



# Acclimatize

## Including Wind Direction in Models

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Dr Mark Wyer, Prof. David Kay, Dr Carl Stapleton,  
Dr Cheryl Davies, Prof. Paul Brewer and Dr Bill Perkins

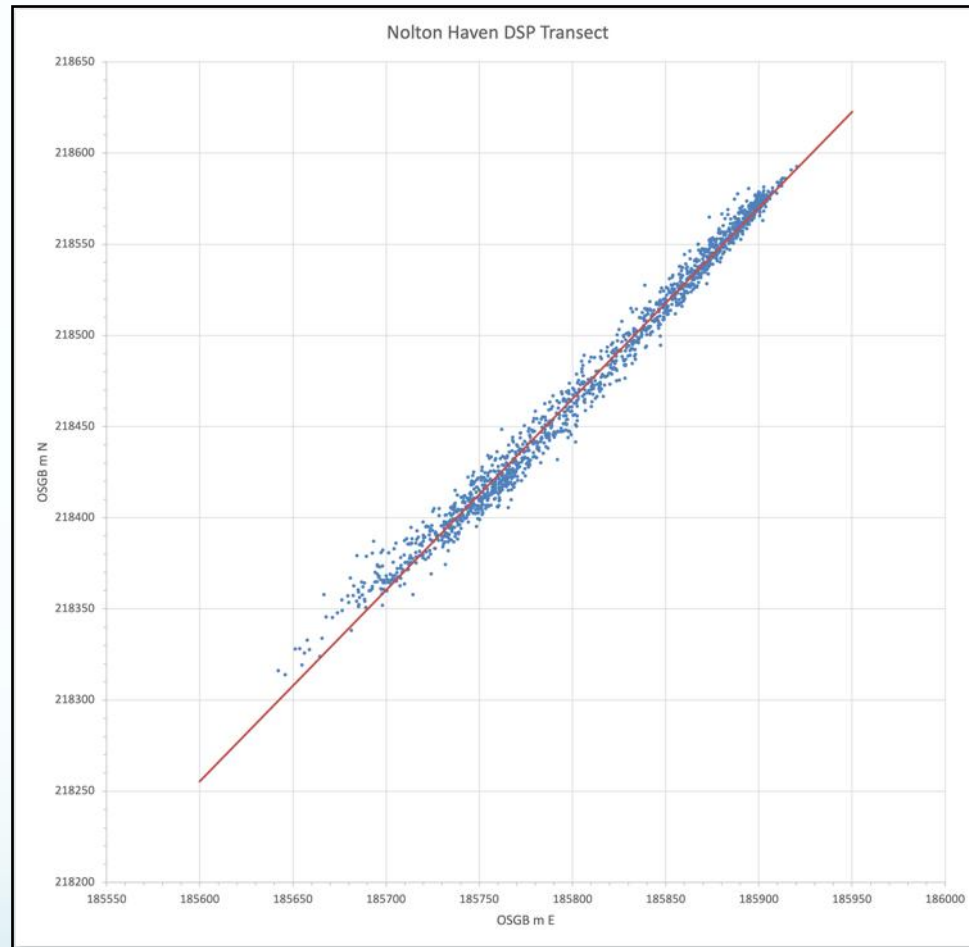
# Background

- Wind direction is a **circular** variable
- Values range from 0° (N) through 180° (S) to 359.99°
- The circular nature of this variable makes it difficult to include in multiple **linear** regression (MLR) models
- This presentation explores a different way of quantifying wind direction to use in MLR

