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working with the weather

## S is for Storm

### Evaluating UK storm frequency and ECMWF forecast accuracy of extreme wind events

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#### Introduction

Storms that are forecast to have substantial impacts on the UK and Ireland have been named since October 2015. The aim is to increase public awareness of severe weather, and improve safety – the theory being that a named storm makes it easier for the public to track its progress, and to share information on social media.

Met Éireann state that a storm will be named if wind gusts >30m/s are forecast.

Since October 2015, eleven storms have been named (see Table 1).

Table 1: Named storms of winter 2015/2016  
Source: UKMO

Storm Name	Maximum wind gust recorded (m/s)
Abigail	38
Barney	38
Clodagh	43
Desmond	36
Eva	38
Frank	38
Gertrude	47
Henry	40
Imogen	43
Jake	37
Katie	47

UK media have questioned whether the high profile storms of winter 2015/2016 are worse and/or more numerous than 'normal'. Here, we address that question.

#### Storm criteria

Met Éireann give a criteria of wind gusts >30 m/s. Storms observed in the 2015/16 season all have central mean sea level pressure (mslp) < 980hPa.

UKMO and Met Éireann use station data for this data, but this is not readily available to the public. We therefore use gridded reanalysis data (ERA-Interim). Using the criteria 10m wind gusts >30 m/s and mslp <980hPa does not capture all named storms, likely due to the gusts being at 10m, the gridded nature of the data, and the fact they are analysis rather than forecast values.

The criteria for reanalysis data were therefore adjusted to 10m wind gusts >26 m/s for at least 1% of grid points and mslp < 980hPa. Storms are classified as independent when there is at least 48 hours of calm between storms. These criteria capture the named storms between October 2015 and February 2016 (see Figure 1).

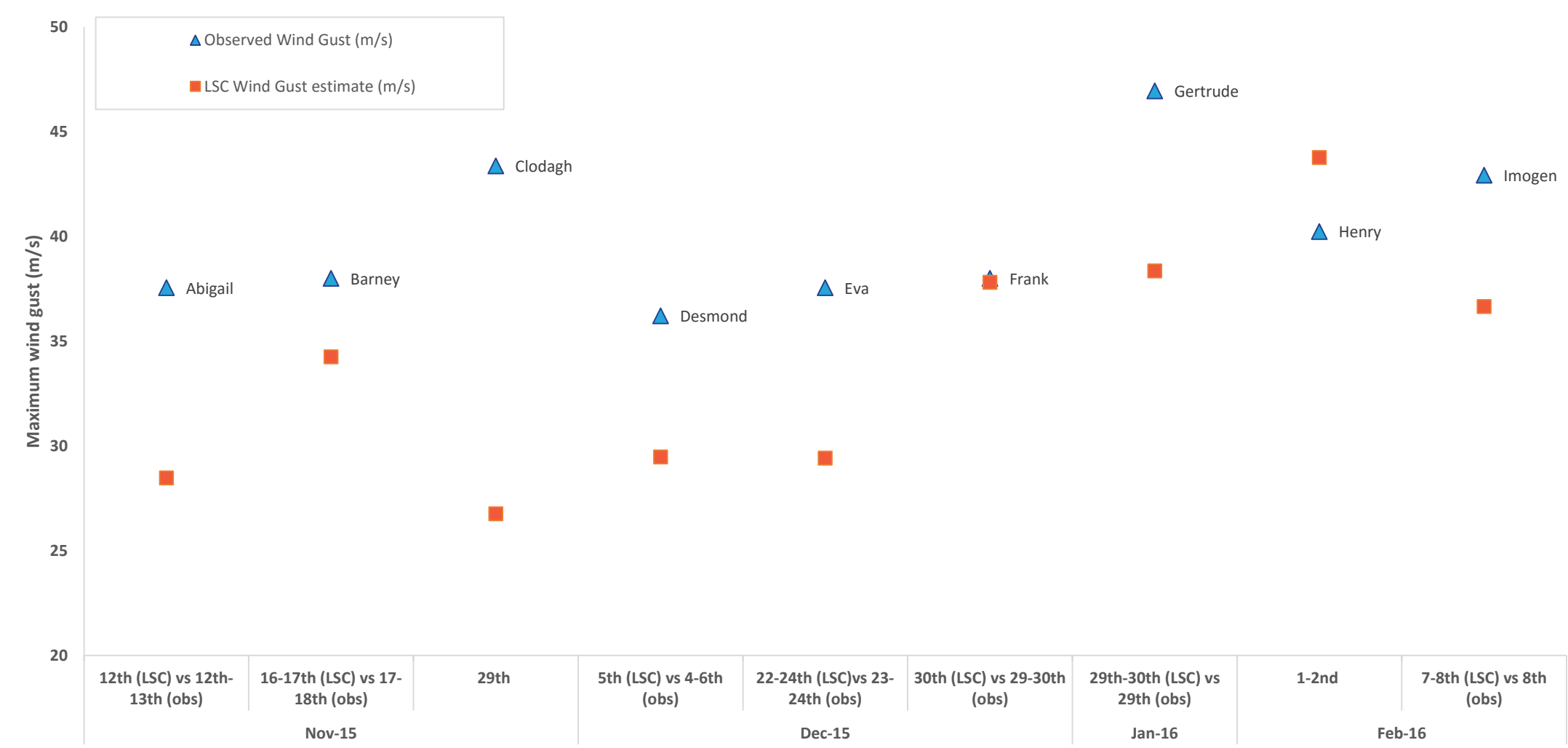
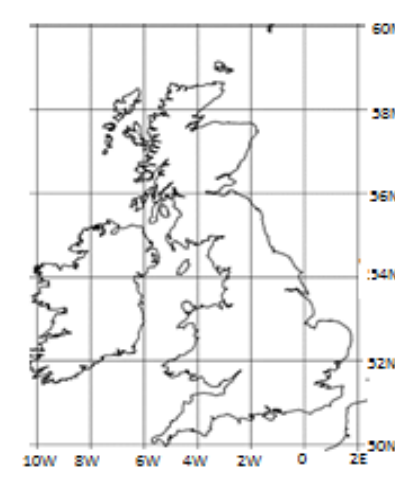


