The Clay Research Group

RESEARCH AREAS

Climate Change ◆ Data Analysis ◆ Electrical Resistivity Tomography
Time Domain Reflectometry ◆ BioSciences ◆ Ground Movement
Soil Testing Techniques ◆ Telemetry ◆ Numerical Modelling
Ground Remediation Techniques ◆ Risk Analysis
Mapping ◆ Software Analysis Tools

The Clay Research Group

August 2013

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Issue 99, August, 2013

NEXT MONTH
Contributions for the 100th Edition Welcome.

Anniversary Edition

We were reminded by Tony Boobier that the 100th edition looms, and that, as a special anniversary, it should be marked in some way.

We have prepared an article devoted to a vision of the future. How will things look in say 20 years time? Will data analysis change the way we handle claims? And what about technology – will we be making use of some of the methods that the industry have been researching?

Any articles or suggestions welcomed.

THE CLAY RESEARCH GROUP
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The Aldenham Weather Station

Plotting data year on year reveals just how complicated meaningful interpretation can be. Some days are hotter than others, but for shorter periods. A record temperature might last an hour or so, and another, just a degree lower, might last for twice as long. Solar radiation is an important factor, as of course is rainfall.

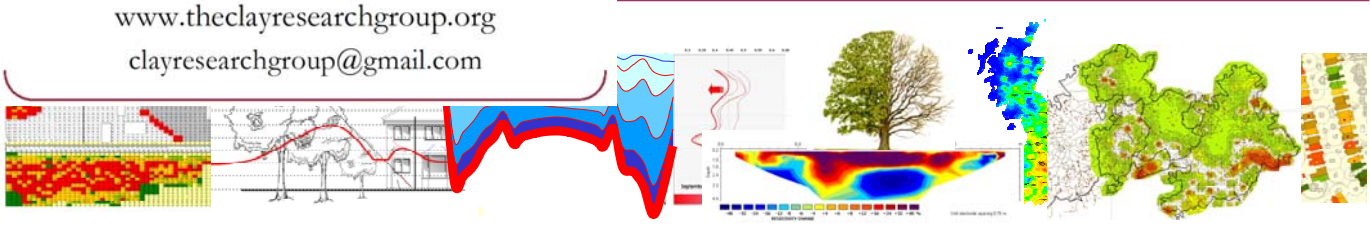
In this respect, the Aldenham Station replicates the problems of interpreting averages from around the globe.

In addition, there have been practical problems. The station was changed towards the beginning of 2007 due to a fault and batteries failed in 2012, resulting in loss of data for several months in 2 out of 5.5 years.

Reverting to the monthly data supplied by the Met Office we have advanced our research into the link between claim numbers and weather by using a normalisation technique. What combination of rainfall, hours of sunshine and temperature deliver the best correlation with claims experience? The results have been interesting, although not predictive of course.

The method, applied to a sample of the years, has delivered a correlation between summer weather and subsidence claims of 0.889. A high value demonstrating the importance not only temperature, but rainfall.

These values have proven to be stronger than any link between claim count and the Soil Moisture Deficit. Prediction for 2013? Particularly hard to call but bearing in mind the advice of climatologists around change, perhaps less than 30,000 claims?



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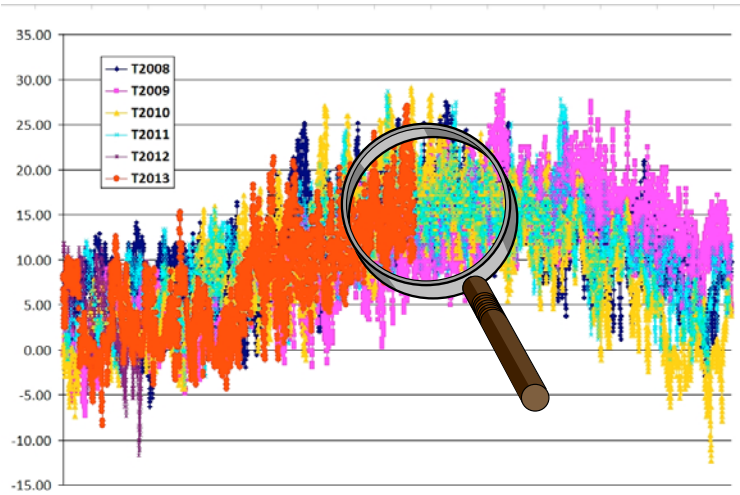
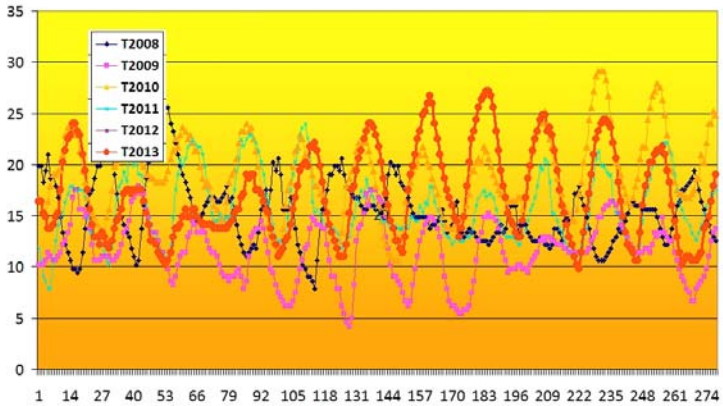
ALDENHAM WEATHER STATION