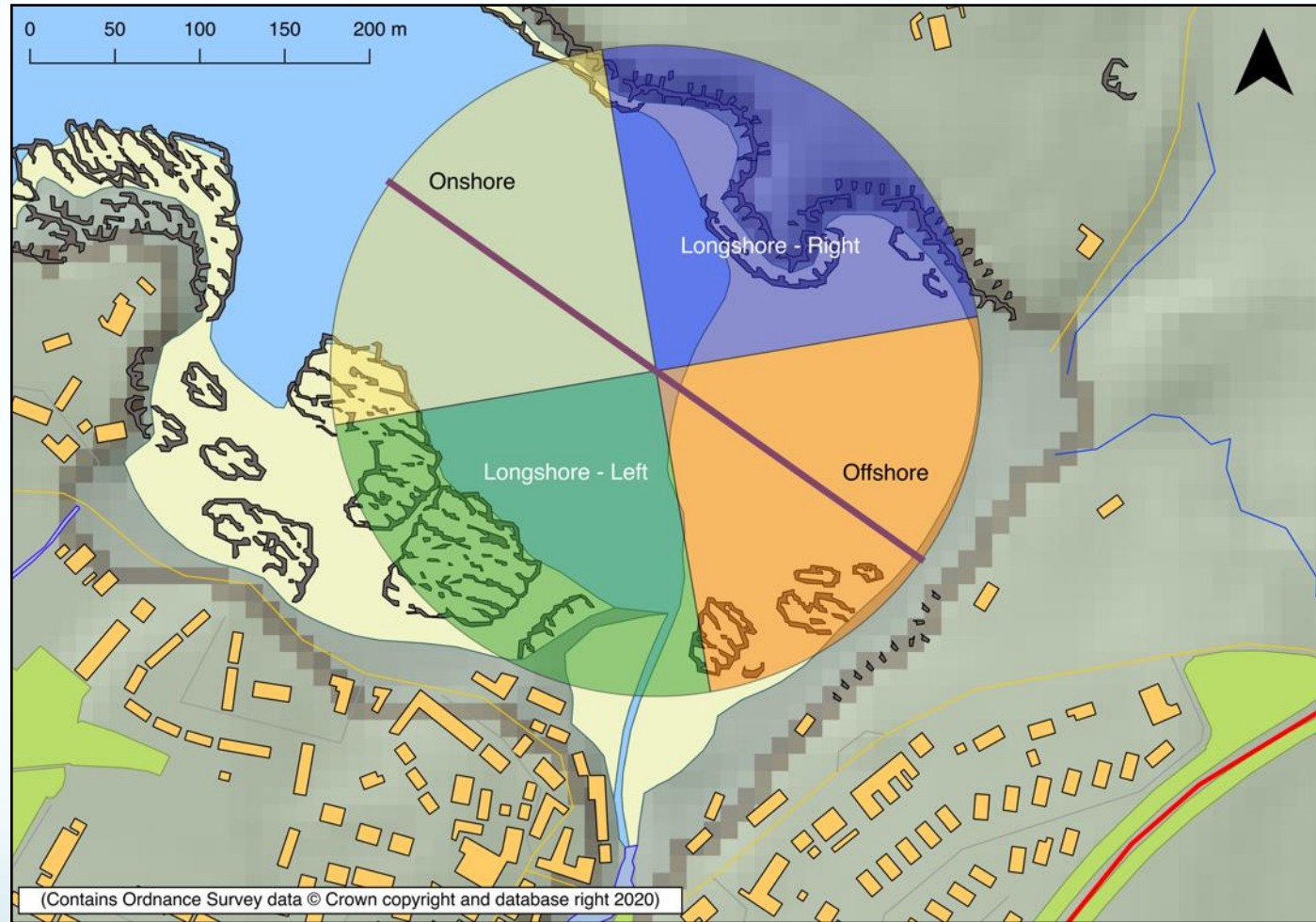
# Wind direction quantification

- The Acclimatize data includes positions for each sample - GPS
- Orthogonal linear regression used to fit a transect line for each site
- Four 90° wind sectors were then computed in relation to the transect:
  - Onshore
  - Offshore
  - Longshore from the right
  - Longshore from the left
- Wind direction data are then categorized into each sector
- The proportion (%) of values in each sector is then calculated for antecedent time periods e. g. 6 hours, 12, hours, 24 hours etc.

