PANG AND LAMBOURN HYDROMETRIC REVIEW 2009

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Soil moisture measurement site at Sheepdrove Farm on the Berkshire Downs near Lambourn. The land-use is predominantly grassland and arable.

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2010

Index

Introduction and Background	**3**
Weather Observations	**6**
Groundwater and River Flow	**11**
Pang Lambourn: Soil Moisture and Soil Tension Data	**13**
Pang Lambourn Water Content: Time-Series Plots	**13**

Tables

Table 1. 2009 Rainfall summary: Thames Valley

Table 2. 2009 Storage and tipping bucket raingauge summary

Table 3. Monthly UK Weather Summaries 2009

Table 4. Site Grid References

Figures

Figure 1. Geology of the Lambourn and Pang: a) Solid geology, b) Drift

Figure 2. Physical features of the basins: a) Topography, b) Permeability, c) Land cover

Figure 3. Comparison of storage and tipping bucket raingauge totals

Figure 4. Cumulative rainfall (mm) for each tipping bucket raingauge

Figure 5. Weather in 2009 (Sheepdrove Farm)

Figure 6. River Lambourn flow (m3/s) at Shaw, 2003-2009

Figure 7. Groundwater levels and rainfall, 2003 - 2009

Figure 8. Sheepdrove Farm, Soil Moisture, 2003- 2009

Figure 9. Grimsbury Wood, Soil Moisture, 2003- 2009

Figure 10. Frilsham Meadow, Soil Moisture, 2002- 2009

Figure 11. Beche Park Wood, Soil Moisture, 2002- 2009

Figure 12. Highfield Farm, Soil Moisture, 2002- 2006

Introduction and Background

This Review covers the streamflow, soil water, groundwater and weather data collected from the hydrological infrastructure networks in the Pang and Lambourn catchments. The period covered here is primarily for the calendar year 2009, but because the dataset extends back nearly a decade the earlier years are included in some of the graphs and accompanying text to provide a longer term context. This study follows on from the programme of research in the LOCAR (LOwland CAtchment Research) initiative (Wheater and Neal (Eds.), 2006).

The aims of this informal report series are to provide:

a) A brief annual review of the catchment hydrometry,

b) A record of the data and catchment metadata.

c) Highlight any extreme events or observations of special interest

The catchments of the rivers Pang (171 km^2) and the Lambourn (234 km^2) lie between Swindon and Reading in southern England (see Figure 1.). The long-term annual rainfall is about 700 mm. Both catchments are predominantly rural and overlie the Chalk aquifer – the country's most important groundwater supply. The Chalk is generally at or very close to the ground surface in the catchments, except in the south of the Pang catchment where it is often covered by clays and sands that can be up to 40m thick.

The Centre for Ecology and Hydrology (CEH) installed instruments in the area in late 2002/early 2003, as part of its core monitoring program.

The data collected in 2009 included:

2 Automatic Weather Stations - Frilsham Meadow and Sheepdrove Farm,

3 Tipping Bucket Raingauges – Frilsham, Sheepdrove, West Ilsley

4 Recharge sites – Beche Park, Grimsbury, Sheepdrove and Frilsham, operating 9 (of original 27) neutron probe tubes – 2 at Frilsham, 2 at Sheepdrove, 4 at Grimsbury, 1 at Beche.

