Is the UK flooding caused by extreme weather or extreme incompetence?

By Dr Darko Butina

While the flooding in UK, mainly in south-west England and south Wales, is still ongoing, questions are now being asked in relation to whether or not the flooding could have been prevented.

If we are to believe to the UK Meteorological Office's chief scientist Dr Julia Slingo the current flooding could not have been predicted since, and I quote: "The current winter had the most exceptional period of rainfall in 248 years" or "We have records going back to 1766 and we have seen nothing like this". Furthermore, Slingo also states that she knows the reasons for this flooding: "… all the evidence suggests there is a link to climate change". In other words, the current precipitation was unprecedented, it could not have been predicted, it was caused by man-made global warming and man-made climate change and therefore the UK Meteorological Office did not fail in its duty to advise the UK government and local planning authorities accordingly.

Since Julia Slingo speaks for UK Meteorological Office as their chief scientist, one would assume that her statements are based on facts, i.e. 'knowing everything that there is to know' about their own precipitation data, for example. It follows that an audit of the Meteorological Office's data by an independent specialist in numerical analysis of instrumental/experimental data should be able to confirm her findings.

So, this audit will try to answer two key questions:

1. If the current flooding was caused by precipitation levels never observed in the past, as it is claimed by the UK Meteorological Office, what has been learned from the current flooding episodes and how will that knowledge be used to prevent any future flooding?
2. If, however, the precipitation levels that caused the current flooding have been observed in the past, why was that knowledge ignored and not used to prevent the current flooding?

Let me start by quoting Richard Feynman, the Nobel Prize winner for Physics in 1965:

"In general, we look for a new law by the following process: First we guess it; then we compute the consequences of the guess to see what would be implied if this law that we guessed is right; then we compare the result of the computation to nature, with experiment or experience, compare it directly with observation, to see if it works. If it disagrees with experiment, it is wrong. In that simple statement is the key to science. *It does not make any difference how beautiful your guess is, it does not make any difference how smart you are, who made the guess, or what his name is—if it disagrees with experiment, it is wrong.*"

Feynman's statement is one of the shortest definitions of experimental sciences that captures the process of extracting knowledge from instrumental/experimental data, the very same process that all researchers in experimental sciences use on a daily basis. Every single observation or experiment must be accounted for, or explained by a given theory and any theory that cannot explain every datapoint cannot be called a 'theory'.

Before we start with the audit of the UK Meteorological Office's own precipitation data and find out what Slingo knew or should have known when she made the statements quoted above, for scientific accuracy, I need to digress here and address issues connected with 'extreme events' and 'man-made global warming'.

The theory of man-made global warming is based on the following arguments: the global temperature is going up, the observed rises in temperatures are causing our 'climate' to be out of control and as a result we are observing 'extreme events' across the globe. Since the single cause of this unprecedented global warming is due to humankind burning fossil fuels, it follows that if we stop burning fossil fuels the global temperature together with the 'climate' will get back to normal and no more 'extreme events' will occur. The conclusion: we humans are in control of our planet's climate.

However, the well-known scientific facts tell us a completely different story: there is *not a single example* in the history of modern science where we have managed to prevent any extreme events from happening - we can't stop volcanos erupting, we can't stop hurricanes and tornadoes forming, we can't stop extreme cold or hot weather and we prevent neither rainfall nor snowfall. The only thing that we can do is to try to limit the effects that those extreme events have on our survival! Since all scientific knowledge from our physical sciences tells us that the human contribution towards the planetary climate is 0%, any future predictions or 'scenarios' must be 100% wrong.

The other major issue is the frequent use the word 'extreme' to describe drought, flooding, high/low temperatures and so on, without attaching any relevant numbers to it. Once one uses the term 'extreme', one should first define what 'normal' is. To help the scientific community working in physical sciences to classify sets of datapoints as 'normal' or abnormal, i.e. 'extreme', the field of statistics has set up a generally accepted framework of normalised data. This will be discussed in detail below.

So let us now start with the audit and establish when and how much precipitation was observed in south west England and south Wales, the areas most affected by the current flooding.