Cyril Nazareth has collected the data from the Aldenham Weather Station and we have plotted the output onto previous years to illustrate the difficulty in making meaningful assessments. 2013 is plotted in red/orange, to the front of the set.



Temperature plots from Aldenham for the period 2008 through to 12th July, 2013.

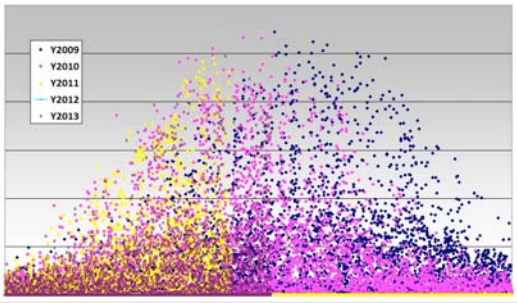
Although we can take daily/weekly/monthly averages it seems a crude tool to understand the net effect. July data up until the 12th is shown below.

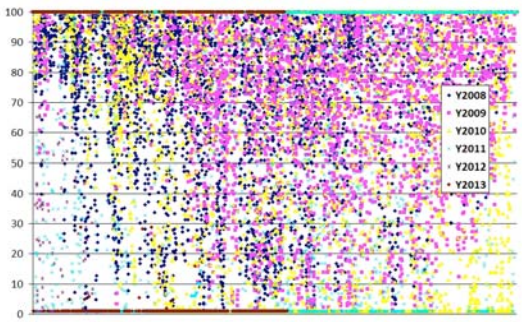


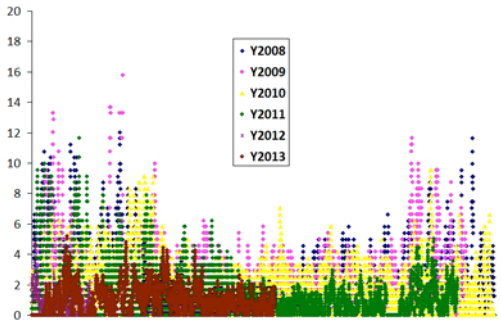
Aldenham temperature plots for 6 years, starting in 2008 through to the 12th July, 2013 showing the diurnal signature and variations in amplitude.

Below are plots of solar radiation measured in Watts per square metre (top) and relative humidity (bottom).

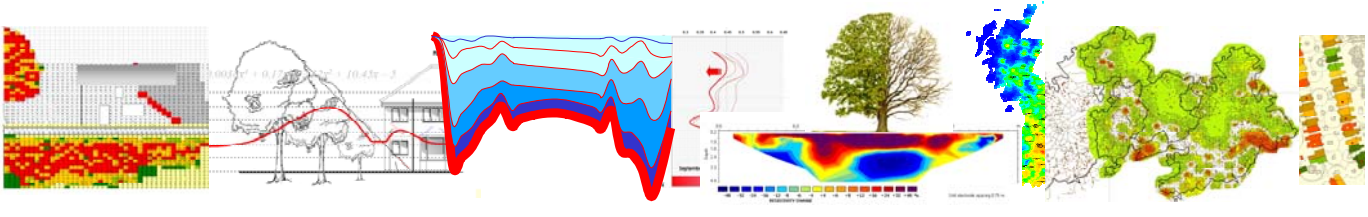
Both are important measures in terms of photosynthesis and transpiration.







Rainfall data is shown above. The station has been less reliable in recording rainfall data over recent years.