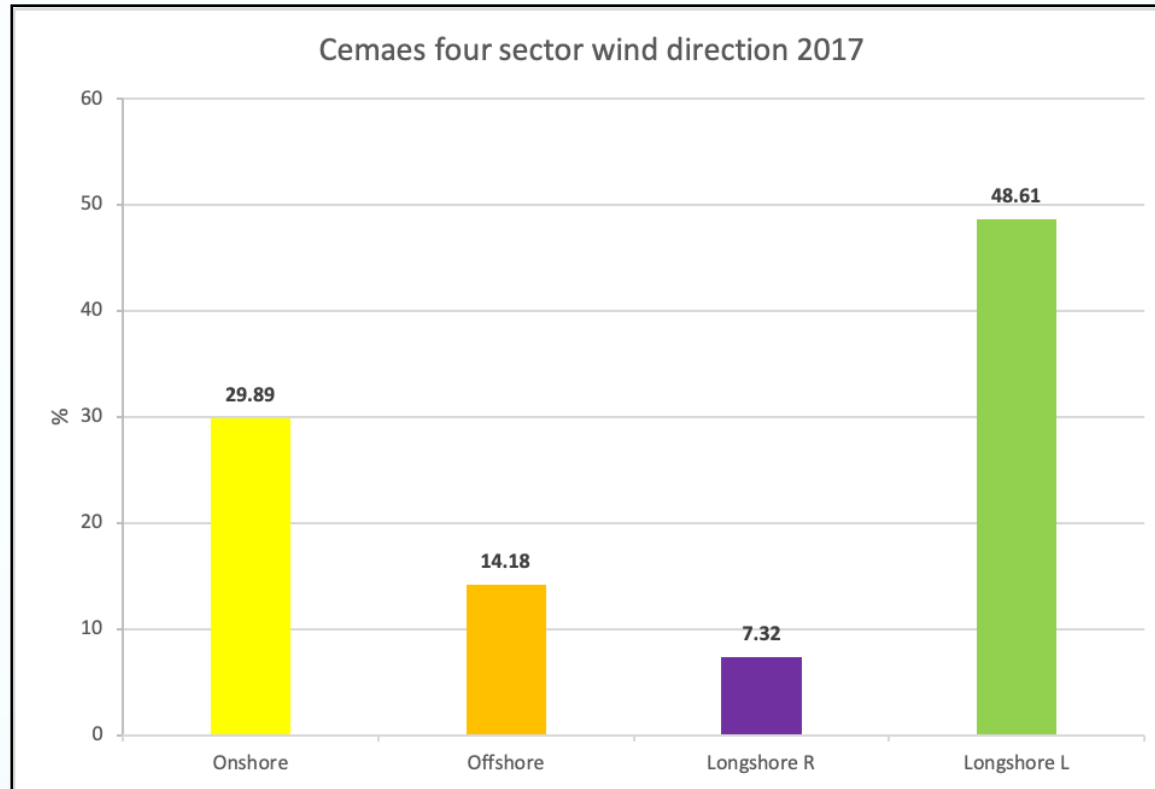
# Transect example



# Cemaes transect and wind sectors

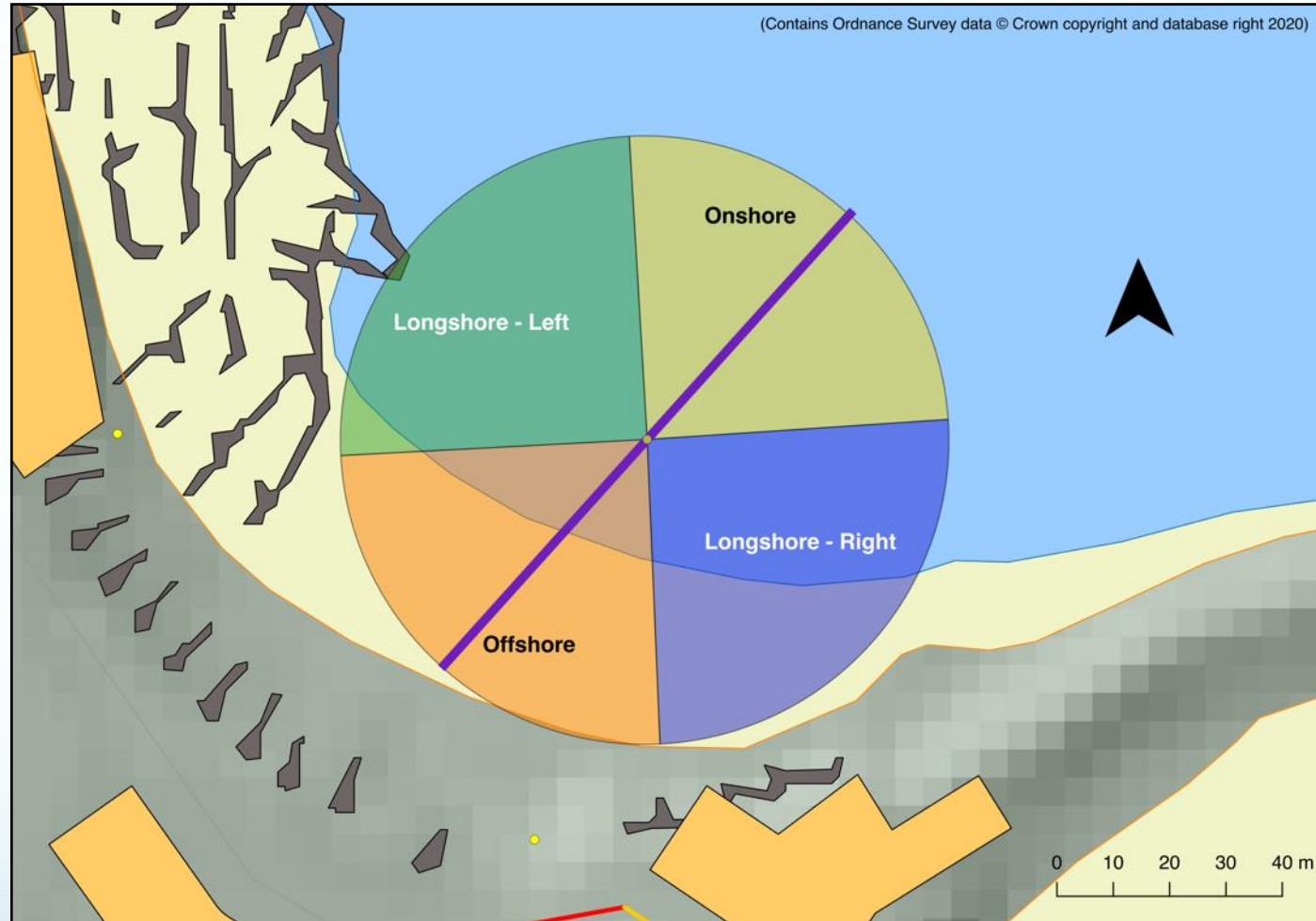


