

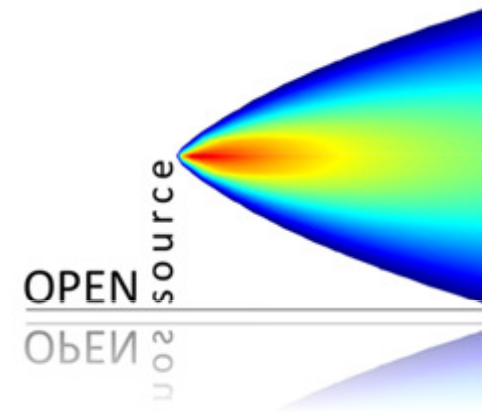
# Openair on the SAQD



Dr Scott Hamilton - AEA

- Introduction to Openair
- Existing functionality on the SAQD website
- Enhanced functionality coming soon....

- A relatively recent tool for looking at trends in air quality data
- Very good for conditioning data sets
- Operates in the 'R' statistical environment
- Standalone needs a little programming know how (though the commands are straightforward)
- Useful for performing quick analyses of large data sets
- Provides easy to interpret images that can inspire further investigation
- Some of the software functionality is already included on the SAQD- you can get data to import straight into R

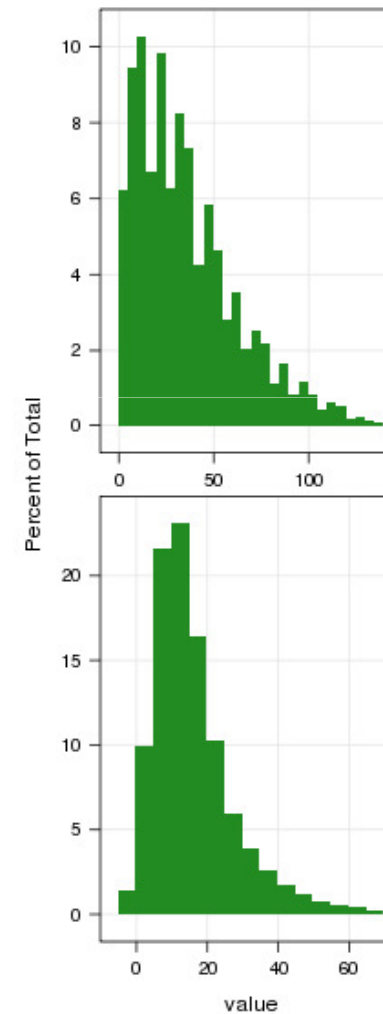
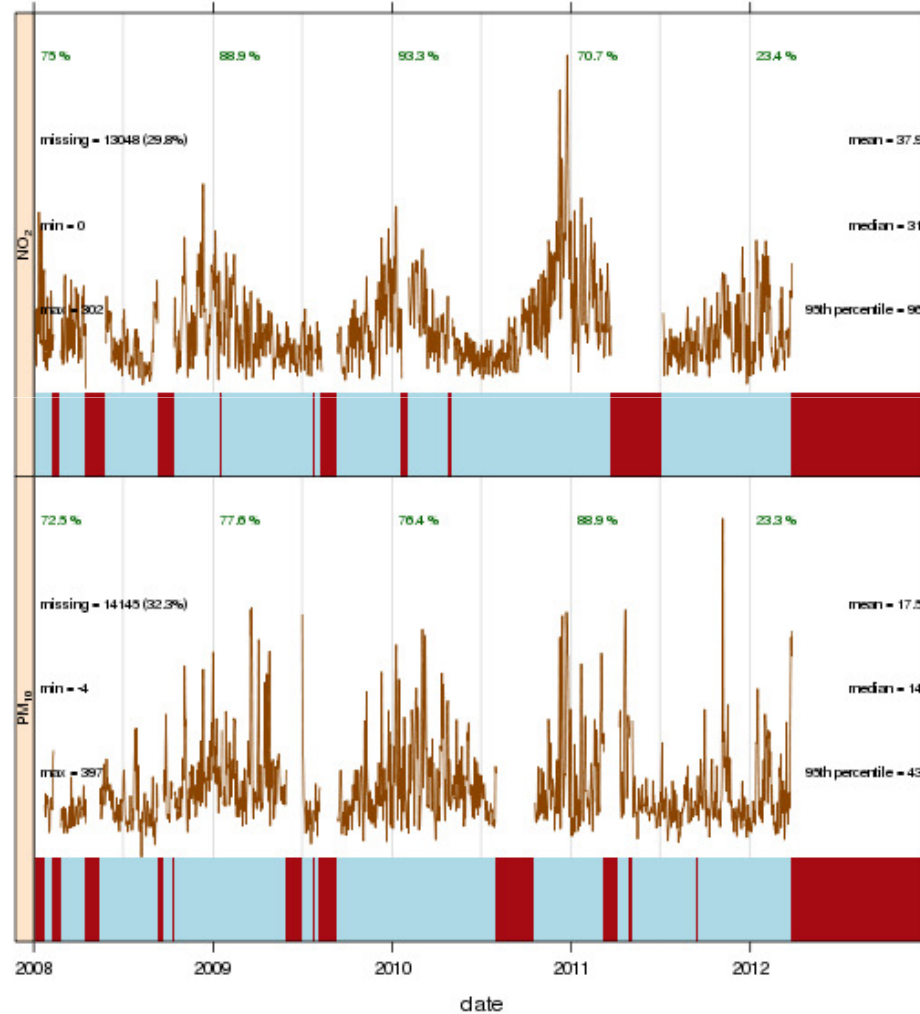