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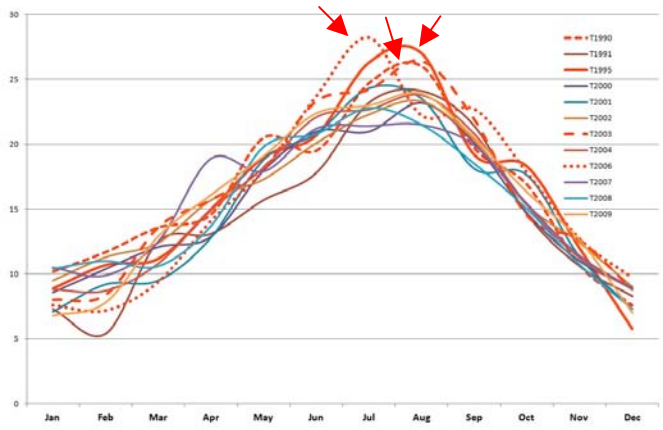
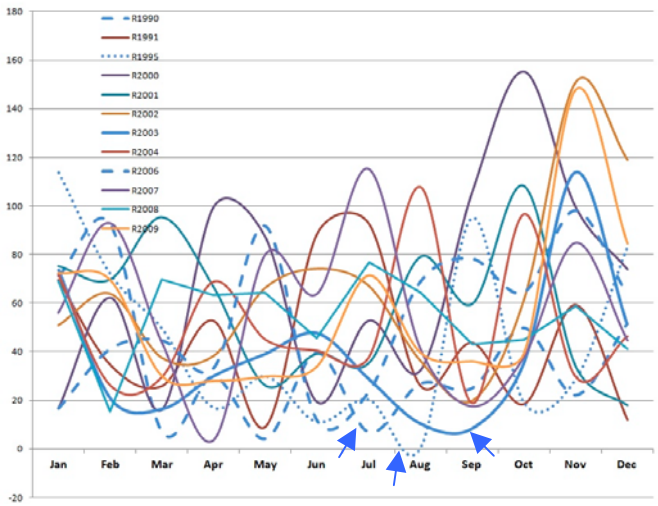
Met Office Weather Records

Using Met Office data, temperatures for the years noted are plotted below and it can be seen that so-called event years (red lines) are characterised by fairly short duration 'peaks' (that is, lines rising above their 'normal claim year' counterparts) of a few degrees, around July and August.





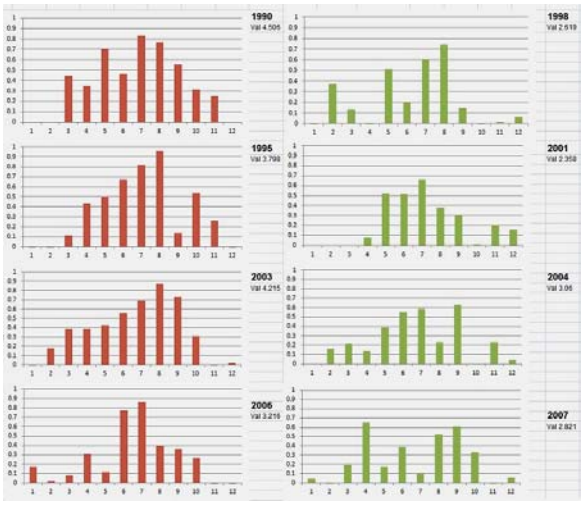
Similarly, the rainfall plots for these same event years (plotted blue) all show significant deficits of a slightly longer duration over the same period.

CLAIMS –v- WEATHER ELEMENTS

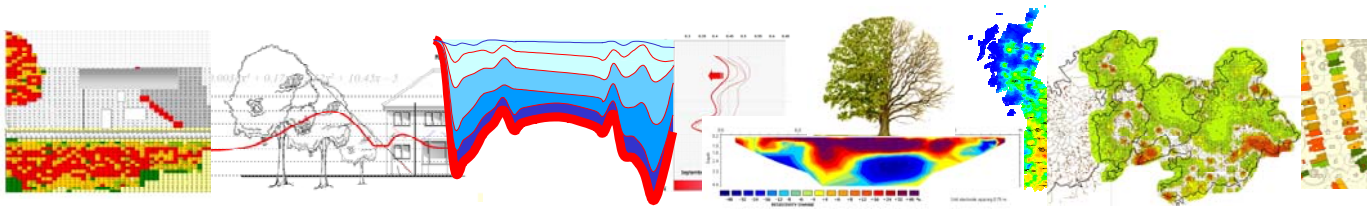
To determine what combination of weather elements correlate most closely with count of claims as recorded by the ABI, temperature, sunshine and rainfall were analysed for both event and normal claim years.