Figure 1: 2015/2016 storms as detailed by UK Met Office and by the LSC estimate from forecasts  
Source: Lake Street Consulting Ltd



The onset of storms according to our criteria is often a day earlier than the Met Office reports, likely due to the designated storm region extending further west in our study (see figure 2). This does not, however, impact the number of storms.

Figure 2: Area designated as UK storm region.  
Source: GISS, NOAA

#### What is a typical storm year?

A storm year is defined as September through to August.

Using reanalysis data (ERA-Interim) for storm years 1980-81 through 2014-15, the average number of storms per month were calculated. Storm criteria are as above.

A total of 373 storms were isolated, averaging at 10-11 storms a year (10.6). 95% of the storms occur between September and March, with Figure 3 showing the month within year profile.

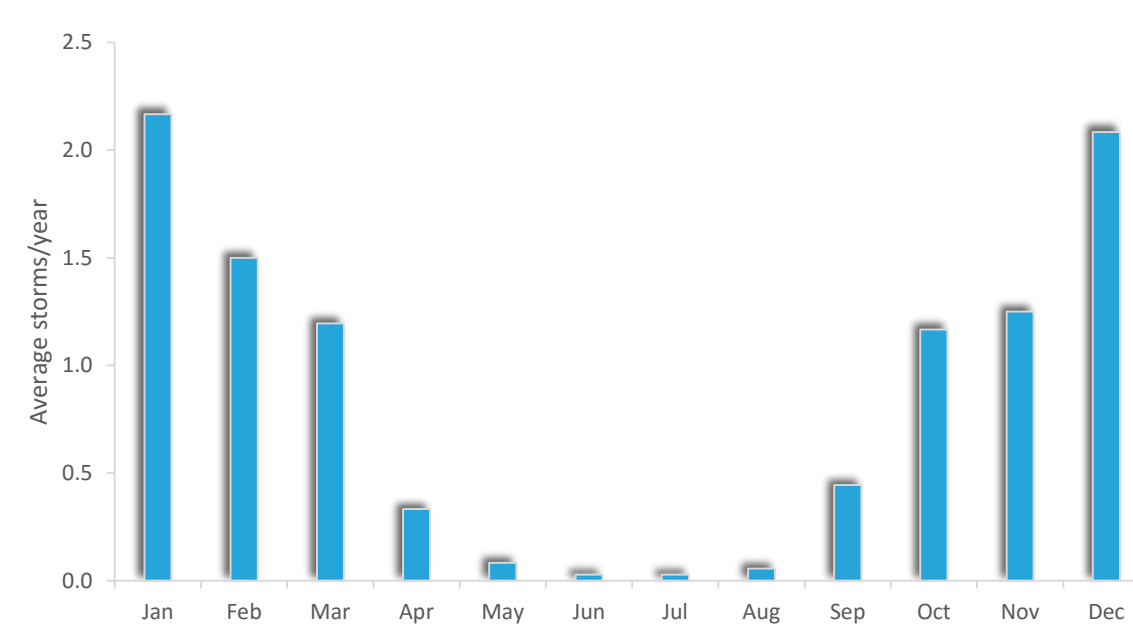


Figure 3: Average of UK storms per year, by month.  
Source: Lake Street Consulting Ltd.