<http://www.openair-project.org/>

# Examples of existing functionality- summarise data

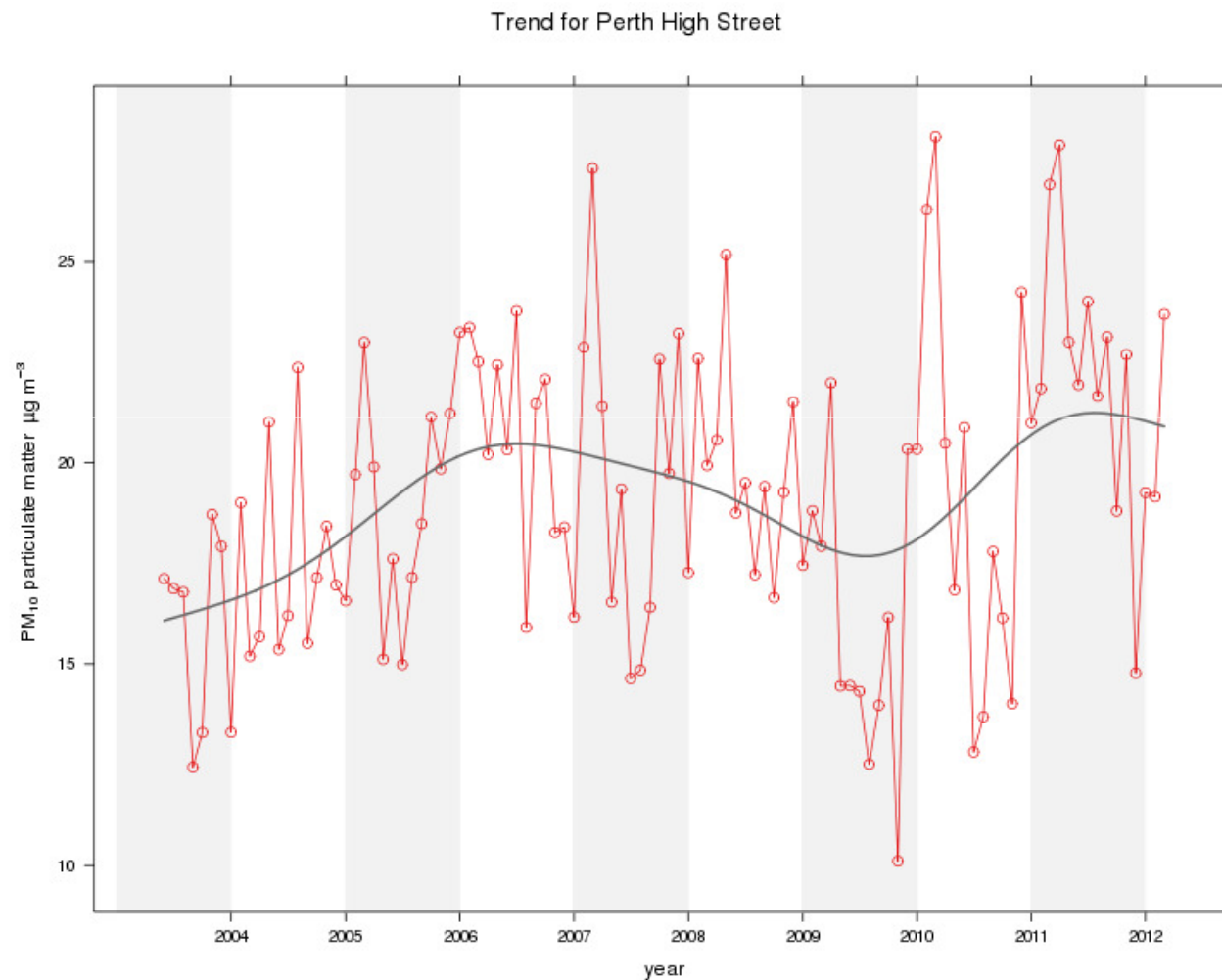


Data Summary at Paisley Gordon Street for the period 01/05/2004 to 27/03/2012



- (1) a time series plot for each pollutant
- (2) a histogram providing the percentage of the date range that a pollutant is within a particular concentration range.

# Examples of existing functionality- smooth trend

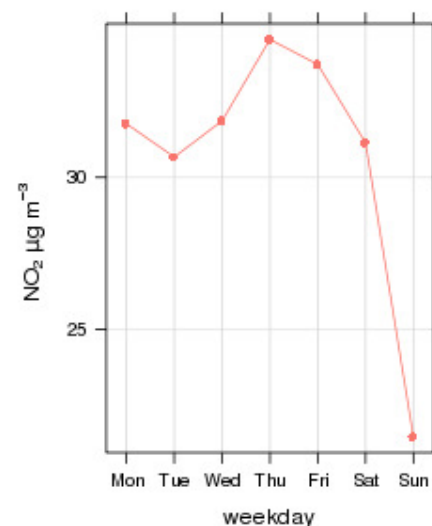
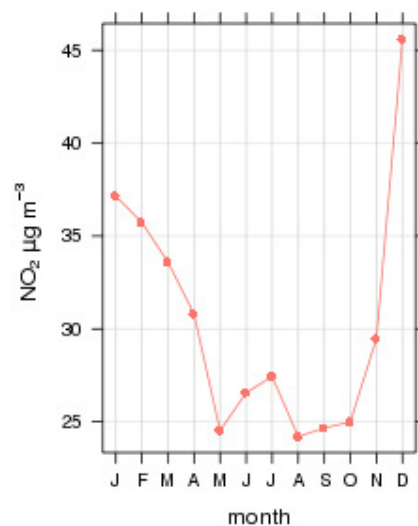
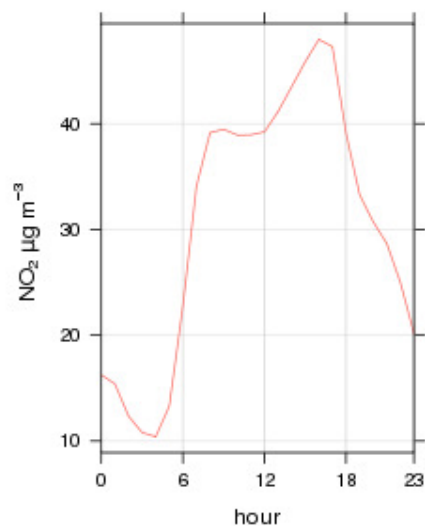
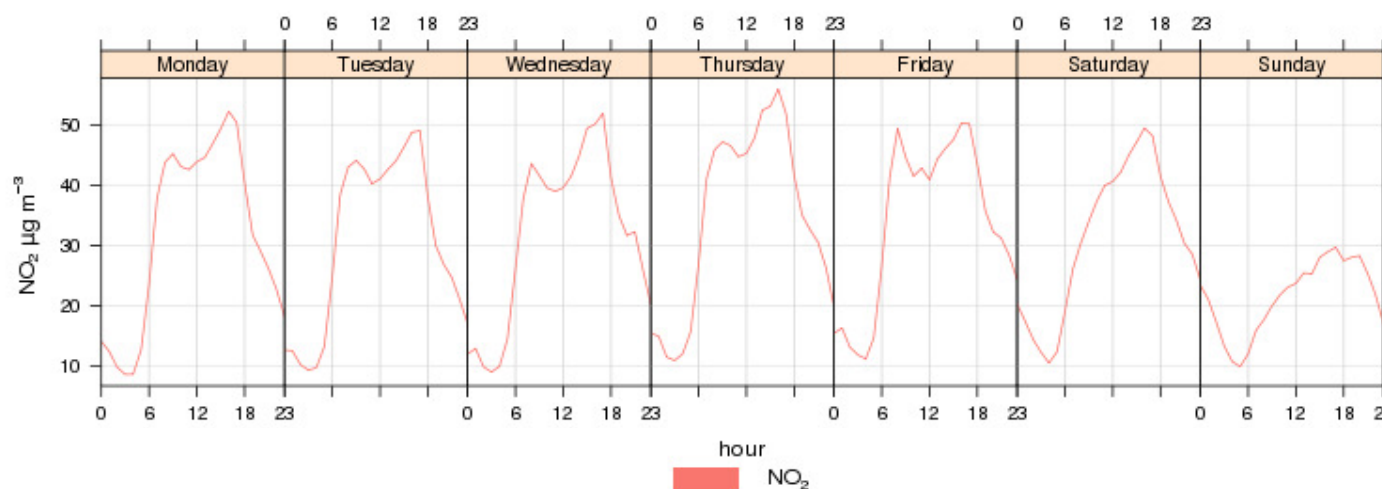


Smooth trend calculates and fits a smoothed trend line to measurements of one atmospheric pollutant over a user selected time range at one or multiple sites.