There is an issue trying to understand the relevance of say 29.5degC for 5 days with 32degC for half an hour, and what that means in terms of 32mm of rainfall compared with 18mm etc.

We have used the Met Office dataset from the Heathrow weather station for the period Jan 1948 through to the current time. The data lists temperature (max and min), sunshine and rainfall. 'Maximum temperature' values have been used.



Normalised Weather Data for the Sample Years



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The weather data for the entire period has been normalised on a scale 0 – 1. This allows us to make meaningful comparisons between years.

The maximum temperature value (T_{max}) = 28.2 degC and the rainfall (R_{max}) = 178.4mm for the period under consideration.

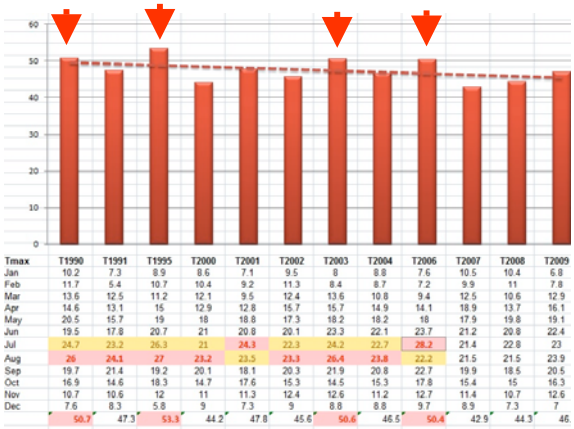
Normalisation has been carried out using the formula $Val/(Val_{max} - Val_{min})$. Rainfall has been subtracted from temperature to derive an adjusted weather value that takes account of both. The graphs, right, show the output for the months July and August.

What is evident is that whilst many of us spend time looking at the temperature to try to predict event years, low rainfall is a major contributory factor.

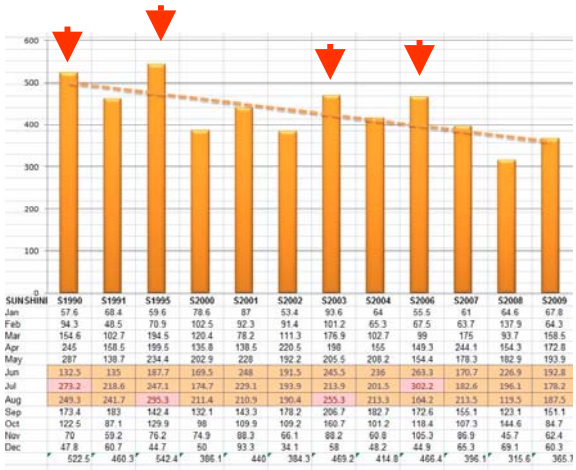
The correlation with ABI 'count of claims' data for the sample years using this method is 0.749. The correlation for the summer months of July, August and September (i.e. not the full year) improved this still further to 0.889 - a very strong correlation.

This compares with a correlation between claim count and SMD of 0.581 for the year, improving to 0.754 using the summer months – July, August and September.

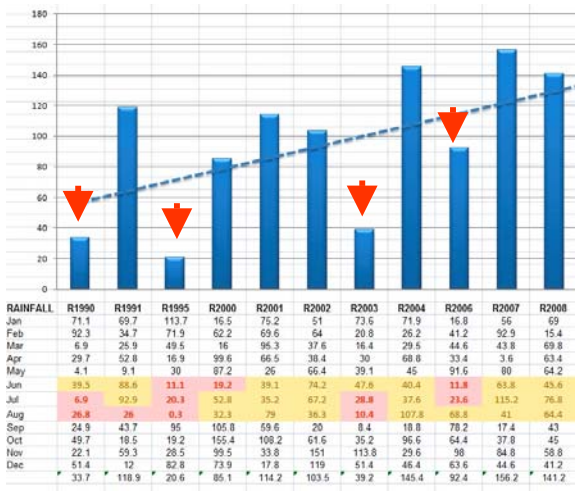
Conclusions: using normalised weather data, derived as outlined above, and subtracting rainfall from temperature, delivers a robust correlation with claims. Rainfall data is as important as temperature data.