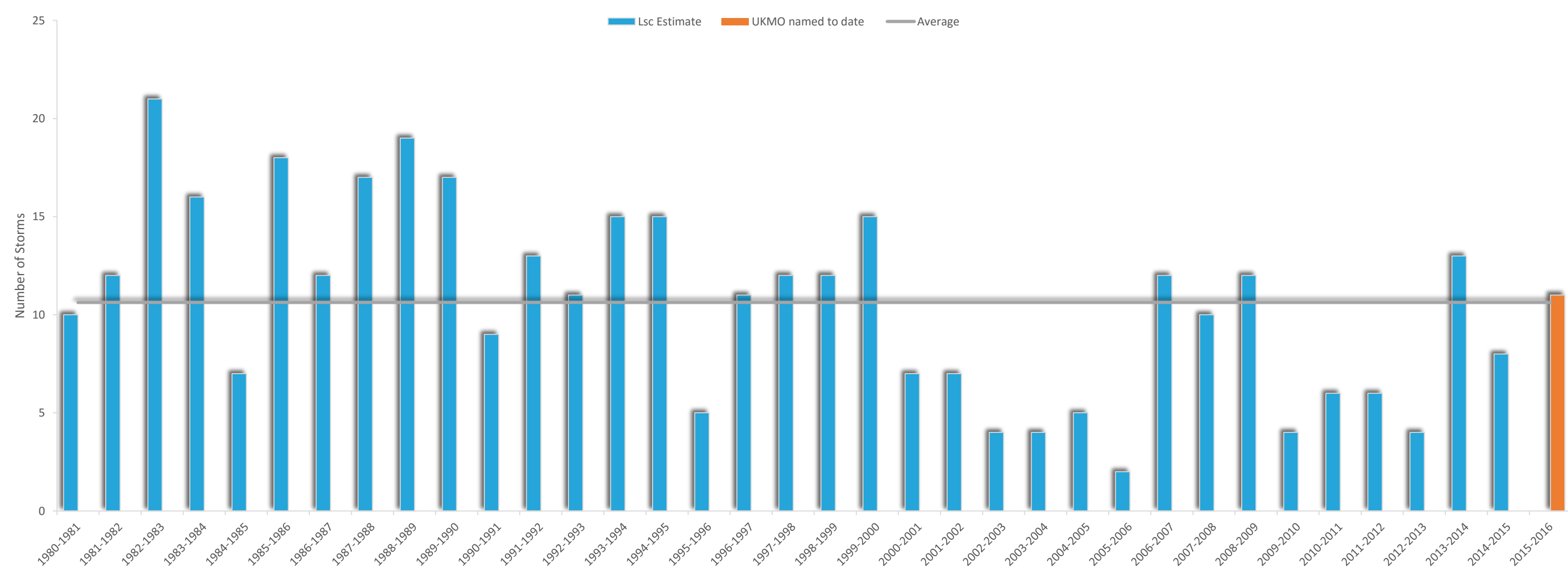


Figure 4: Number of estimated UK storms by year since 1980.  
Source: Lake Street Consulting Ltd

Is 2015/2016 a stormy year? Figure 4 shows the storm frequency by storm year. 2015/2016 is, so far, near normal.

#### Conclusion

Storm criteria of 10m gust strength > 26m/s for at least 1% of the UK region (see Figure 2) and mslp < 980hPa pick out the storms which have been named by UK Met Office and Met Éireann in their pilot study during winter 2015/2016.

Using these criteria, a "normal" storm year for the UK has been determined with 10-11 storms per year and storms by month as depicted in figure 3.

2015/16 has seen 11 storms so far, suggesting that it looks to be a "normal" year.

The wind gust forecast accuracy when compared to analysis has low skill, with the analysis value rarely falling in the middle of ensemble forecasts. The next step of this study is to see if LAM forecasts have better skill.

#### ECMWF forecast accuracy for wind vs storms

Forecasts for 10m wind gust have an associated degree of error as both underestimation and overestimation are notable during storm periods. Using ECMWF historic ensemble forecast data (12z initialisations, cycle 41r1) and reanalysis data (ERA-Interim) we computed the rank histograms for the 2015/2016 winter storm period for various lead times (12h through 60h) and 10m gust strengths (>10m/s, > 15m/s and > 20m/s)



Figure 5: Rank histograms for ECENS 12z forecasts for 2015/16 winter storm period  
Source: Lake Street Consulting Ltd

The data shows that the forecasts for 10 m wind gust throughout winter 2015/2016 are usually too low when compared to analysis, or sometimes forecasting a storm when none materialises. The skill decreases as wind gust strength increases, though none suggest a good forecast.