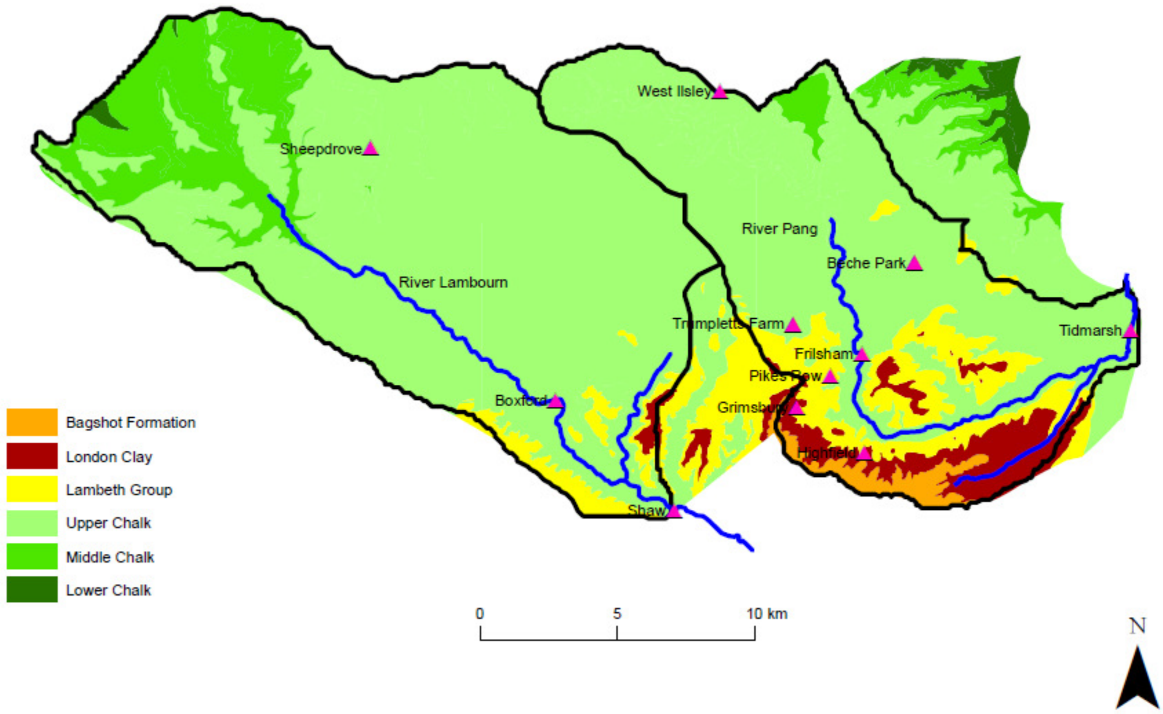
3 Sets of Tensiometers - Grimsbury, Sheepdrove, Frilsham

2 River Sites – Pang at Tidmarsh, Lambourn at Shaw

2 Boreholes – at Grimsbury and Beche Park. (BGS had started decommissioning the remainder of the Pang-Lambourn borehole network including clusters at floodplain sites in the Lambourn (Boxford) and Pang (Frilsham, Pikes Row and Trumpletts Farm.)

Subsequently several sites were decommissioned and closed; the AWS and recharge at Frilsham Meadow, the recharge site and borehole at Grimsbury Wood and the recharge site and borehole at Beche Park Wood. (The infrastructure at Beche Park Wood is still in-situ but data are not being recorded and the site is no longer being visited.)