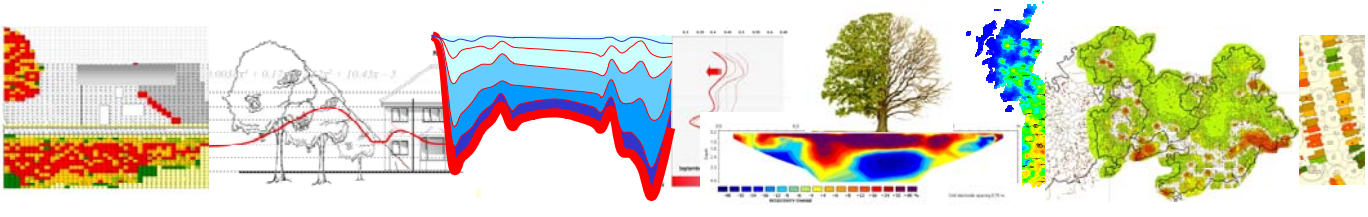
Tmax	T1990	T1991	T1995	T2000	T2001	T2002	T2003	T2004	T2006	T2007	T2008	T2009
Jan	10.2	7.3	8.9	8.6	7.1	9.5	8	8.8	7.6	10.5	10.4	6.8
Feb	11.7	5.4	10.7	10.4	9.2	11.3	8.4	8.7	7.2	9.9	11	7.8
Mar	13.6	12.5	11.2	12.1	9.5	12.4	13.6	10.8	9.4	12.5	10.6	12.9
Apr	14.6	13.1	15	12.9	12.8	15.7	15.7	14.9	14.1	18.9	13.7	16.1
May	20.5	15.7	19	18	18.8	17.3	18.2	18.2	18	17.9	19.8	19.1
Jun	19.5	17.8	20.7	21	20.8	20.1	23.3	22.1	23.7	21.2	20.8	22.4
Jul	24.7	23.2	26.3	21	24.3	22.3	24.2	22.7	28.2	21.4	22.8	23
Aug	26	24.1	27	23.2	23.5	23.3	26.4	23.8	22.2	21.5	21.5	23.9
Sep	19.7	21.4	19.2	20.1	18.1	20.3	21.9	20.8	22.7	19.9	18.5	20.5
Oct	16.9	14.6	18.3	14.7	17.6	15.3	14.5	15.3	17.8	15.4	15	16.3
Nov	10.7	10.6	12	11	11.3	12.4	12.6	11.2	12.7	11.4	10.7	12.6
Dec	7.6	8.3	5.8	9	7.3	9	8.8	8.8	9.7	8.9	7.3	7
	50.7	47.3	53.3	44.2	47.8	45.6	50.6	46.5	50.4	42.9	44.3	46



SUNSHINE	S1990	S1991	S1995	S2000	S2001	S2002	S2003	S2004	S2006	S2007	S2008	S2009
Jan	57.6	68.4	59.6	78.6	87	53.4	93.6	64	55.5	61	64.6	67.8
Feb	94.3	48.5	70.9	102.5	92.3	91.4	101.2	65.3	67.5	63.7	137.9	64.3
Mar	154.6	102.7	194.5	120.4	78.2	111.3	176.9	102.7	99	175	93.7	158.5
Apr	245	158.5	199.5	135.8	138.5	220.5	198	155	149.3	244.1	154.3	172.8
May	287	138.7	234.4	202.9	228	192.2	205.5	208.2	154.4	178.3	182.9	193.9
Jun	132.5	135	187.7	169.5	248	191.5	245.5	236	263.3	170.7	226.9	192.8
Jul	273.2	218.6	247.1	174.7	229.1	193.9	213.9	201.5	302.2	182.6	196.1	178.2
Aug	249.3	241.7	295.3	211.4	210.9	190.4	255.3	213.3	164.2	213.5	119.5	187.5
Sep	173.4	183	142.4	132.1	143.3	178.2	206.7	182.7	172.6	155.1	123.1	151.1
Oct	122.5	87.1	129.9	98	109.9	109.2	160.7	101.2	118.4	107.3	144.6	84.7
Nov	70	59.2	76.2	74.9	88.3	66.1	88.2	60.8	105.3	86.9	45.7	62.4
Dec	47.8	60.7	44.7	60	93.3	34.1	58	48.2	44.9	65.3	69.1	60.3
	522.5	460.3	542.4	386.1	440	384.3	469.2	414.8	466.4	396.1	315.6	365.1