# Cemaes wind direction

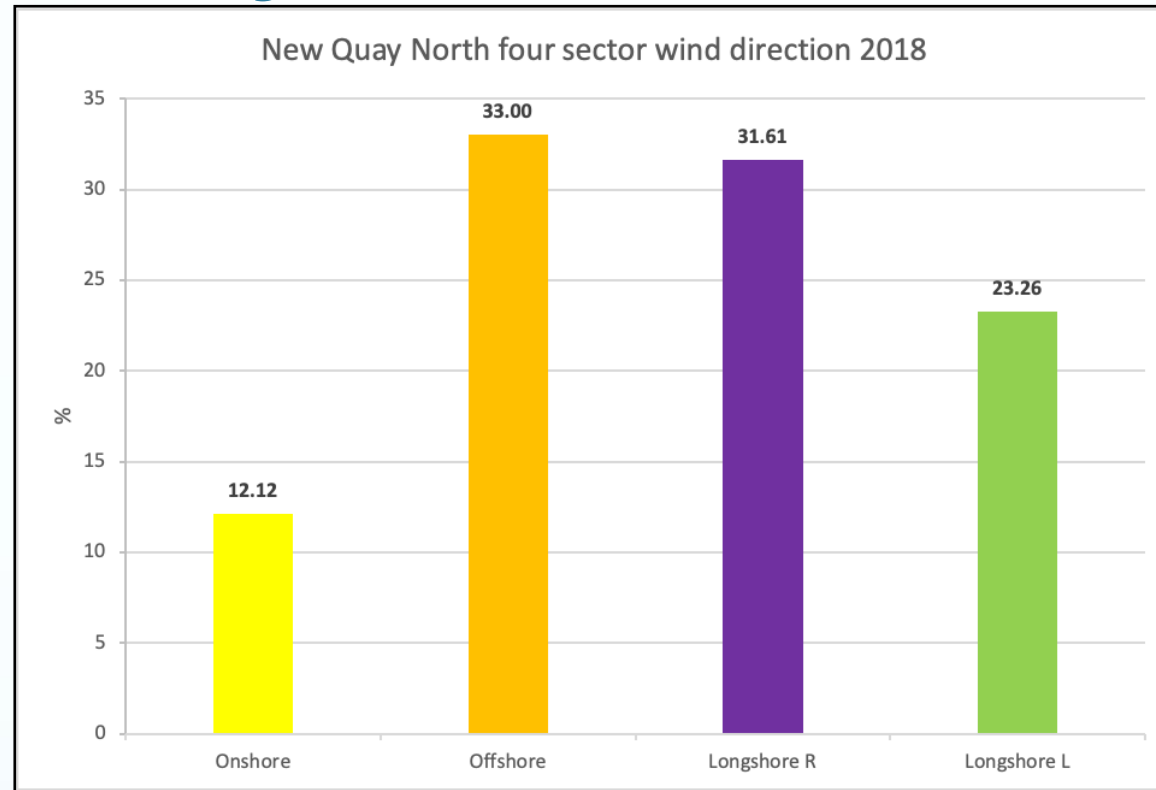


- Dominant wind direction is in the longshore sector from the left (looking out to sea) – 48.61%  $\approx$  southwesterly