Local vs Global

Let me use the well known phrase 'Garbage in, garbage out' to demonstrate the importance of applying the right type of data to a given problem. If the objective is to deal with flooding in south west England and south Wales, hereafter referred to as SWE-SW, one needs to analyse precipitation data for those regions, i.e. local, while the data for the UK, i.e. global, are totally irrelevant. To demonstrate importance of using the right data November's precipitation data for the UK vs SWE-SW were downloaded from the UK Meteorological Office website www.metoffice.gov.uk/climate/uk/summaries/datasets:

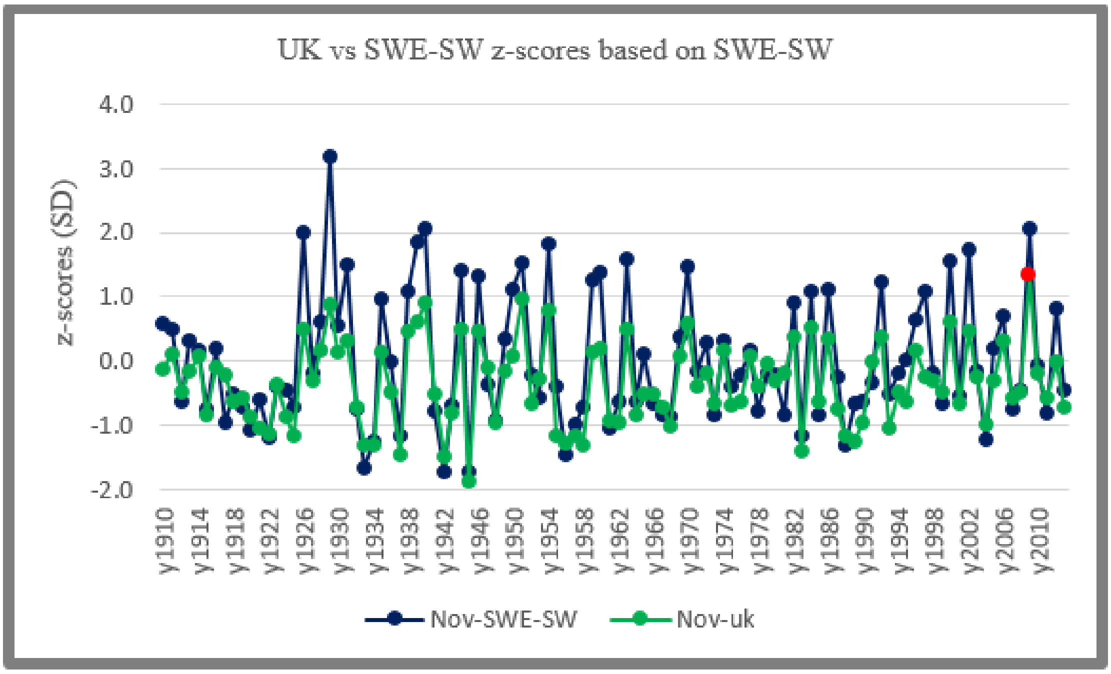

Figure 1. November precipitation data (1910-2013) for the UK (green) vs SWE-SW (dark-blue)

The single message from Figure 1 is that the use of precipitation data averaged across the whole of the UK is irrelevant information for anyone who is trying to project manage river systems in a local region. The UK data, in red, have identified year 2009 as the most critical November since 1910, in terms of high rainfall, with 216 mm of rain, while the most relevant year in SWE-SW was 1929 with 328 mm of rain, a difference of over 100 mm.