RAINFALL	R1990	R1991	R1995	R2000	R2001	R2002	R2003	R2004	R2006	R2007	R2008
Jan	71.1	69.7	113.7	16.5	75.2	51	73.6	71.9	16.8	56	69
Feb	92.3	34.7	71.9	62.2	69.6	64	20.8	26.2	41.2	92.9	15.4
Mar	6.9	25.9	49.5	16	95.3	37.6	16.4	29.5	44.6	43.8	69.8
Apr	29.7	52.8	16.9	99.6	66.5	38.4	30	68.6	33.4	3.6	63.4
May	4.1	9.1	30	87.2	26	66.4	39.1	45	91.6	80	64.2
Jun	39.5	88.6	11.1	19.2	39.1	74.2	47.6	40.4	11.8	63.8	45.6
Jul	6.9	92.9	20.3	52.8	35.2	67.2	28.8	37.6	23.6	115.2	76.8
Aug	26.8	26	0.3	32.3	79	36.3	10.4	107.8	68.8	41	64.4
Sep	24.9	43.7	95	105.8	59.6	20	8.4	18.8	78.2	17.4	43
Oct	49.7	18.5	19.2	155.4	108.2	61.6	35.2	96.6	64.4	37.8	45
Nov	22.1	59.3	28.5	99.5	33.8	151	113.8	29.6	98	84.8	58.8
Dec	51.4	12	82.8	73.9	17.8	119	51.4	46.4	63.6	44.6	41.2
	33.7	118.9	20.6	85.1	114.2	103.5	39.2	145.4	92.4	156.2	141.2



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SOIL MOISTURE DEFICIT

Soil Moisture Deficit (SMD) values* for normal claim years are plotted top right.

They generally tend to cross the bold green line at some stage. Some start dry, and others wet, but the SMD associated with normal claim numbers share the characteristic of being irregular due to periods of rainfall.

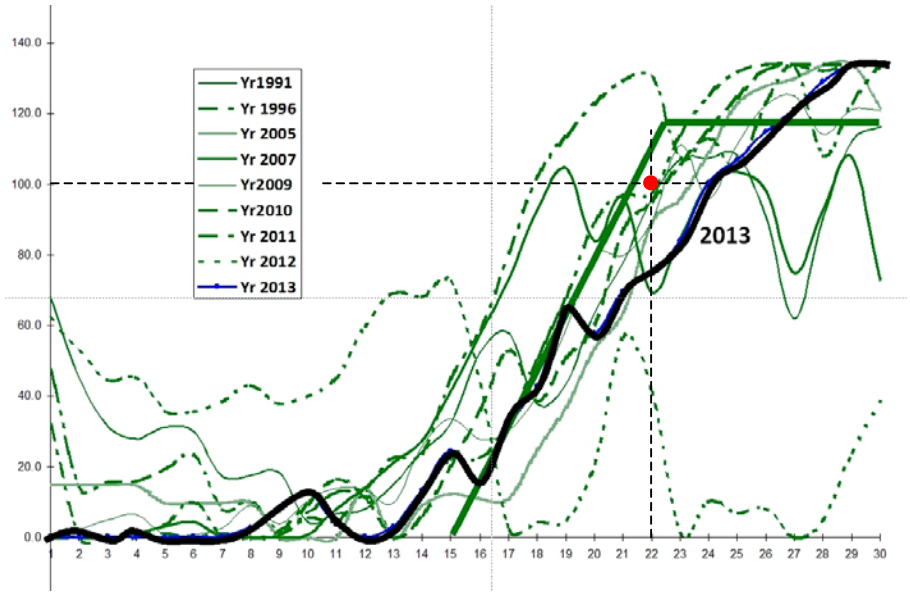
In contrast, the values for busy claim years is shown below.

Nearly all are to the left, and above the bold green line.