# New Quay North transect and wind sectors



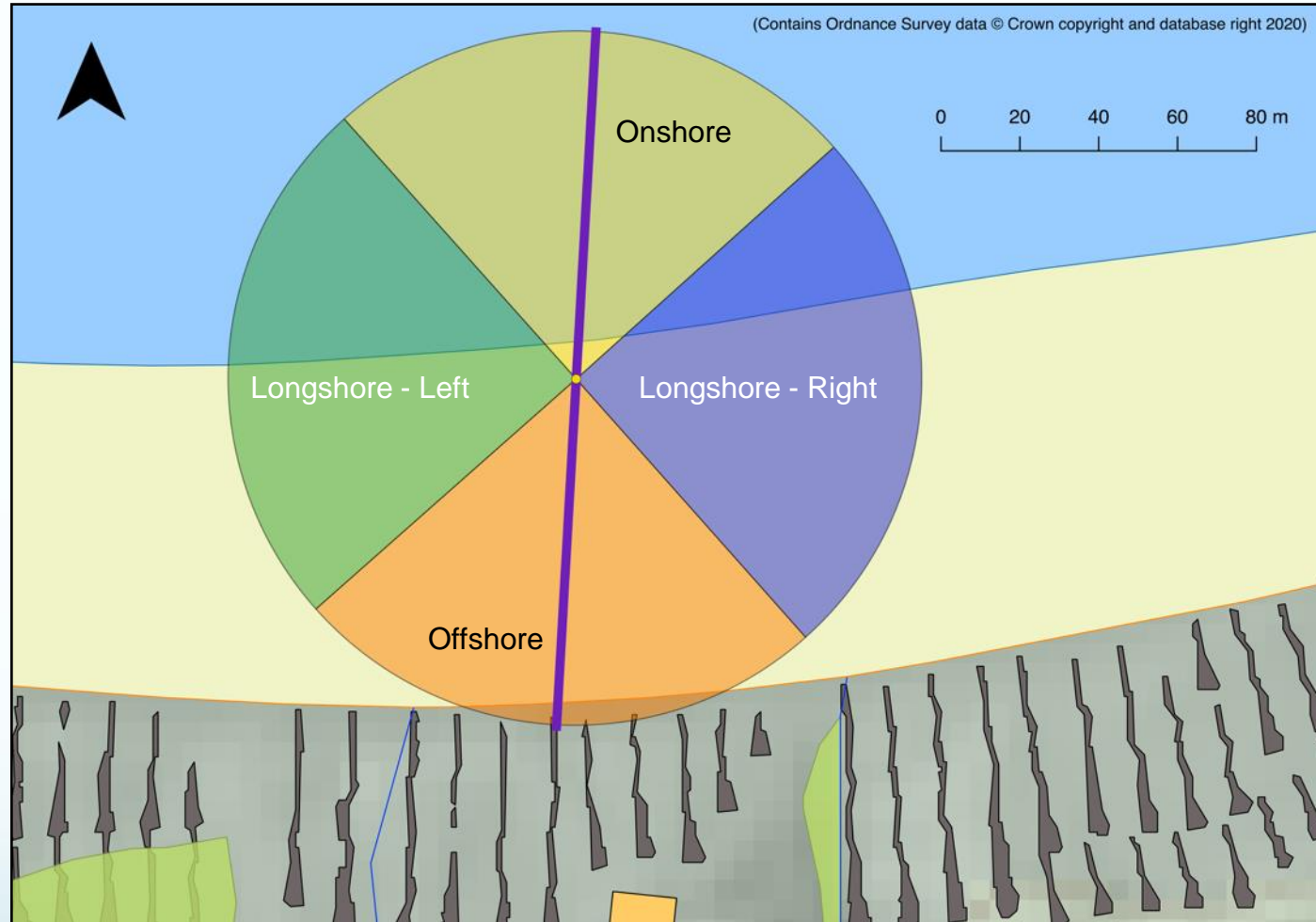
# New Quay North wind direction



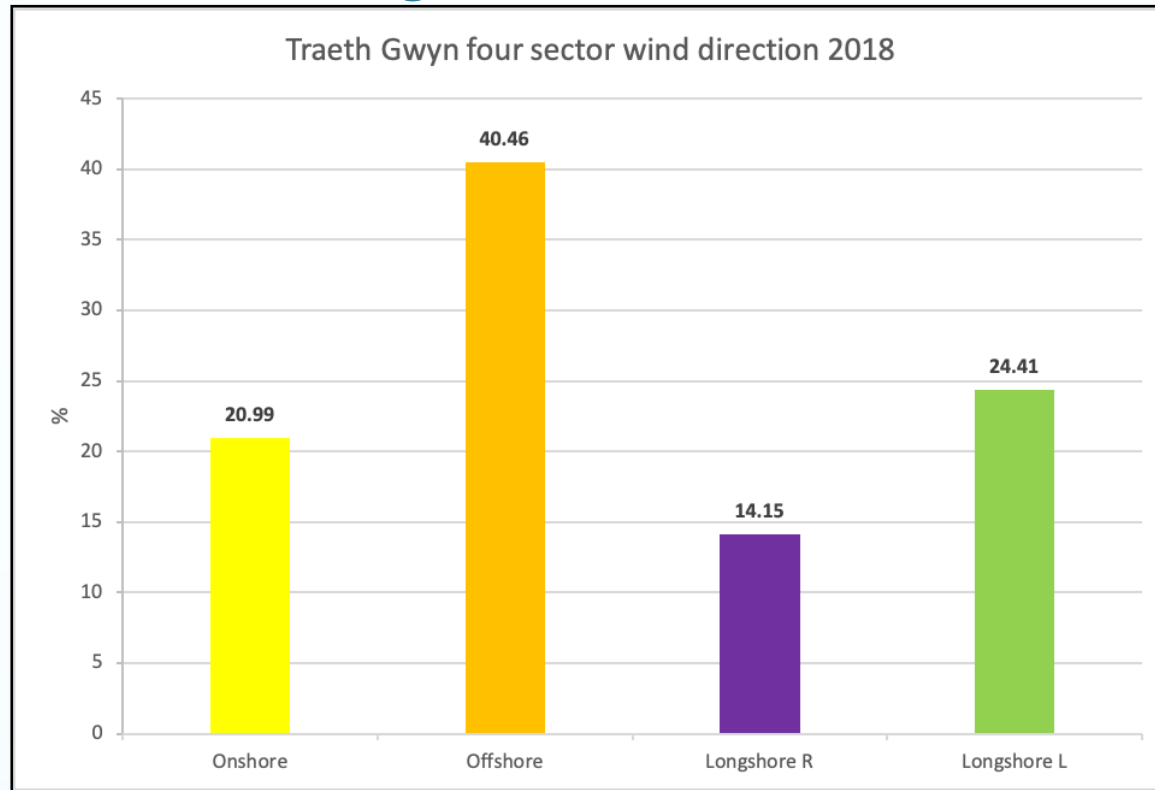
- Dominant wind directions are offshore - 33.00%  $\approx$  southwesterly- and in the longshore sector from the right (looking out to sea) – 31.61%  $\approx$  southeasterly