<u>Monthly vs Seasonal vs Annual</u>

One of the first steps in the numerical analysis of any given dataset is to calculate four ~~4~~ parameters: the mean, the standard deviation, plus the maximum and minimum values. This step is also known as the ‘get-to-know-your-data’ step:

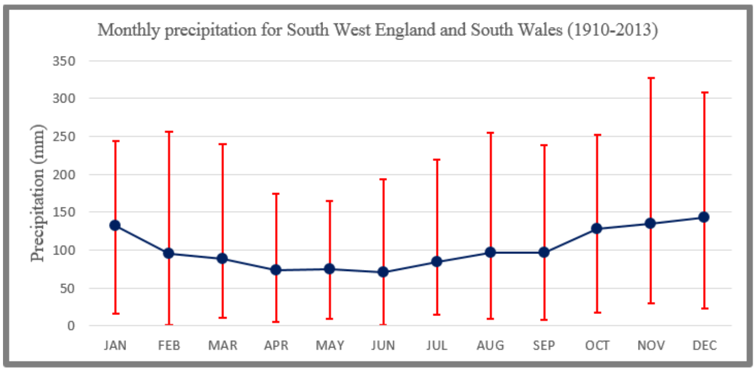

Figure 2. Monthly precipitation data for SWE-SW (1910-2013): the mean (blue) and error bars (red) indicating monthly maximum (top bar) and minimum precipitations levels (bottom bar)

The most important information contained in Figure 2 is that the two months that will have the most effect on possible flooding are November and December since they produce over 100 mm of rain more than any other month. For all practical purposes, the engineer who is tasked to design a river system that will not cause flooding in the future needs to know the maximum precipitation that has been observed in the past, which, in this case, is November. Therefore referencing the averages for 'winter' or 'year' is nonsensical.

<u>Precipitation for November for SWE-SW 1910-2013</u>

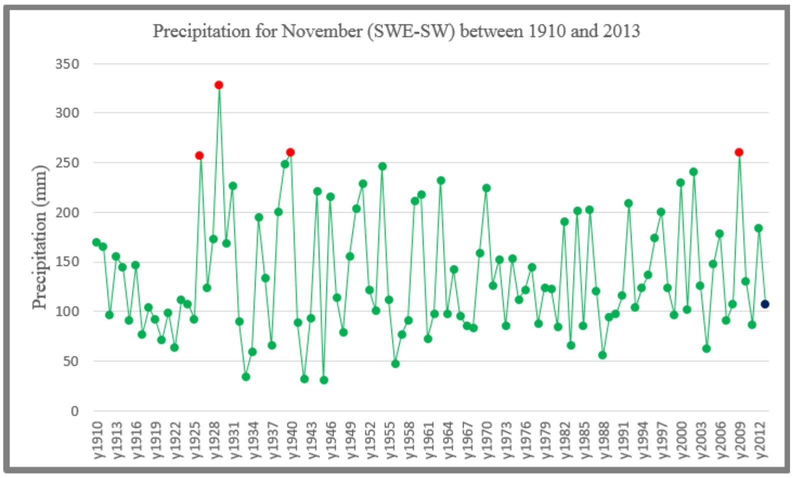

Figure 3. Precipitation data for November (SWE-SW 1910-2013)

As it can be seen from the figure above, the history of precipitation for November is a very 'chaotic' one with the maximum rainfall level observed in 1929 (328 mm) and the minimum observed in 1945 (only 30 mm). For example, the most extreme November in 1929 produced 328 mm of rain, while 4 years later, in 1933 rainfall was only 34 mm. November 1946 was very wet with 215 mm, November 1947 was dry with 30 mm while November 1948 was again wet with 215 mm. It is this apparently random frequency of going from the high extreme to the low extreme that defines this precipitation system as a chaotic one and since it is impossible to learn from the past events, we cannot predict future events.