(a) Solid geology



(b) Drift deposits

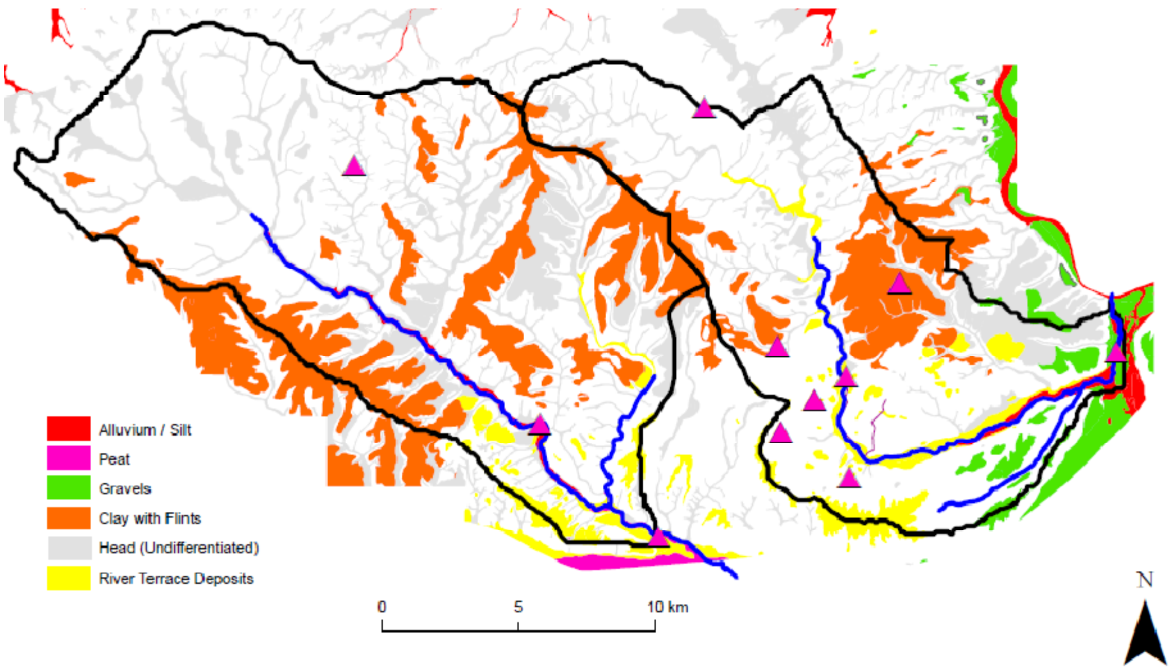


Figure 1. Geology of the Lambourn and Pang

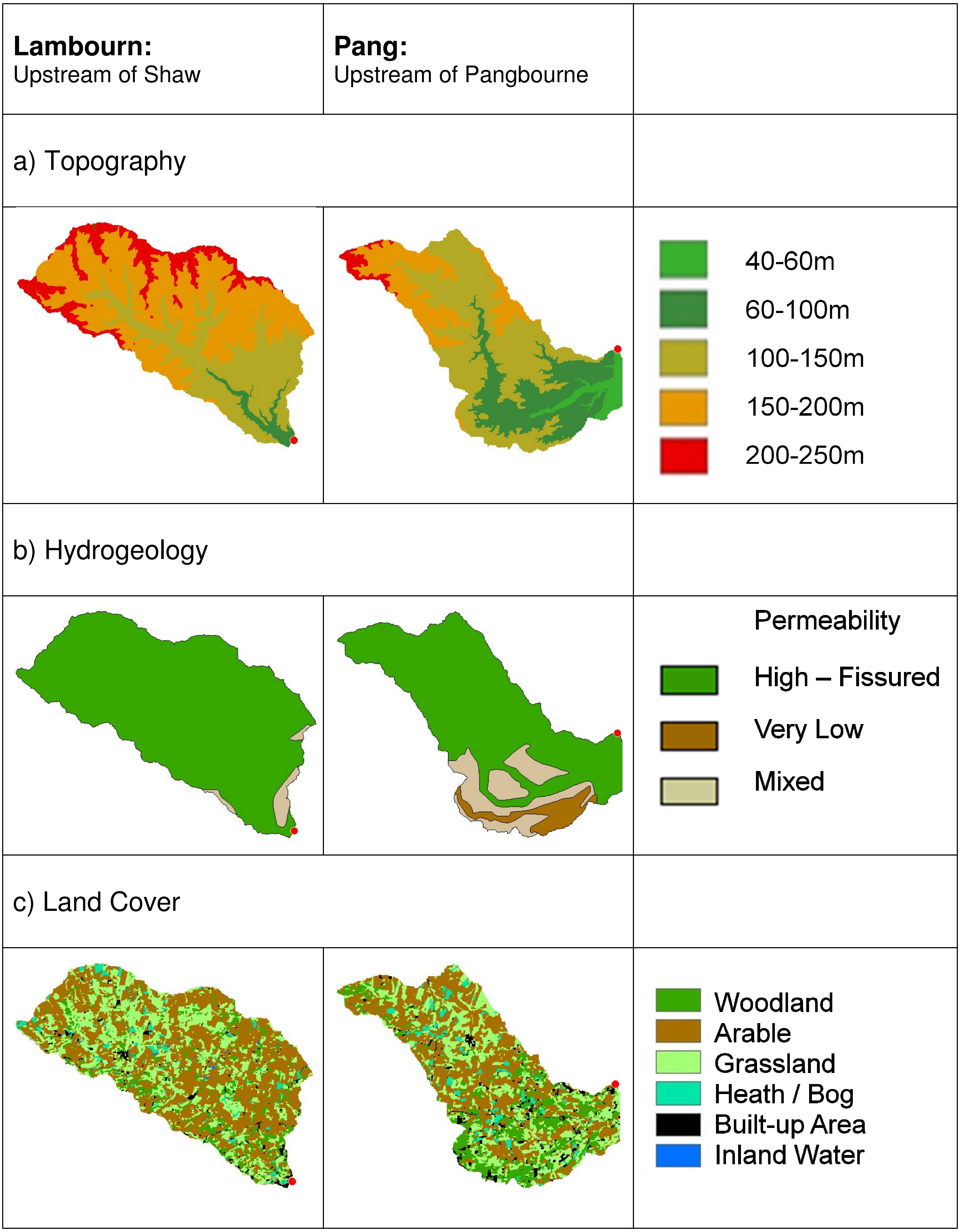


Figure 2. Physical features of the basins: a) Topography, b) Permeability, c) Land Cover

Weather Observations

The monthly rainfall at Sheepdrove and Frilsham in 2009 are shown below (Table 1) with Environment Agency and Met. Office values for comparison. Red text indicates a month with low rainfall (<80% of the long-term mean) while blue text indicates a wet month (>120% of the long-term mean). The Sheepdrove and Frilsham data are based on the tipping bucket gauge verified by comparison to storage gauge readings.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2009
Environment Agency Thames Region												
70	60	32	34	39	44	89	49	27	44	152	91	**731**
Percentage of Long Term Mean, %												
106	**130**	**57**	**67**	**69**	**79**	**178**	**83**	**44**	**69**	**232**	**127**	**96**
Sheepdrove												
58	98	30	51	47	27	87	43	10	41	150	107	**749**
Frilsham Meadow												
65	67	30	43	60	24	84	34	13	45	167	105	**737**
Met Office Oxford												
48	55	20	36	45	49	73	47	9	44	105	90	**621**
Met Office Heathrow												
72	70	30	28	30	34	71	40	36	39	148	85	**683**

Table 1. 2009 Rainfall summary (mm): Thames Valley

The rainfall totals at CEH sites for 2009 show a good overall agreement between the recording gauges and their storage check gauges (Table 2). Sheepdrove and W Ilsley received more rain than at Frilsham Meadow which is about 100 m lower elevation.

Gauge	Period	Storage Gauge	Tipping Bucket
Sheepdrove PL06d	18 Dec 2008 – 25 Jan 2010	894mm	917mm
Frilsham PL11d	18 Dec 2008 – 21 Jan 2010	772mm	798mm
West Ilsley PL29	20 Jan 2009 – 22 Jan 2010	837mm	805mm

Table 2. 2009 Storage and tipping bucket raingauge summary

A detailed comparison between storage and tipping bucket catches within the year also shows a good agrement except for two outlying data points (Figure 3), both relating to Sheepdrove Farm