The smoothed line permits trends in pollutant concentrations to be shown.

# Examples of existing functionality-time variation

Data trends at North Ayrshire Irvine High St for the period 12/02/2009 to 27/03/2012

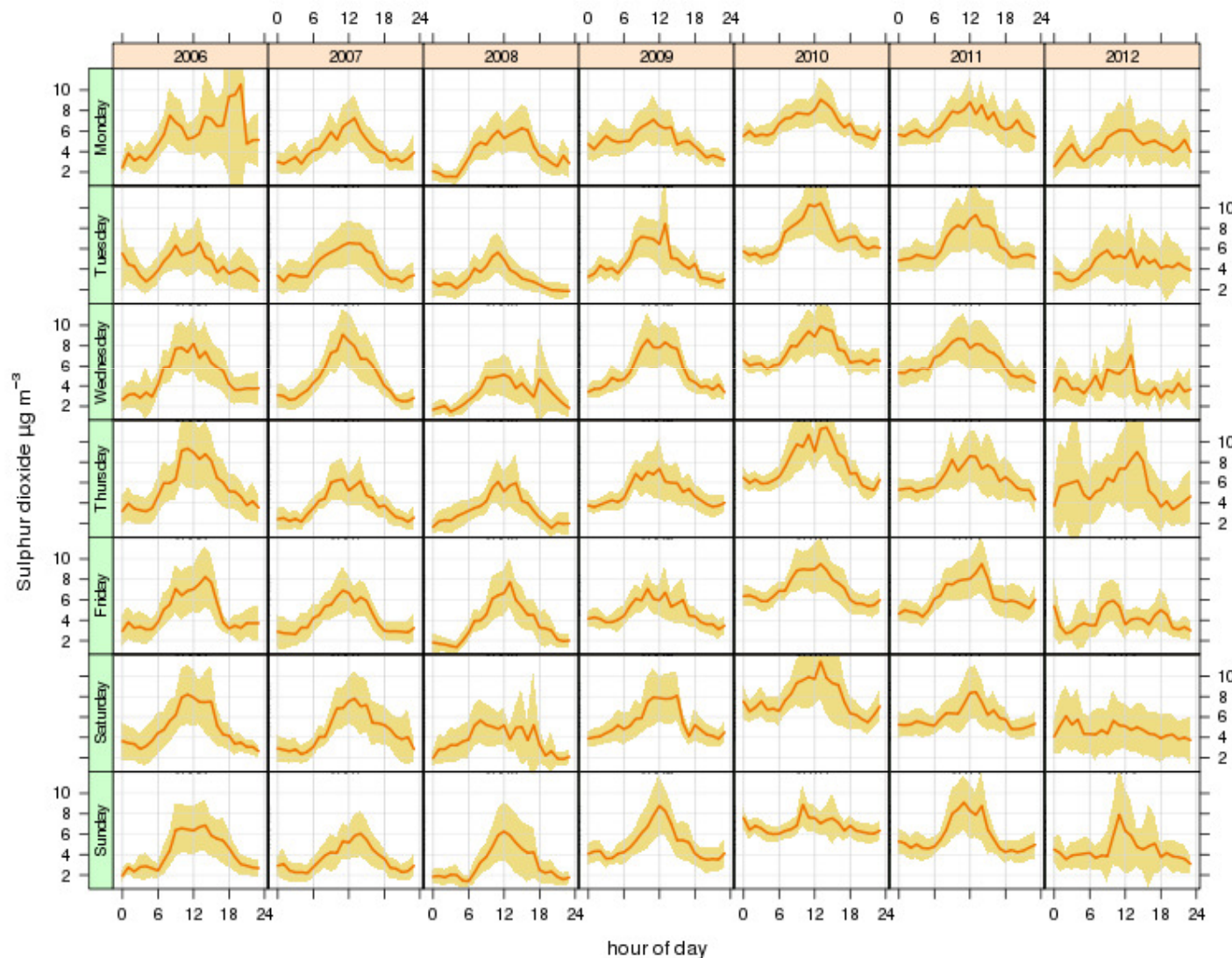


The plotted output shows the pollutant variation by day of the week, mean hour of day, month of year and day of week of one or more atmospheric pollutants over a user selected time range at one or multiple sites.



# Examples of existing functionality-trend hour

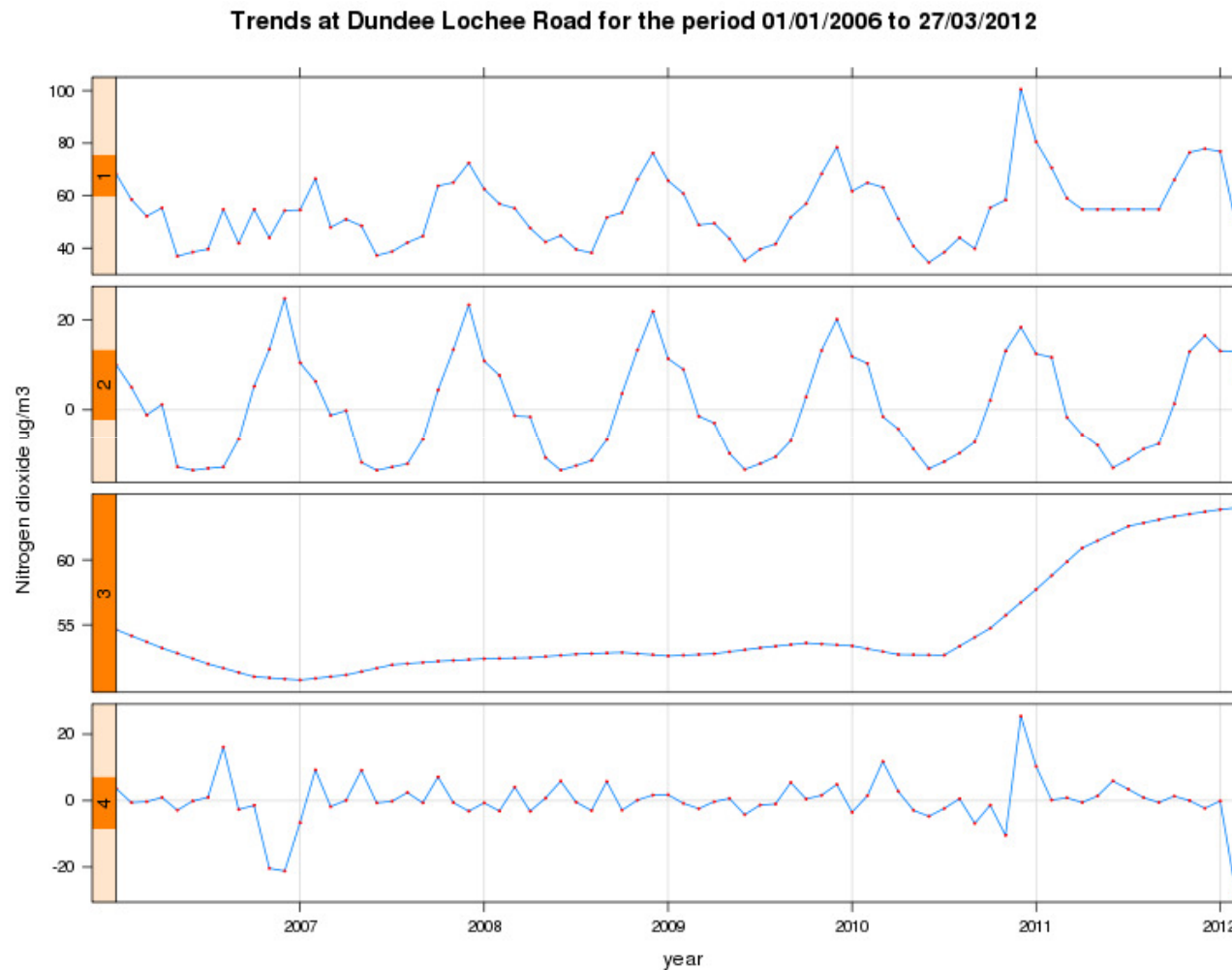
Hour / Weekday trends at Dundee Broughty Ferry Road for the period 01/01/2006 to 27/03/2012