# Traeth Gwyn transect and wind sectors

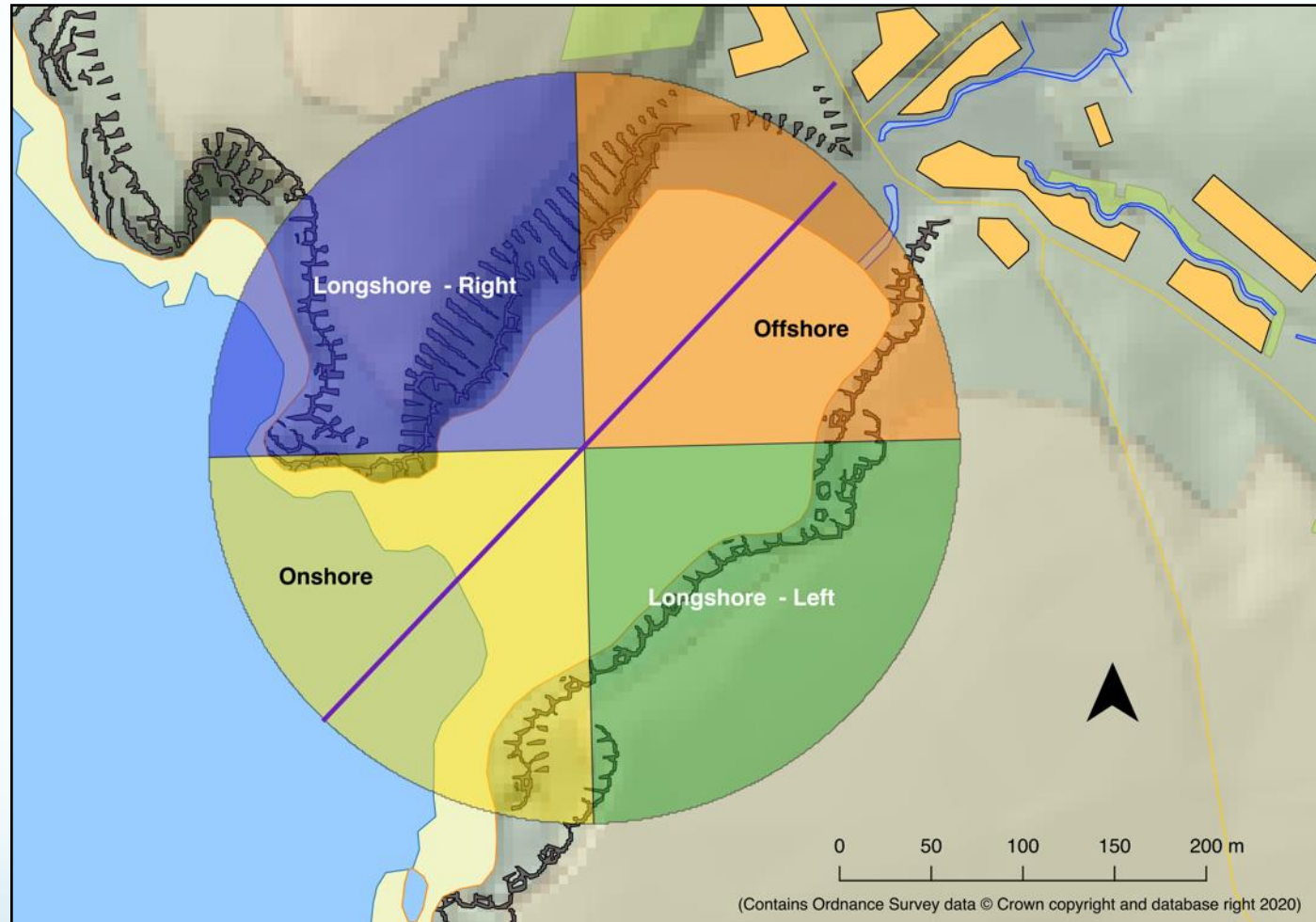


# Traeth Gwyn Wind direction

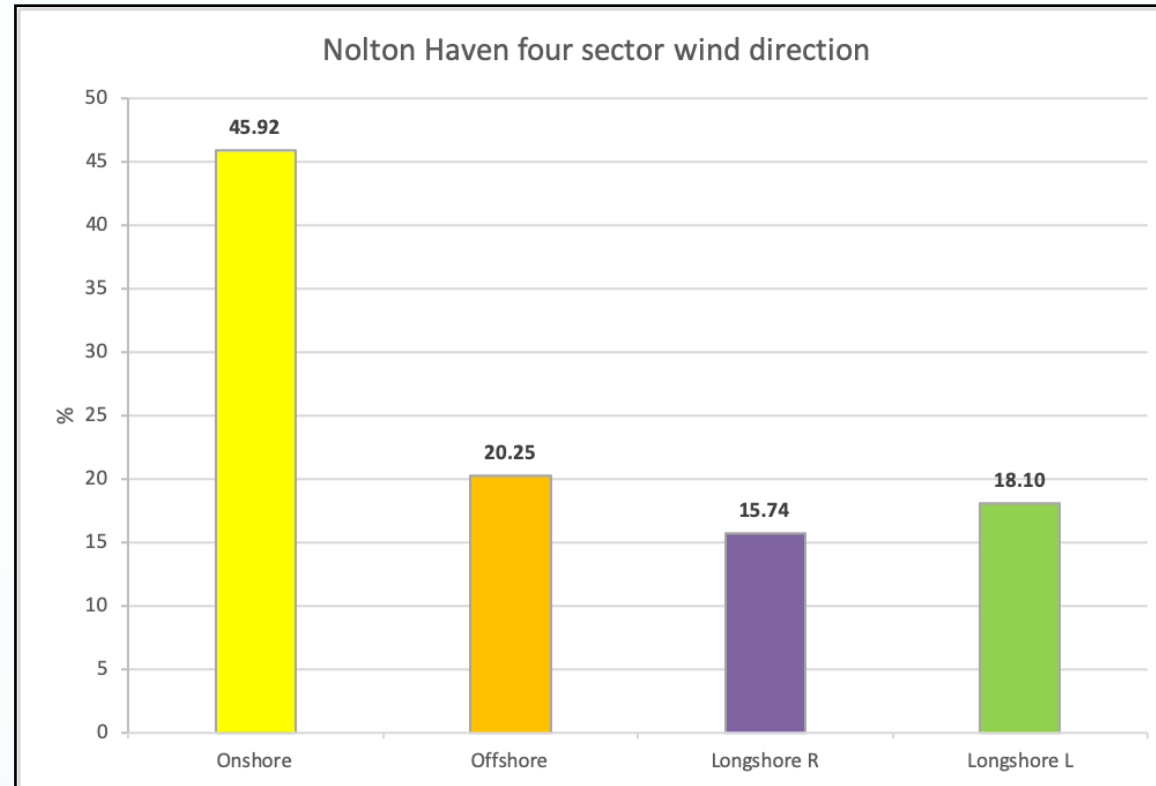


- Dominant wind direction is offshore – 40.46%  $\approx$  southerly
- Onshore & Long shore L directions have similar proportions

# Nolton Haven transect and wind sectors



# Nolton Haven wind direction



- Dominant wind direction is in the onshore sector – 45.92%  $\approx$  southwesterly

# Cemaes results

- New wind direction variables appear in 60-day models
  - % onshore wind on the sampling day as 2<sup>nd</sup> predictor with +ve slope
  - Maximum  $r^2$  increase 10.7% to 0.875
  - Two new viable models with reduced misclassification
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- New wind direction variables appear in 120-interval half-day models
  - % onshore wind on the sampling day as 2<sup>nd</sup> predictor with +ve slope
  - Maximum  $r^2$  increase 8.1% to 0.787
  - Two new viable models with reduced misclassification

# New Quay North results

- New wind direction variables appear in 60-day models
  - % Longshore Left in past 48 hrs with +ve slope
  - % Longshore Right in past 24 hrs with -ve slope
- Maximum  $r^2$  increase 7.8% to 0.629
- Two new viable models with  $r^2 < 0.7$  and misclassification <6%
  
- New wind direction variables appear in 120-interval half-day models
- % Longshore R in past 12 hrs as 2<sup>nd</sup> predictor with -ve slope
- Maximum  $r^2$  increase 7.3% to 0.643
- Two new viable models with  $r^2 < 0.7$  and misclassification 11.21%

# Traeth Gwyn results

- New wind direction variables appear in 60-day models
  - % Onshore in past 24 hrs as 2<sup>nd</sup> or 4<sup>th</sup> predictor with +ve slope