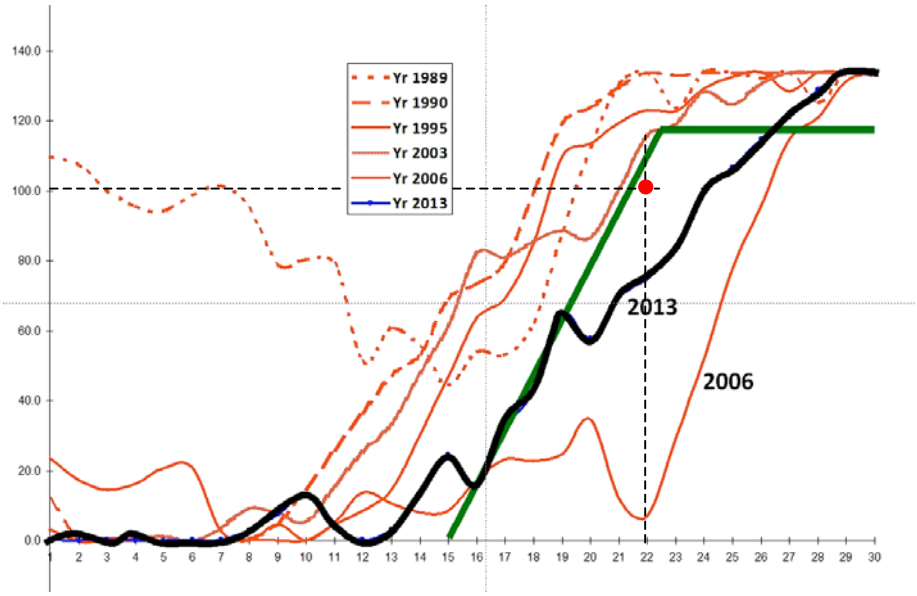
The notable exception is 2006.

As with the graph above, it can be seen that the years can be either wet or dry at the start. It isn't the case that event years are always preceded by dry winters.

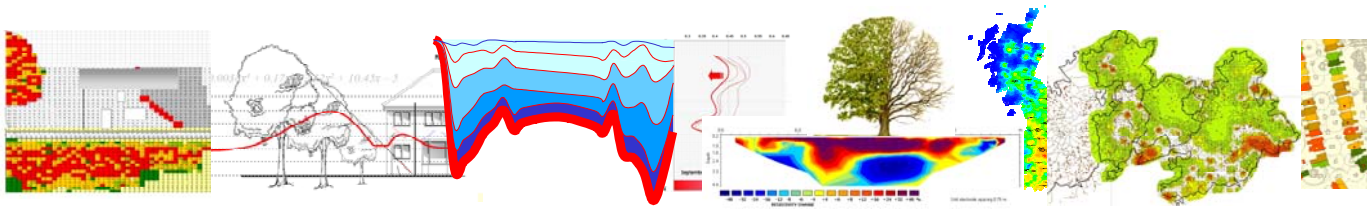
* SMD values for Tile 161 situated in North London, with grass cover and soil with Medium Available Water Capacity supplied by the Met Office.



In the past, normal claim years have been characterised by an SMD less than 100mm at the end of May, with irregular lines crossing the bold, green line either early in the year, or at sometime in the summer.



In contrast, the plot of the SMD for busy claim years tend to have a more regular profile, situated to the left and above the green bold line with the notable exception of 2006.



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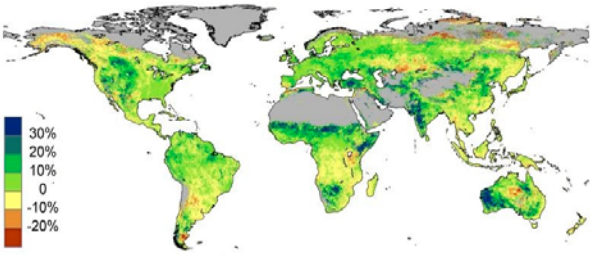
Impact of CO_2 Fertilization on Maximum Foliage Cover Across the Globe's Warm, Arid Environments.

Randall J. *et al*.
Geophysical Research Letters, 2013

Using data gathered by the satellite CSIRO, Randall and colleagues from the Australian National University (ANU), found that rising CO_2 fertilisation correlated with an 11 per cent increase in foliage cover from 1982-2010 across parts of the arid areas studied in Australia, North America, the Middle East and Africa.



"While a CO_2 effect on foliage response has long been speculated, until now it has been difficult to demonstrate," explained Dr Donohue. "Our work was able to tease-out the CO_2 fertilisation effect by using mathematical modelling together with satellite data adjusted to take out the observed effects of other influences such as precipitation, air temperature, the amount of light, and land-use changes."

“The fertilisation effect occurs where elevated CO_2 enables a leaf during photosynthesis, the process by which green plants convert sunlight into sugar, to extract more carbon from the air or lose less water to the air, or both.”