Real data vs Trends

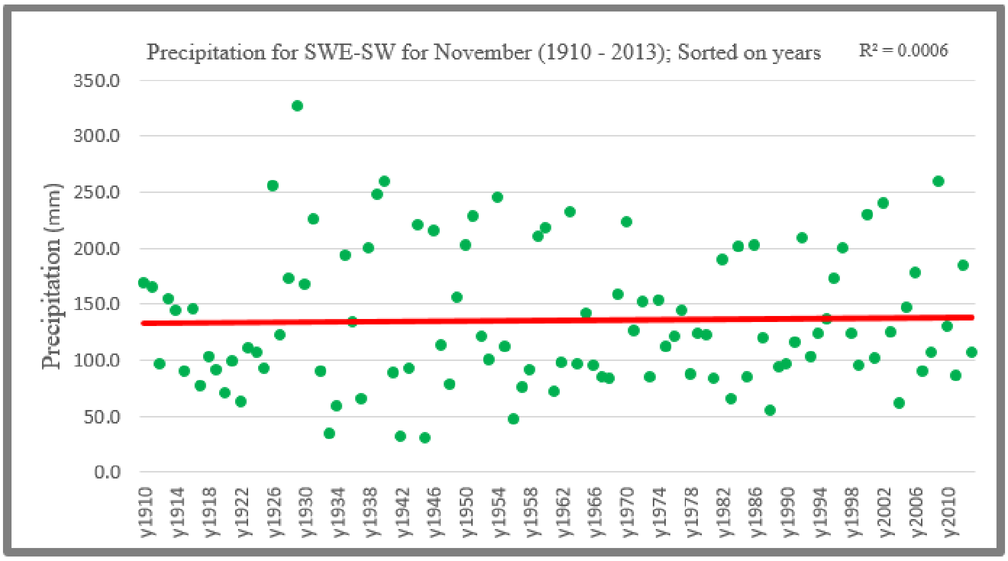

Figure 4. Linear model (trend line) for November's precipitation data with $R^2 = 0.0$; sorted by year

One of the most common misuses of a linear trend line is to generate that trend line irrespective of the spread of the data and without understanding trend line algorithm. Figure 4 is a plot of precipitation data against the year when the precipitation was recorded. The dataset was sorted by year in chronological order, from the oldest, 1910 on the left, to the youngest, 2013, on the right. The objective of that plot was to see whether the Y (dependent) variable, which here is the measured precipitation level, correlates to the X (independent) variable, which is the time of measurement, i.e. the year, and as can be seen by naked eye, there is no correlation whatsoever between precipitation and year (time). To quantify that correlation, the linear trend line, or linear model, is displayed together with the R^2 of that correlation, which is zero (there is a box to tick in excel to display R^2 for the linear trend line). The meaning of R^2 is as follows: the lowest R^2 can be 0 which means that the model explains 0% of the variation in the dataset, i.e. the predictive power of the model is 0%; the highest R^2 is 1 which means that the model explains 100% of the variation in the dataset with the predictive power of 100%. *However, the most important conclusion from Figure 4 is that the mean of the dataset, in this case the mean is the same as the trend line, does not represent that dataset and therefore use of the mean as a reference point is nonsensical.*

Conclusion: The precipitation for November observed in SWE-SW has 0% correlation with the years when it was measured.

Let me briefly digress again here and apply the conclusion just made to the issue of man-made global warming. The only evidence offered in support of global warming is based on global mean temperature values calculated by averaging temperatures between the hot extremes at "+60^{O}C" observed in hottest deserts, and the cold extremes at "-60^{O}C" observed in Antarctica. It must follow that no evidence of global warming in calibrated thermometer data should be found since the observed daily thermometer data can be also described as a chaotic system – and, indeed, that was confirmed by a recently published paper that can be freely accessed on my website:
www.l4patterns.com/uploads/1941-3955_4_2-3_19-db-paper.pdf