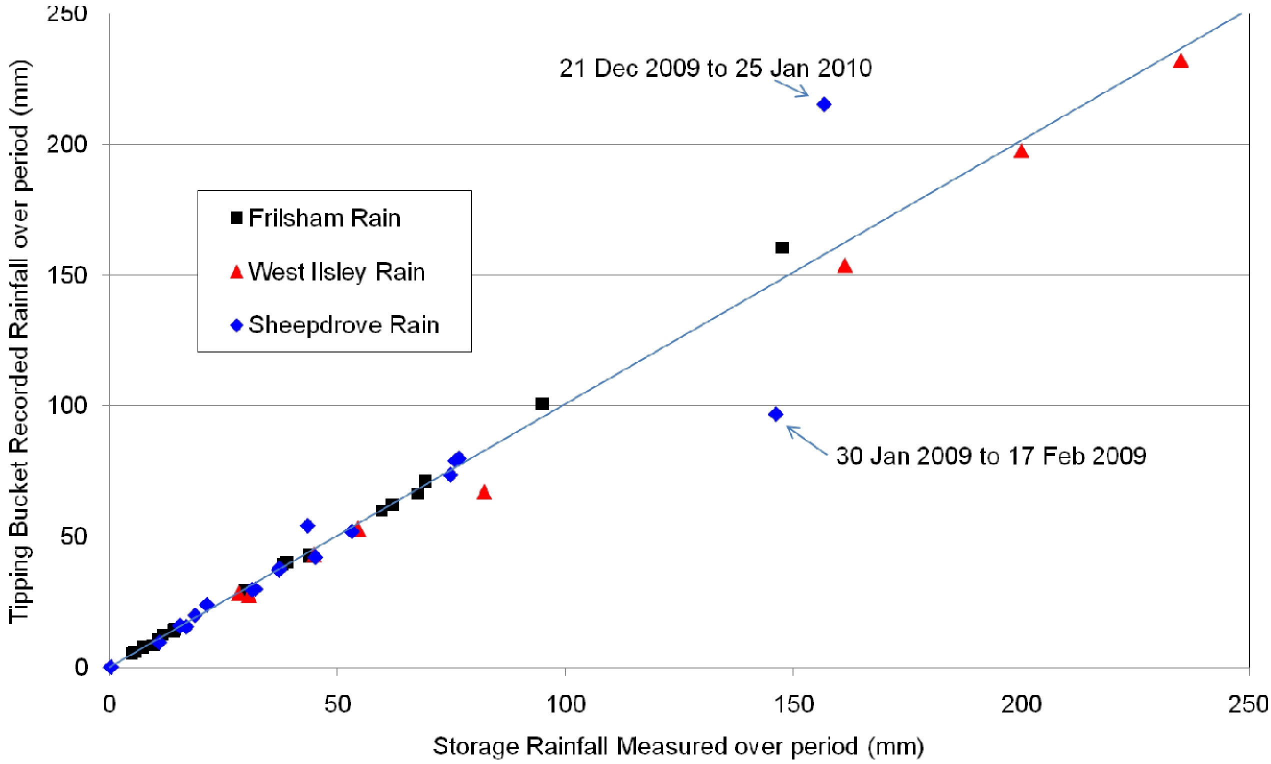


Figure 3. Comparison of storage and Tipping Bucket Raingauge Totals

The lower point (period of 30 Jan to 17 Feb 2009) shows 146.2mm measured in the storage gauge against 97mm recorded by the tipping bucket gauge. A nearby raingauge at the same farm recorded 94mm for this period – almost the same as the tipping bucket – so its record will be assumed correct, while the much higher reading for the storage gauge will be treated as suspect and a possible error has been noted against the data.

The higher point (period of 21 Dec 2009 to 25 Jan 2010) shows that the tipping bucket gauge at Sheepdrove Farm recorded 59mm more rainfall than the Sheepdrove storage gauge and 31mm more than the nearby storage gauge at West Ilsley. No spurious readings could be identified in the tipping bucket data so the data will not be adjusted but treated with caution. It is noteworthy that 140mm of rainfall was recorded between 14 Jan and 16 Jan by the Sheepdrove Farm tipping bucket raingauge and it is likely that the discrepancy between the gauges arose during this period of such intense rainfall.

The cumulative plots of the three CEH tipping bucket raingauges (Figure 4) show similar total rainfall amounts and very similar time distributions of rainfall over the year and are thus thought to be valid. With care, by using the temporal rainfall distribution from a nearby tipping bucket raingauge, along with storage totals for the gauge in question, any missing periods in the tipping bucket raingauge time series could be in-filled.