  - % Offshore in past 24 hrs as 4<sup>th</sup> predictor with –ve slope
- Maximum  $r^2$  increase 8.5% to 0.837
- Four new viable models with minimum misclassification 1.72%
  
- New wind direction variables appear in 120-interval half-day models
  - % Onshore in past 24 hrs as 3<sup>rd</sup> predictor with +ve slope
  - % Offshore in past 3 hrs as 3<sup>rd</sup> predictor with –ve slope
- Maximum  $r^2$  increase 8.6% to 0.792
- Two new viable models with misclassification 4.03% and 6.03%

# Nolton Haven results

- New wind direction variables appear in 60-day models
  - % Onshore in on sampling day or past 12 hrs as +ve slope
  - Maximum  $r^2$  increase 0.5% to 0.869
  - Five new viable models with minimum misclassification 3.23%
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- New wind direction variables appear in 120-interval half-day models
  - % Onshore in past 3 hrs +ve slope as 4<sup>th</sup> predictor
  - Maximum  $r^2$  increase 5.5% to 0.788
  - Six new viable models with misclassification 5.6% and 7.2%



# Conclusions

- Adding the new wind direction predictor variables shows that wind direction is potentially important
- Wind direction variables appeared in MLR models at all sites for both 60-day and 120-interval half-day analyses
- Resulting increases in maximum explained variance were appreciable  $\approx 7.1\%$
- The analysis produced new viable models for potential deployment at all sites
- Although adding wind speed increased  $r^2$  at New Quay North it did not increase the level of explanation above 70%
- Wind direction variables appearing in models appeared broadly plausible – e. g. % onshore wind variables with +ve slope at Cemaes, Traeth Gwyn and Nolton Haven