"On the face of it, elevated CO_2 boosting the foliage in dry country is good news and could assist forestry and agriculture in such areas; however there will be secondary effects that are likely to influence water availability, the carbon cycle, fire regimes and biodiversity, for example," Dr Donohue said.

Images of Vegetation Cover from Around the World.

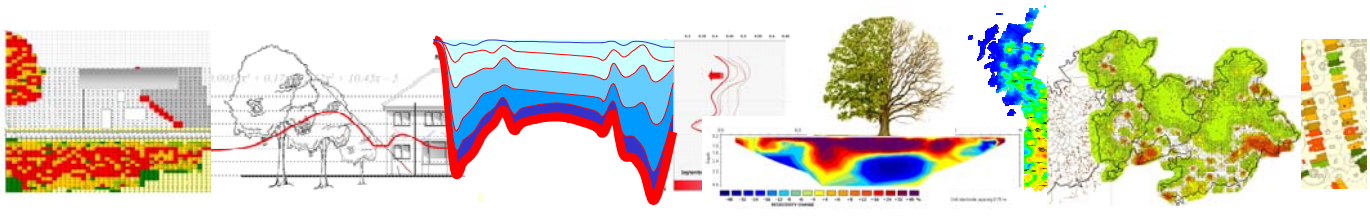
Taken from the web site of the National Oceanic and Atmospheric Administration

http://www.nesdis.noaa.gov

Satellite images of the globe, capable of detecting small changes in the visible spectrum, reveal the greening of the world on a week by week basis.

The time series images, taken over a twelve month period from April 2012 through to April 2013, used Visible-Infrared Imager/Radiometer Suite (VIIRS) instrument on board the NASA/NOAA Suomi NPP satellite.

The data will be incorporated into various climate models and has a range of uses, including predicting drought.



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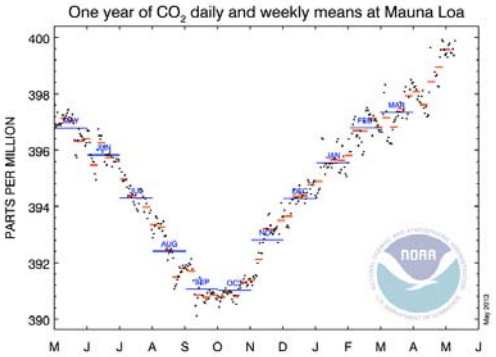
Updates from the NOAA Web Site

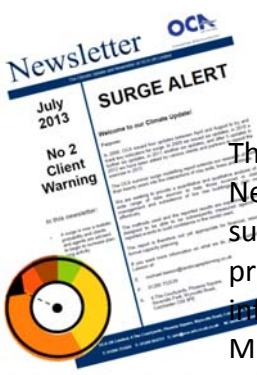
The NOAA and the Scripps Institution of Oceanography have recorded increased levels of CO_2 at the Mauna Loa site – the highest since records began in 1958.



The rate of increase has accelerated since the measurements started, from about 0.7 ppm per year in the late 1950s to 2.1 ppm per year during the last 10 years.

- The combined average temperature over global land and ocean surfaces for May 2013 tied with 1998 and 2005 as the third warmest on record, at 0.66°C (1.19°F) above the 20th century average of 14.8°C (58.6°F).
- The global land surface temperature was 1.11°C (2.00°F) above the 20th century average of 11.1°C (52.0°F), also the third warmest May on record. For the ocean, the May global sea surface temperature was 0.49°C (0.88°F) above the 20th century average of 16.3°C (61.3°F), tying with 2003 and 2009 as the fifth warmest May on record.
- The combined global land and ocean average surface temperature for the March–May period was 0.59°C (1.06°F) above the 20th century average of 13.7°C (56.7°F), tying with 2004 as the eighth warmest such period on record.
- The March–May worldwide land surface temperature was 0.97°C (1.75°F) above the 20th century average, the 11th warmest such period on record. The global ocean surface temperature for the same period was 0.45°C (0.81°F) above the 20th century average and tied with 2001 as the seventh warmest such period on record.
- The combined global land and ocean average surface temperature for the January–May period (year-to-date) was 0.59°C (1.06°F) above the 20th century average of 13.1°C (55.5°F), the eighth warmest such period on record.

OCA ALERT BULLETIN



The July edition of the OCA Newsletter suggests that surge is now a realistic probability. For further information contact Michael at …

michael.lawson@landscapeplanning.co.uk