Trend hour weekday plots provide an efficient way of considering the diurnal variation in pollutant concentrations both by day of the week and year.

This plot may be useful in settings where changing activity patterns are important.

# Examples of existing functionality-trend decomposition



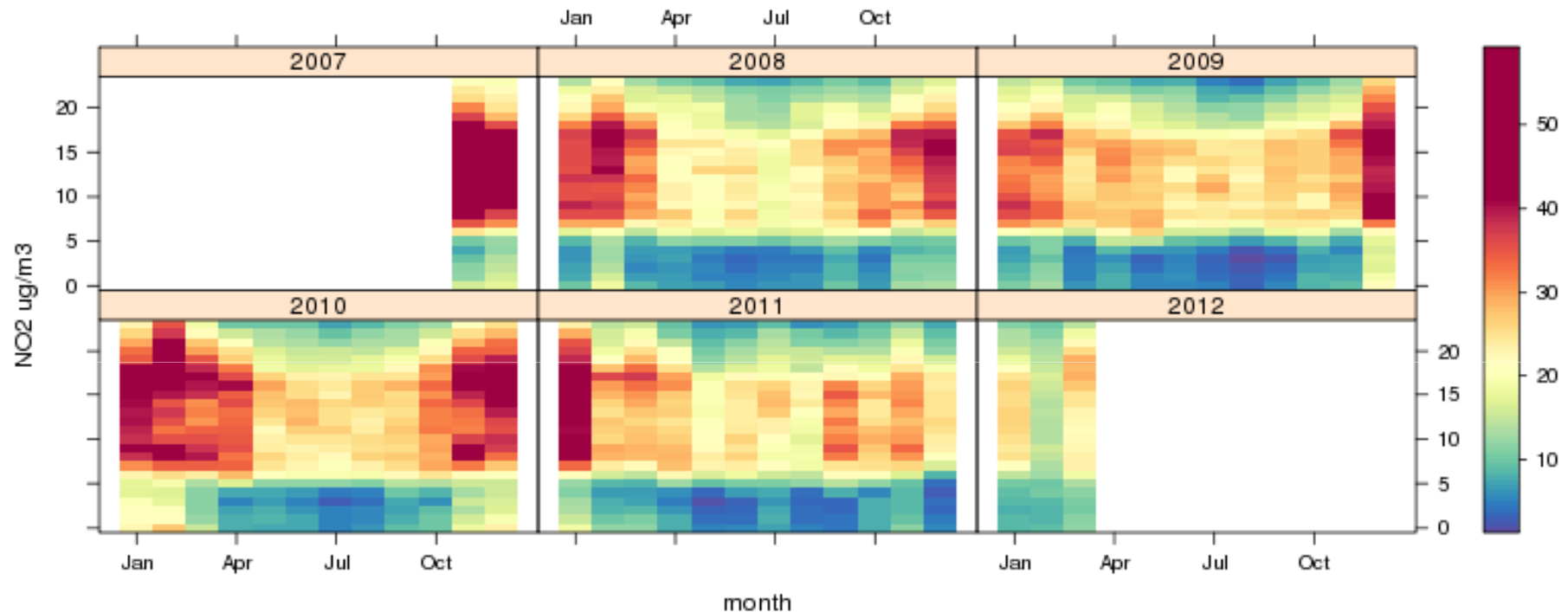
Decomposing time series into different time-scale components: trend, seasonal and remainder components, allows interesting features to be revealed.

The seasonal cycle of a pollutant can provide information on regional and global-scale influences; whereas the trend component provides a much clearer indication of the long-term trends in pollutant concentrations



# Examples of existing functionality-trend level hour

Data trend at South Ayrshire Ayr High St for the period 11/09/2007 to 27/03/2012



Trend level hour provides a way of rapidly showing a large amount of data in a condensed format.

In a single plot, the variation in the concentration of a pollutant is shown by time of day, month of year and year. The plot therefore provides information on trends, seasonal effects and diurnal variations.

# So, Openair on SAQD was pretty good.....

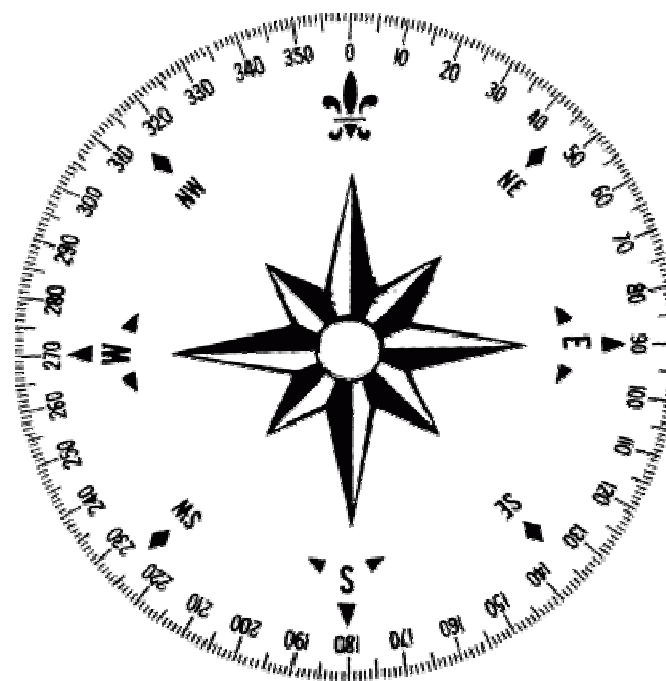


The plots shown earlier are useful for looking at issues like:

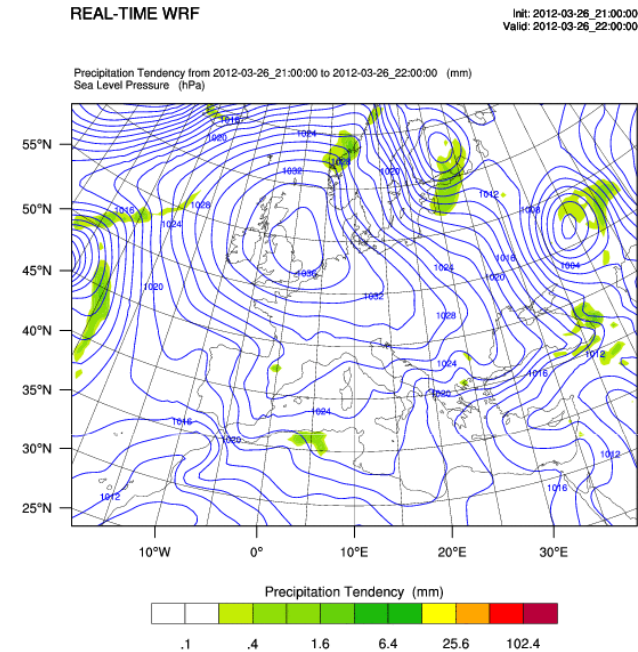
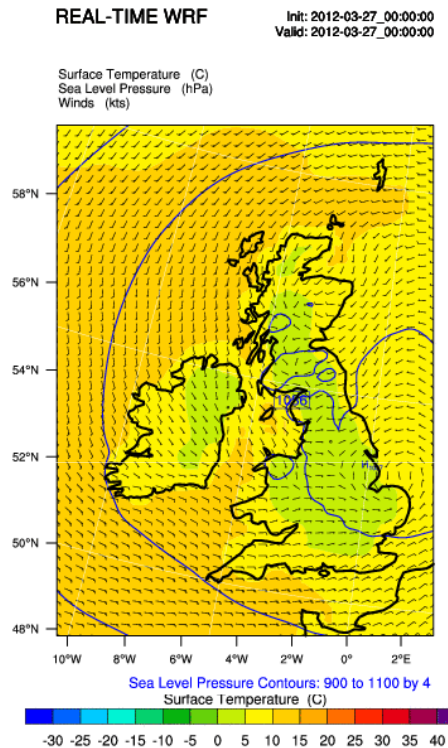
- What direction does the source lie in?
- What variation is there in concentration by time of day?
- Is there seasonal variation in concentrations?

## What about the weather?

The standalone version of Openair could look at meteorology, but requires some programming.....



# Some new functions make use of modelled weather data



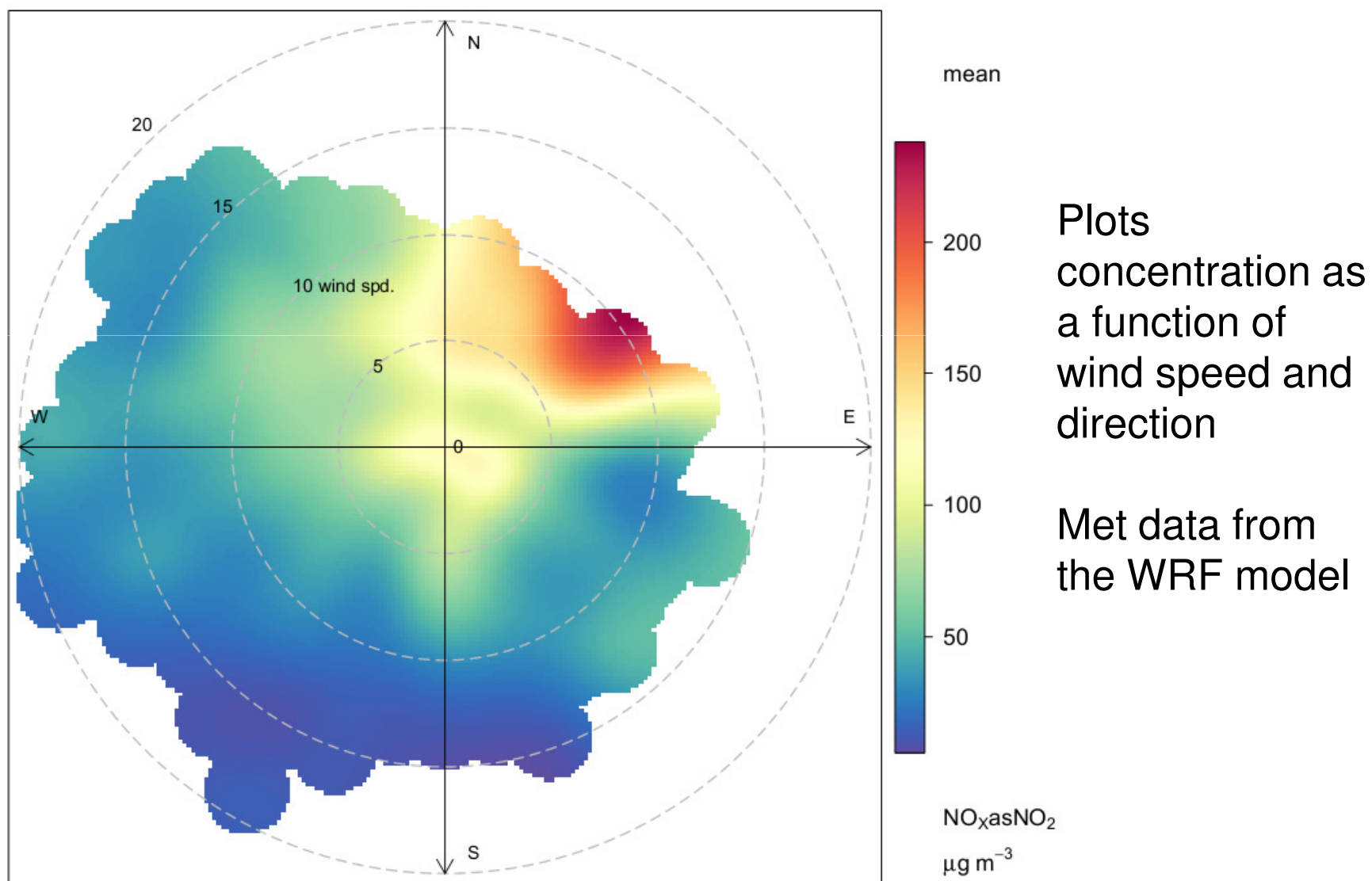
OUTPUT FROM WRF V3.0.1 MODEL  
WE = 120 ; SN = 90 ; Levels = 49 ; Dis = 50km ; Phys Opt = 2 ; PBL Opt = 1 ; Cu Opt = 1

