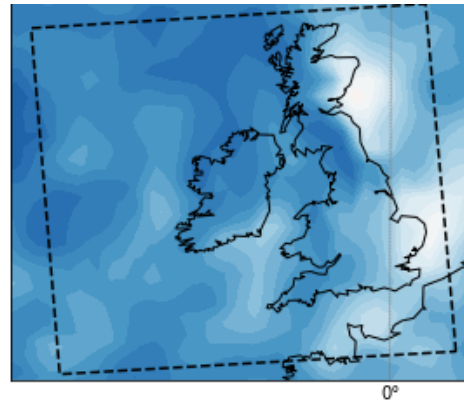


# Correlation maps – wind-solar

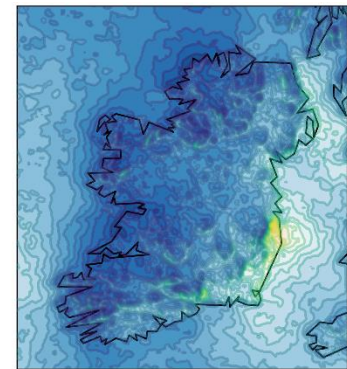
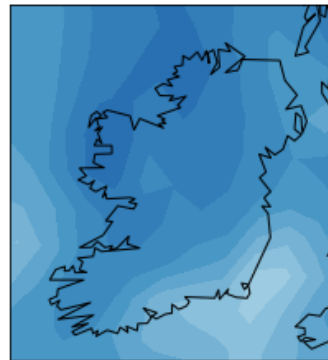
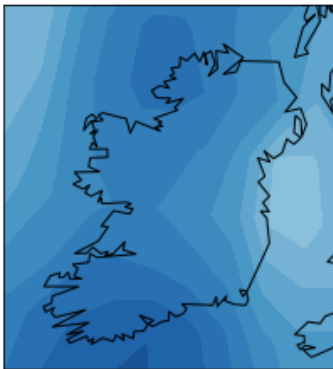
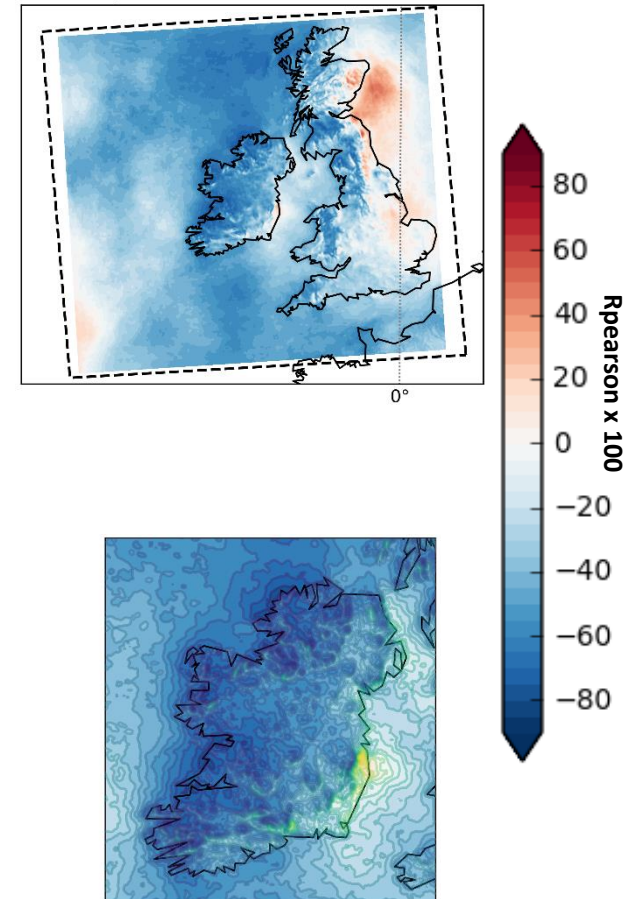
ERA