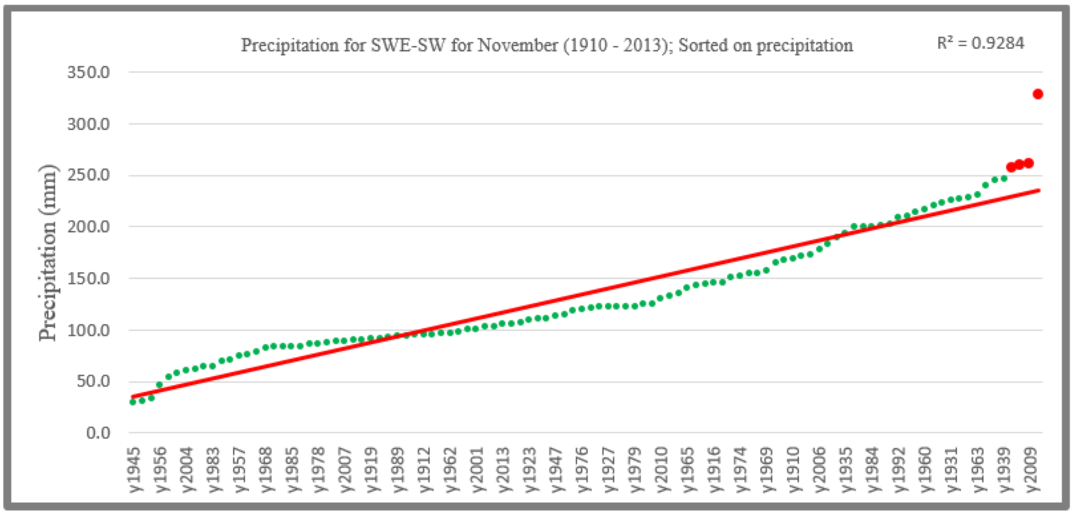

Figure 5. Linear model (trend line) for November's precipitation data with $R^2 = 0.93$; sorted on precipitation

The figure above was created by sorting November data by precipitation, from the lowest on the left and the highest on the right with the resulting linear model (trend line in red) indicating R^2 of 0.93, i.e. predictive power of 93%. The only problem with that model is that the years are completely scrambled from their chronological order while the most extreme datapoint is observed in 1929 (n.b. the year label is NOT displayed) in the far upper right corner of the plot!

Conclusion: The precipitation for November observed in SWE-SW has 0% correlation with the years when it was measured.

Normal vs Extreme

One of the standard tools for classifying any datapoint as normal or extreme can be found in the field of statistics and it is called z-score. The overall process is quite simple – a given dataset is transformed into a 'normalised' space where each datapoint is represented by its distance in standard deviation units, the z-score, relative to the mean.

To calculate z-score one needs to calculate the mean, μ, and the standard deviation, SD or σ, for the whole of the dataset and then apply the following formula:

$$\text{z-score} = (X – \text{Mean})/\text{Standard Deviation} \quad \text{or z-score} = (X - \mu)/ \sigma$$

where X is an individual observation, in this case amount of rainfall in mm. Please note that MS Excel uses a function called 'average' to calculate 'the mean', and a function 'stdevp' to calculate the standard deviation for the dataset.

All datapoints with z-scores between +/- 1.96 are labelled as normal and all those above or below +/- 1.96 are labelled extreme. In simplistic terms, the frequency and size of datapoints with z-scores between +/- 1.96 define those datapoints as a 'normal' or as a 'natural variations', while those with z-score 2 or more either above or below the mean are defined as extremes but still statistically significant. For more detailed explanation on z-scores check any standard textbook on statistics.

Since the z-scores are calculated from the original datapoints, it means that scientists working with instrumental data can exchange information without loss of the original data. It also means that we can compare different datasets obtained with either identical or different instruments and compare the respective conclusions.

Let us start with the precipitation observed in November and identify the historical extreme precipitation events in SWE-SW:

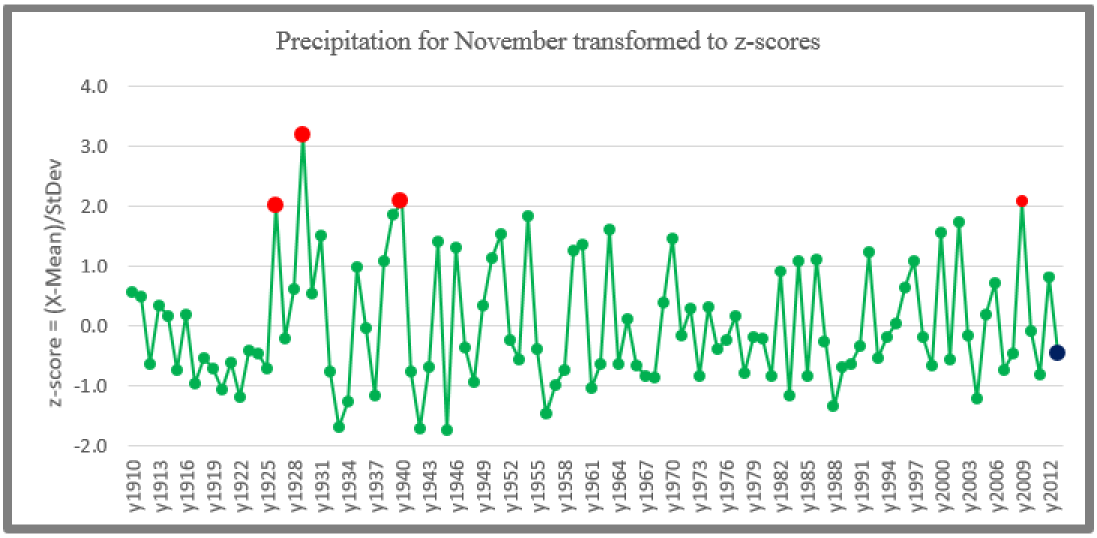

Figure 6. The history of November precipitation data for SWE-SW in z-scores: datapoints in green are 'normal', those in red are extreme (z-score >= 2.0) and single datapoint in blue represents November 2013 with z-score of -0.5

The first thing to emphasise that Figure 6 and Figure 3 (page 3) are identical in terms of patterns and that transforming the original data into z-scores simply offers a unique way to classify datapoint as either 'normal' or 'extreme' while at the same time makes it possible to assign the original value to each datapoint.

Secondly, in terms of extreme precipitations, there were 3 extreme precipitation events in the distant past: 1926, 1929 and 1940 and only one recently, in 2009. *The last datapoint in Figure 6 (in dark blue) is for November 2013, presumably used by the UK Meteorological Office to predict that the forthcoming winter will be dry!*

What about December?

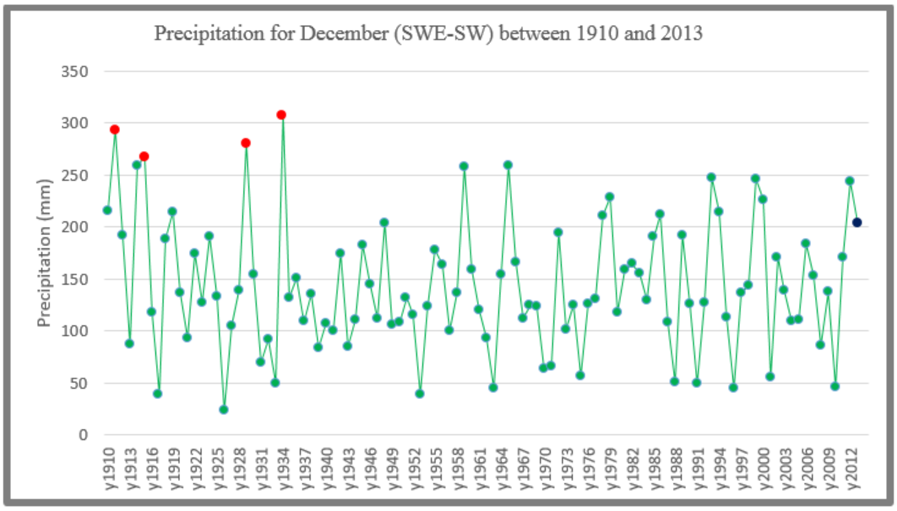

Figure7. The history of December precipitation data for SWE-SW classified by z-score: datapoints in green are ‘normal’ (z-score <2.0), those in red are extreme (z-score >= 2.0) and the single datapoint in blue represents December 2013

Well, December 2013 is even worse for the proponents of the ‘recent extreme weather ‘alarms, since only four extreme events happened in 1911, 1915, 1929 and 1934, while in 2013 (blue point) the rainfall was more than 100 mm less than the December rainfall measured in those four years.