We already use a lot of this data- e.g. for daily air quality forecasts. Its now being made available for use in Openair

**Important to note it is modelled met data that will be used in Openair (validation report will be published soon)**

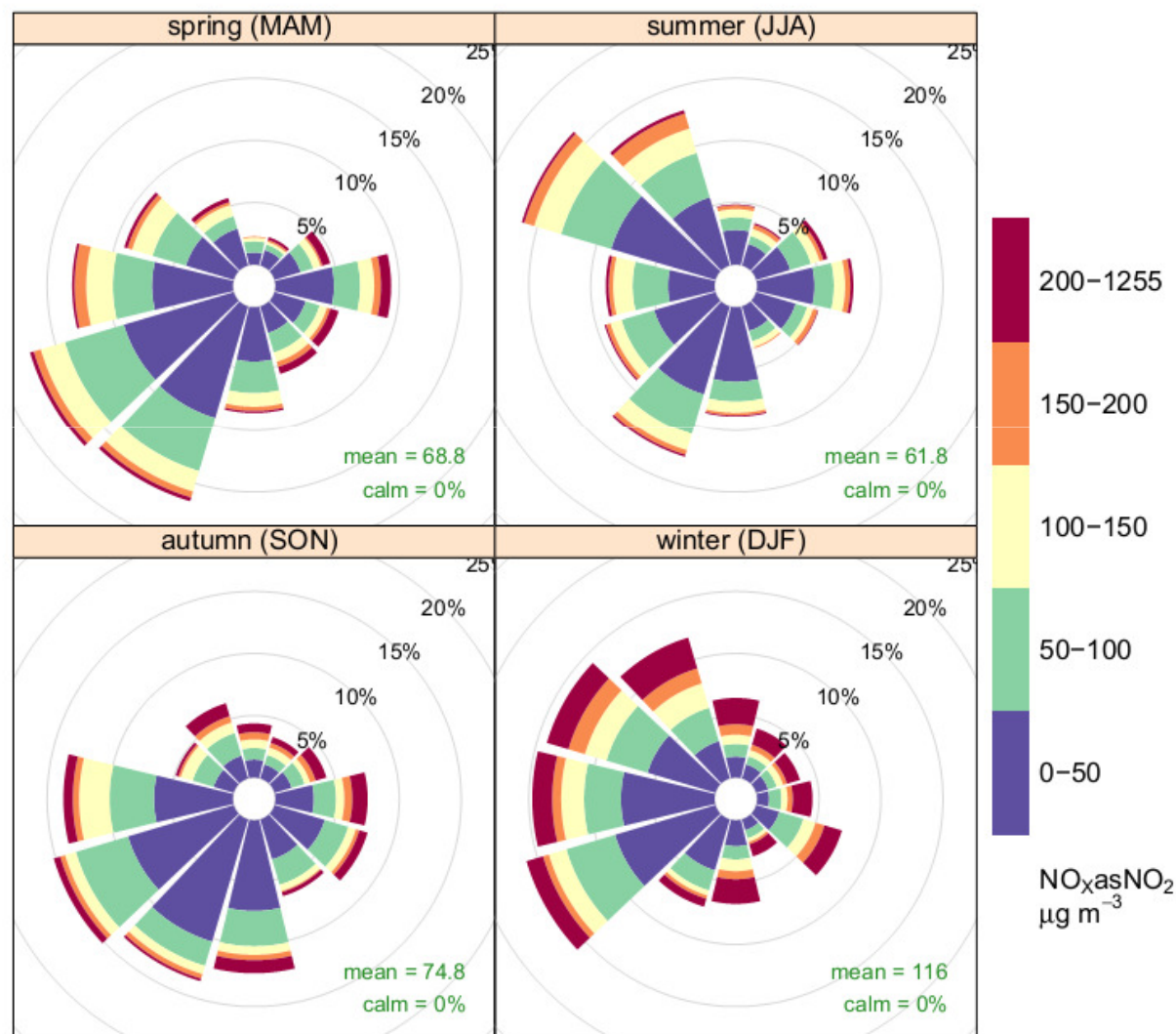
# New Functionality- Polar plot

Polar plot of  $\text{NO}_x$  as  $\text{NO}_2$  at Dumfries averaged for the period 01/08/2010 to 22/03/2012



# New Functionality- Polar plot

Pollution Rose plot of  $\text{NO}_x$  as  $\text{NO}_2$  at Dumfries for the period 01/08/2010 to 23/03/2012