MERRA-2



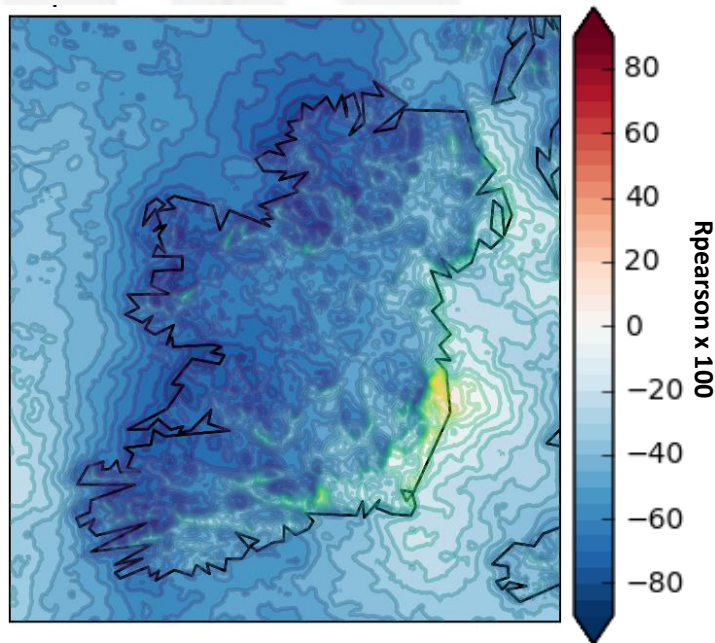
MÉRA



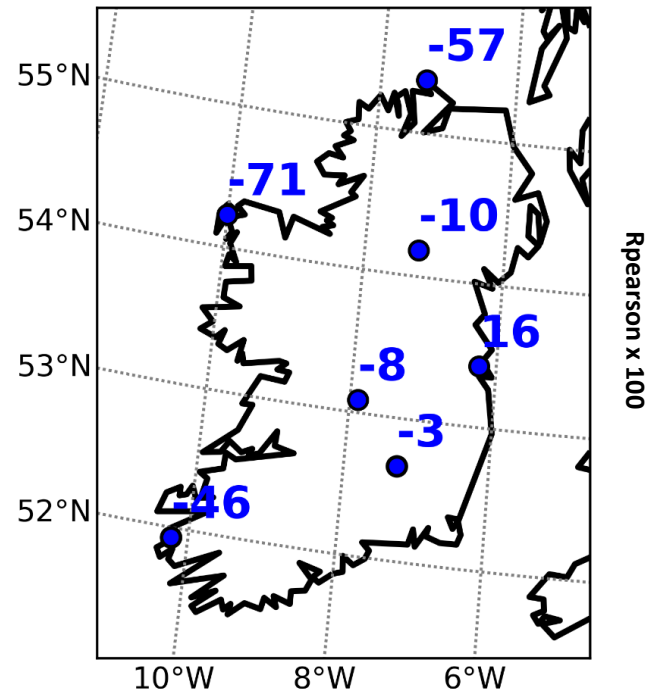


# Correlation maps – wind-solar

MÉRA



Observations

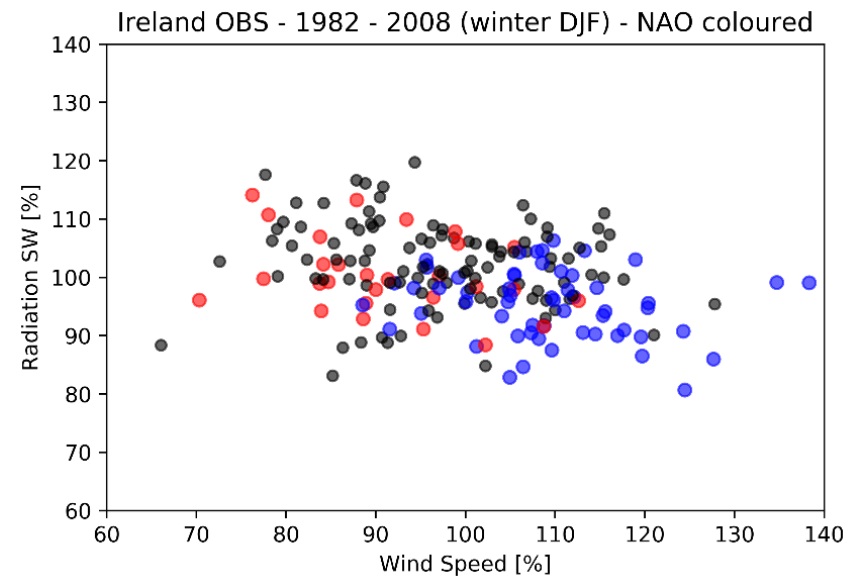
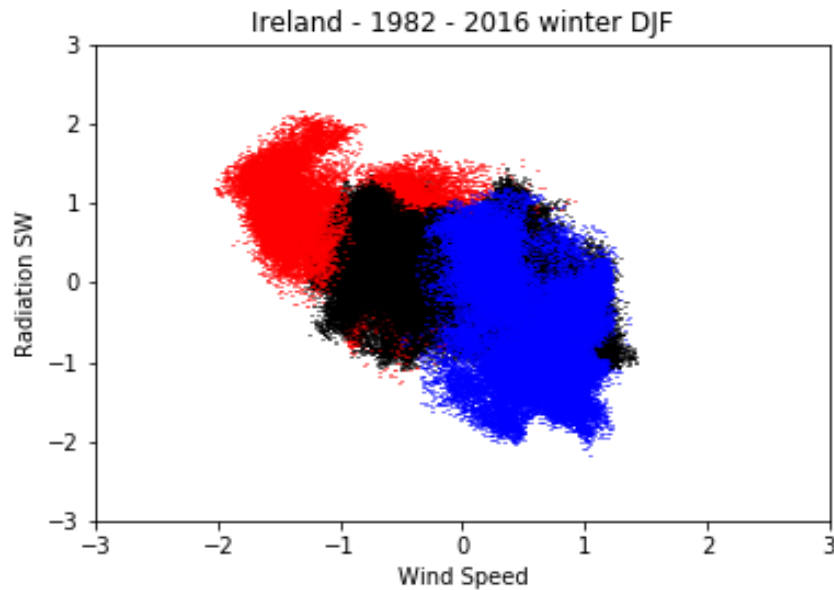


# Wind-Solar relationships according to NAO phase

NAO-    NAO neutral    NAO+

MÉRA

Observations



# Conclusions

- General agreement between all three reanalysis on the impact of large scale pressure patterns on winter wind speed and SW radiation.
  - As expected, MÉRA Climate Reanalysis offers more detailed assessments.
- Significant impact of the NAO and SCAND modes on both **winter** wind speeds and SW radiation.
- Some degree of anti-correlation between wind and solar resources on both Ireland and the UK mainland, with a west-east variation of the correlation sign/strength.

## Future work

- Convert wind speeds and SW radiation to wind and solar power and further assess climate modes impact;
- Seasonal renewable energy forecasting – possible due to potential predictability of NAO/EA/SCAND?