<u>Winter months referenced to the November mean and standard deviation</u>

Let us now conclude this audit and compare the winter months, December, January and February to November and calculate z-scores for the winter months using November’s mean and SD:

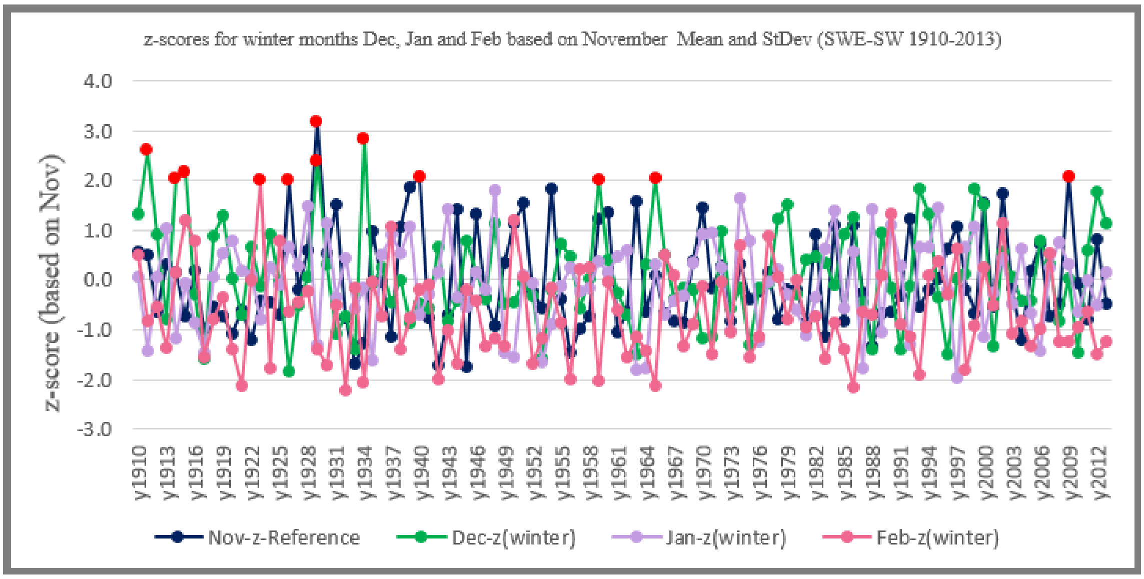

Figure 8. z-scores for December, January and February against *November as a reference*: extreme precipitation dots in red

Since the most extreme month in SWE-SW was October 1929 it would be used as a marker by a civil engineer contracted to design a river system that should never flood if rainfall fell below 328 mm. Therefore it makes sense to use November’s mean and standard deviation to calculate z-scores for the winter months and identify frequency and amounts of those extreme events:

$$z_{Dec} = (X_{Dec} - \mu_{Nov})/\sigma_{Nov}$$

If we ignore the colour-coded (by month) z-scores below 2.0 we can easily identify all extreme years when one or more winter months have been declared extreme (red dots). Out of 12 extreme years, 11 occurred before the invention of global warming, i.e. before the 1980s (please note that the 1970s were described as globally cold years), while only one occurred during the global warming period, in 2009. So in terms of a football score it is no contest: No-global warming beat Global warming 11-1!

Conclusions

First of all, there is NO evidence in the UK Meteorological Office's own data that supports the assertion that precipitation levels in December 2013 (203 mm) and January 2014 (248 mm) were the 'most exceptional in the last 248 years' or 'we have seen nothing like this since 1766' as similar rainfall values have observed on 11 occasions relatively recently, i.e. since 1911.

So how should the public statements made by the chief scientist of the UK Meteorological Office have been interpreted? These statements, in the author's opinion, were clearly incorrect and prompt an obvious, albeit a highly controversial, question. Did the statements result from flawed interpretation of data within the UK Meteorological Office or was there an underlying intention to mislead the general public?

The only conclusion that the audit above can draw is that recent flooding in the UK was NOT caused by extreme precipitation but resulted from extreme incompetence.

What is obvious by examining the measured data is that 'normal' amounts of rain were causing the flooding. This implies that rivers in December of 2013 and January/February 2014 were removing much lower volumes of water than in previous years! That, in turn, can indicate only one thing (which is a widely-held belief in the flooded areas): the present and past governments plus the Environment Agency had, for whatever reason, stopped managing river flow rates adequately despite the warnings of engineering and local experts.