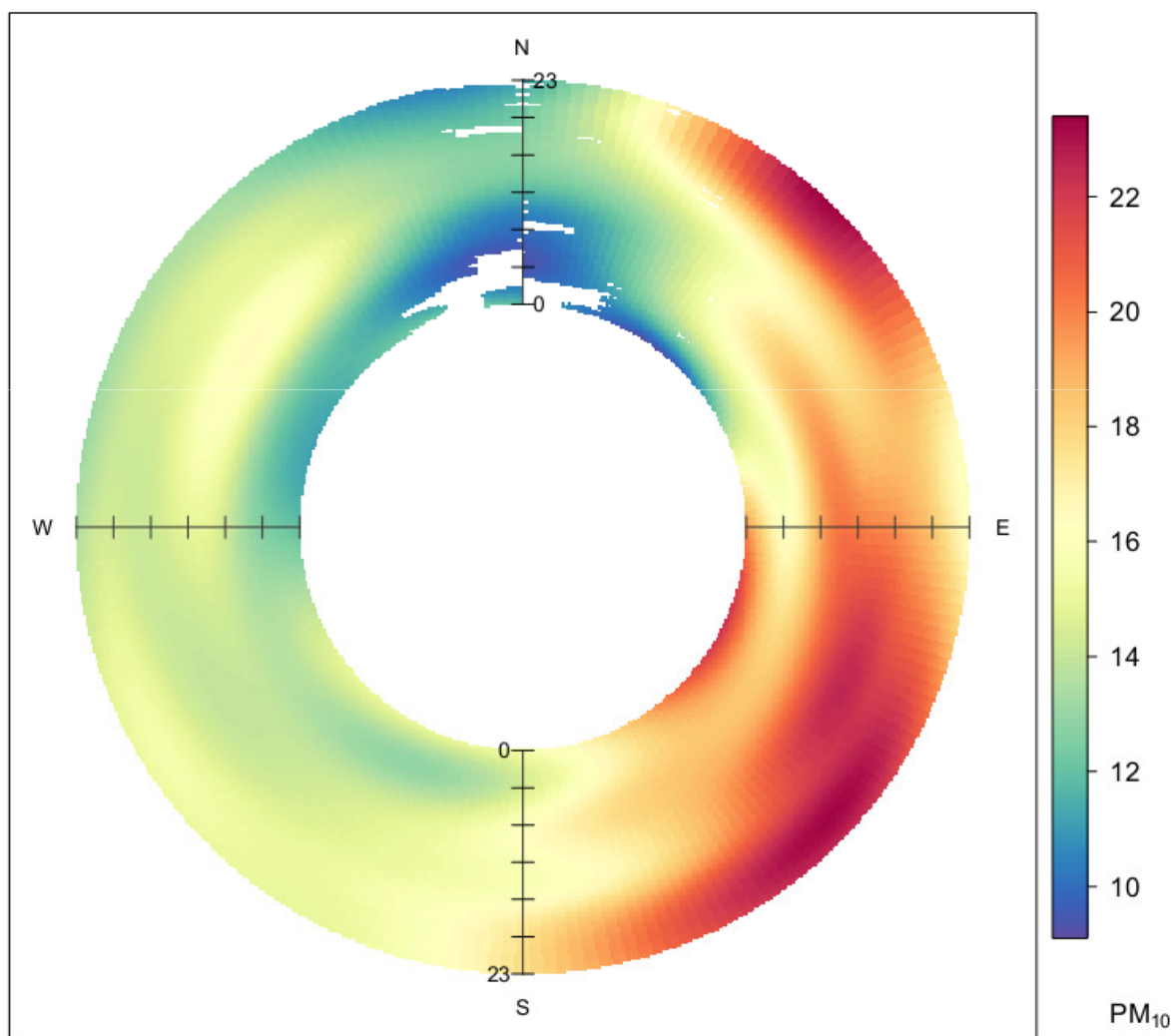


Frequency of counts by wind direction (%)



# New Functionality- Polar annulus

Polar annulus plot of  $PM_{10}$  at Edinburgh St Leonards for the period 01/08/2010 to 23/03/2012