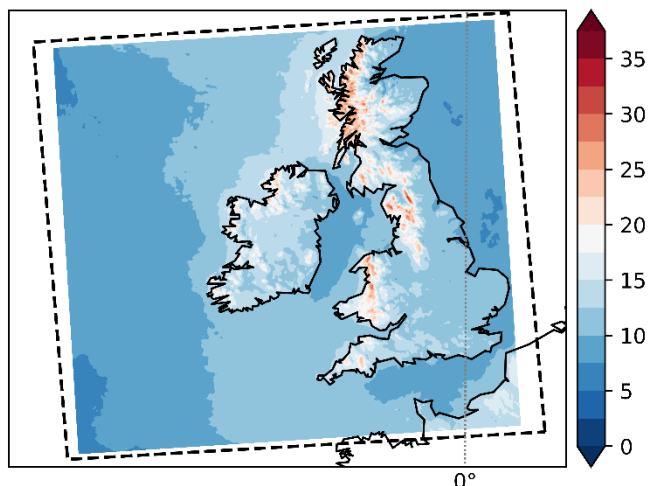
[joao.monteirocorreia@ucdconnect.ie](mailto:joao.monteirocorreia@ucdconnect.ie)  
[www.esipp.ie](http://www.esipp.ie)



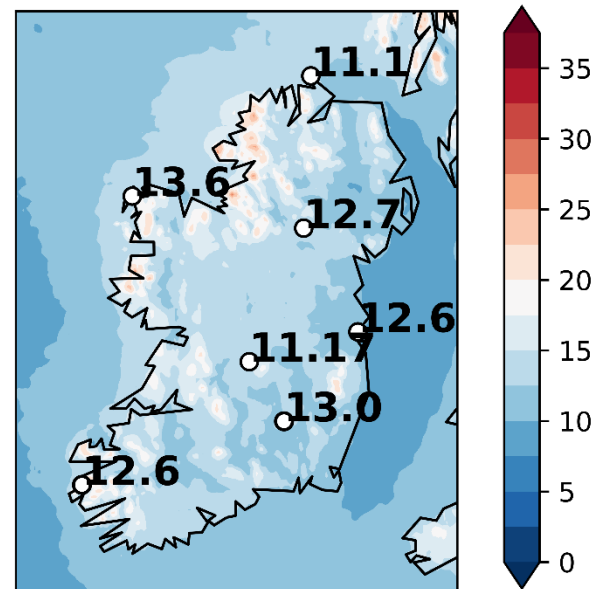
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# Coefficient of Interannual Variation: SW radiation

Coefficient of Interannual Variation of SW Radiation (MÉRA Climate Reanalysis)  
DJF season, yearly [1982 : 2008]



Coefficient of Interannual Variation  
SW Radiation (MÉRA Climate Reanalysis)  
DJF season, yearly [1982 : 2008]

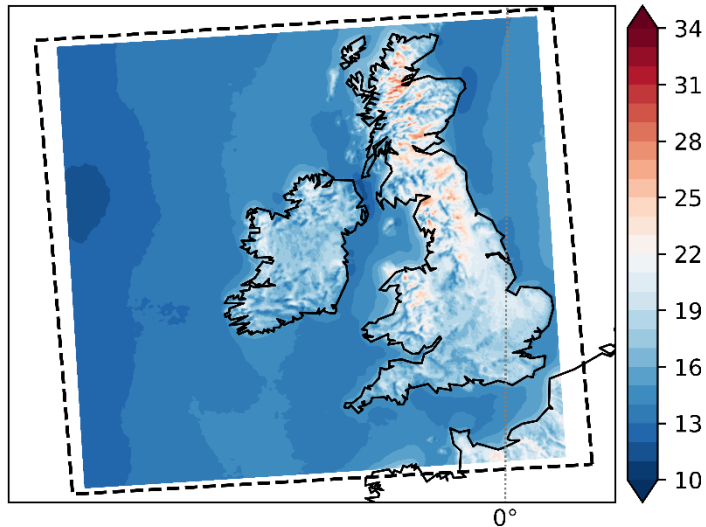


Higher level of detail



# Coefficient of Interannual Variation: wind speed

Coefficient of Interannual Variation of Wind speed (MÉRA Climate Reanalysis)  
DJF season [1982 : 2008]



Coefficient of Interannual Variation  
Wind speed (MÉRA Climate Reanalysis)  
DJF season [1982 : 2008]

