Y12 Lesson 3

<u>Overview:</u>
This lesson applies the knowledge built in lessons 1 and 2 to investigate how an atmospheric model can be used. This covers predicting weather variables and verifying the weather forecast. The key themes covered include:
- Linear Regression,
- Data Presentation

<u>Introduction (10 – 15 minutes presentation):</u>
Start the lesson by displaying the BBC UK weather forecast for today, available at: http://www.bbc.co.uk/weather/ and ask students to identify if there are any patterns in temperature/rainfall/wind speed across the country.

<u>Lesson Plan:</u>
* = activity on individual whiteboards/verbal activity
**=extension activities

1. **Linear Regression:** In this section the relationship between latitude, longitude and temperature will be investigated. The data set available at http://mathmetics.org/documents/General/10Jul2013_Met_Office_Observation_Data.xlsx will be required and should be displayed to the students.
   1.1. **Recover the process of least squares linear regression for a simple scatter plot. Ensure students know the equation of the regression line: $y = mx + (\bar{y} - m\bar{x})$ where $m = \frac{Sxy}{Sxx}$ is the gradient.
   1.2. Alternatively state these equations as this is sufficient for the worksheet.

2. **Worksheet:** Ask students to complete the first question only of the worksheet, this will require the spreadsheet <u>"Data"</u> to be displayed.
   2.1. Once students have completed the first question demonstrate how the spreadsheet can be used to calculate the linear regression coefficients.
   2.2. Next display the scatter plot of temperature against longitude (on the "Temp vs. Lon" sheet), discuss whether the regression suggested by this method is suitable.
      2.2.1. Random spread of data suggests little significant correlation between temperature and longitude.
   2.3. Finally display the scatter plot of temperature against latitude (on the "Temp vs. Lat" sheet), discuss the suitability of this model.
      2.3.1. Negative correlation apparent, spread of data still is large.

3. **Discussion:** Work through question 2 on the worksheet together as a class. Ask students to complete question 3 individually or in pairs.

4. After students have completed this discuss the solutions and ask:
   4.1. What is the expected temperature at or south of the equator? (Maybe not a linear trend)
   4.2. Importance of repeatability of the model? Display the scatter plot of today's observation data from the website at http://mathmetics.org/cForecast%20Verification/bCurrent%20UK%20Temperatures.php. Does this confirm the model?
   4.3. Discuss questions 2 and 3.

5. **Forecast Verification:** Using the observation data from the website, alongside the Met Office forecast and the school's observation data, ask students to complete the second section of the worksheet.

    5.1. End the lesson with a discussion based on this topic, instruct students how forecasts are made by running a large ensemble of models each with slightly different initial conditions – to allow for observation inaccuracy. The same process used for climate change prediction.