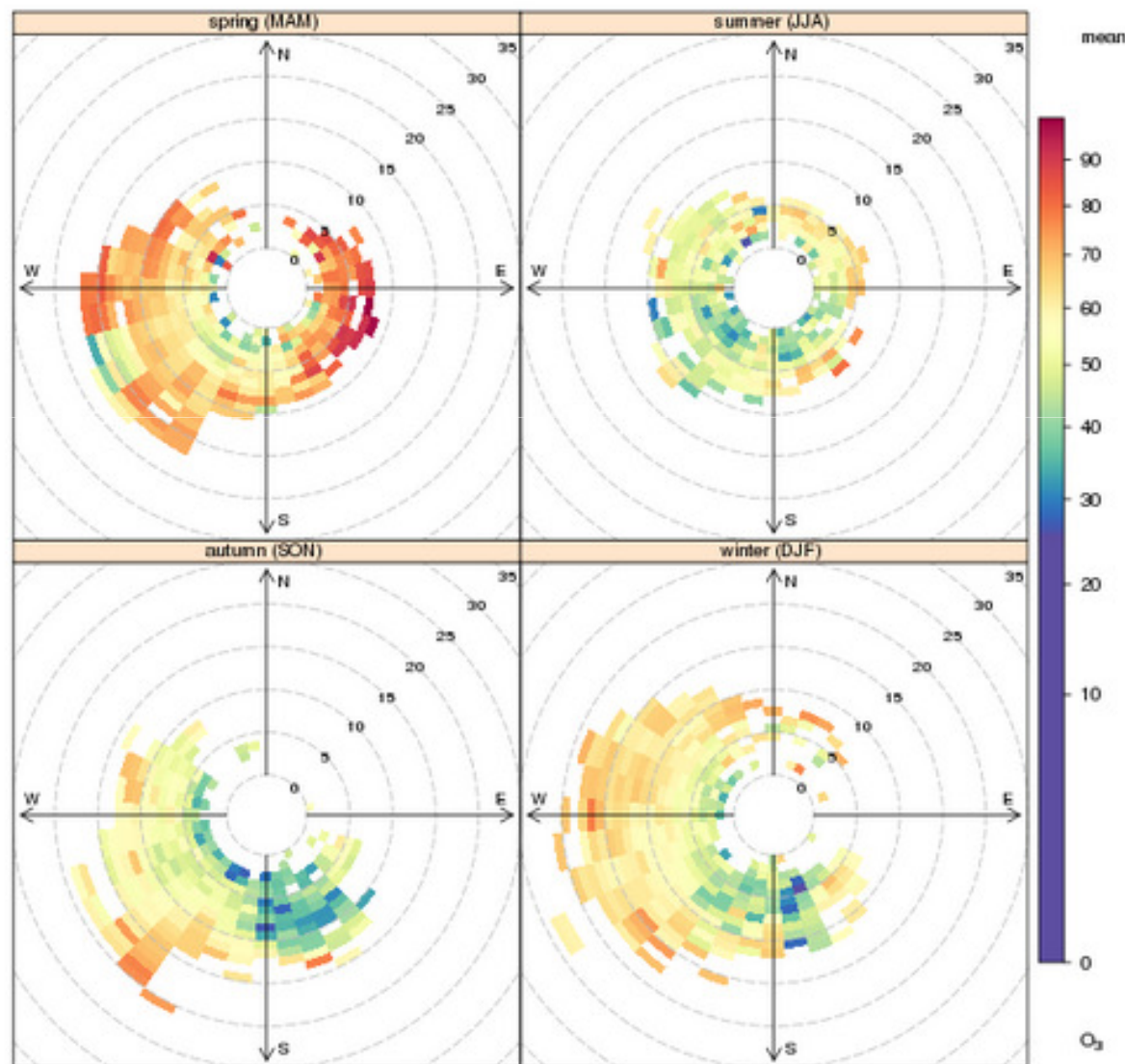


Shows  
concentrations  
by wind  
direction and  
time of day

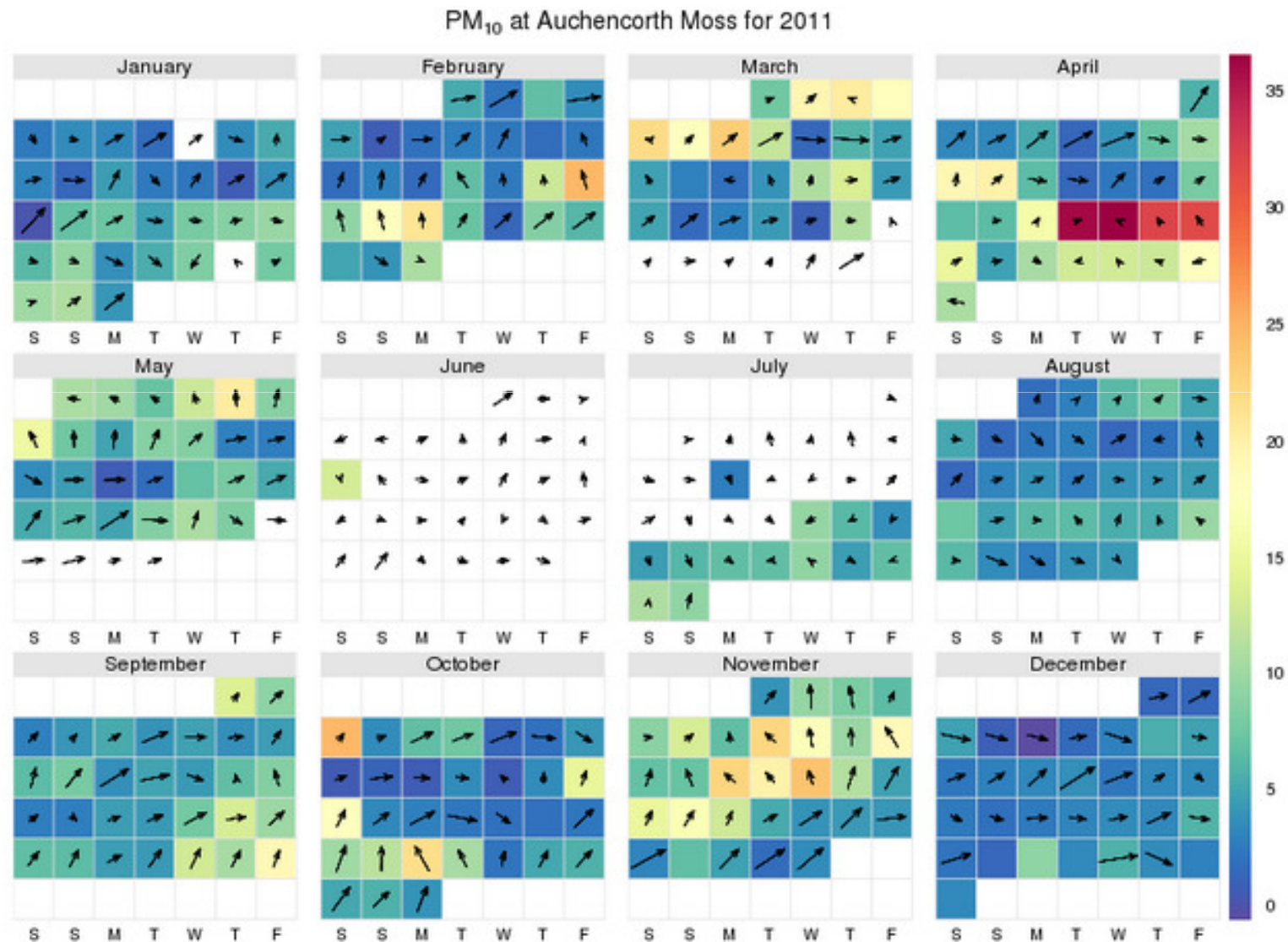
$PM_{10}$

# New Functionality- Polar frequency

Polar frequency plot of mean  $O_3$  by wind speed, direction and season at Auchencorth Moss for the period 2011 to 2012

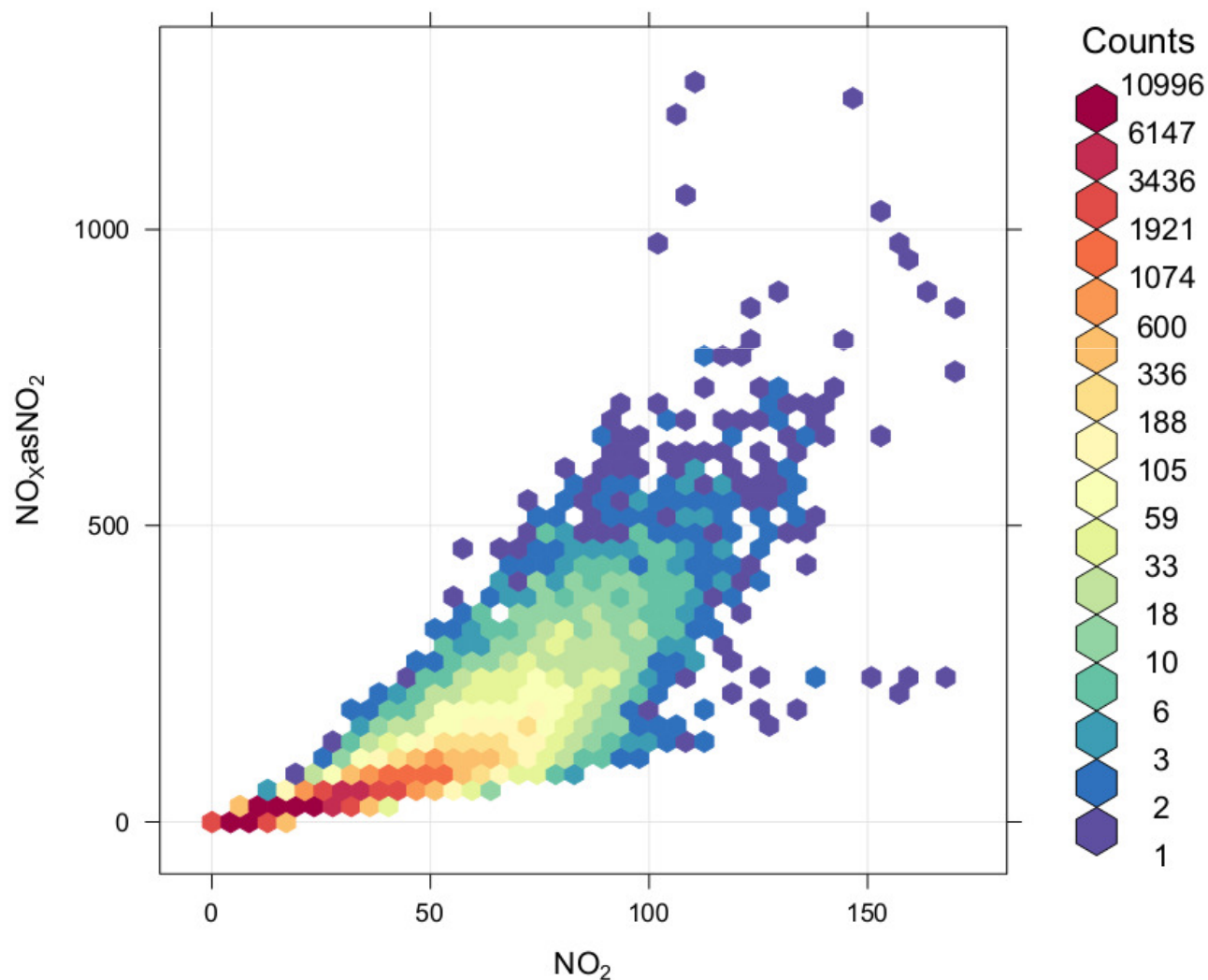


# New Functionality- Calendar plot



# New Functionality- scatter plot e.g. NO<sub>x</sub>/ NO<sub>2</sub> ratio

Scatter plot of NO<sub>2</sub> vs. NO<sub>x</sub>asNO<sub>2</sub> at Aberdeen for the period 18/09/1999 to 23/03/2012



- The existing functions on the SAQD are already hugely useful
- The new functions have introduced meteorological factors
- The WRF model provides the underpinning meteorology
- New functionality will be useful for analysing broad trends in meteorology/pollution relationships
- The new functions could be used for indicative work with local meteorological data being preferred for more definitive studies





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