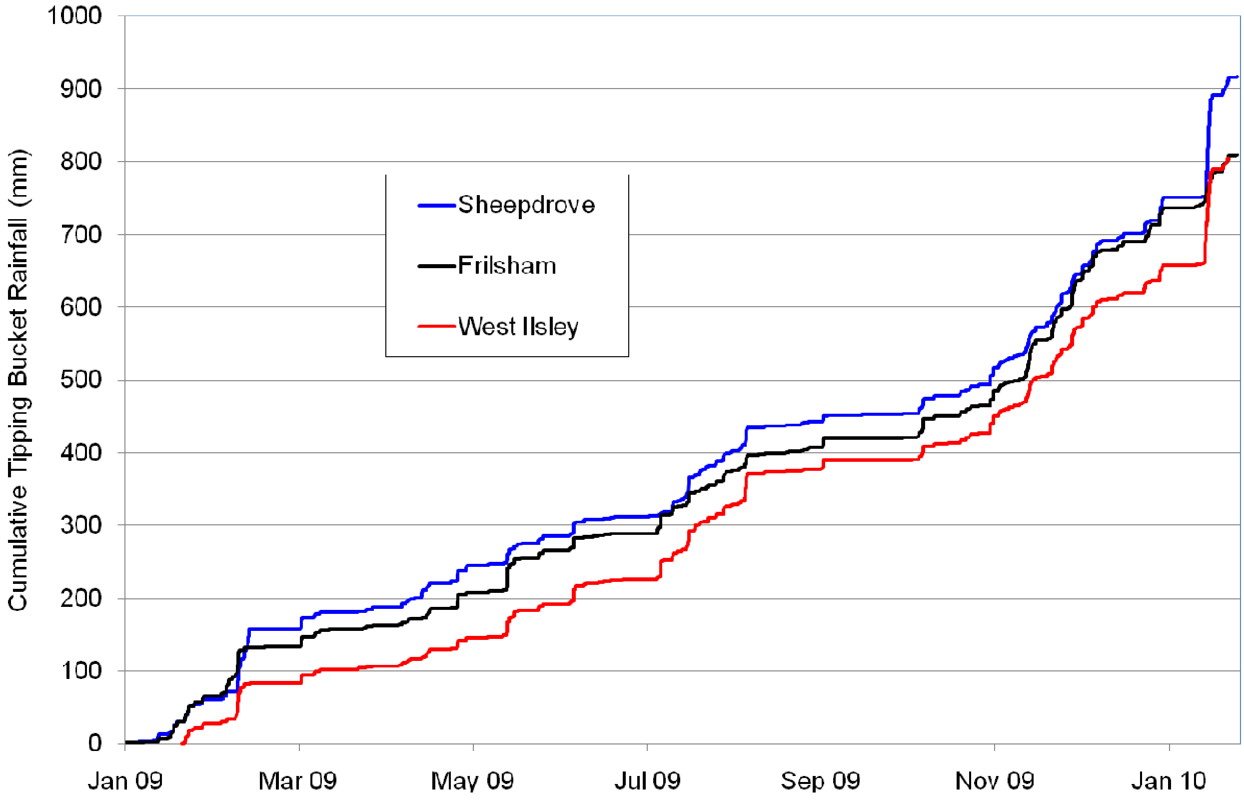


Figure 4. Cumulative rainfall (mm) for each tipping bucket gauge

Annual UK Weather Summary 2009

The following represents an assessment of the weather experienced across the UK during 2009 and how it compared with the averages for the period 1971 to 2000.

Daily maximum, minimum and mean temperatures were generally about 0.5 °C above the 1971–2000 average across the UK, making 2009 a slightly warmer year than 2008 and the equal 15th warmest in a series from 1910. Spring and autumn were both very mild and the summer was slightly warmer than average.

Annual rainfall was somewhat above average for the UK overall. 2009 was the twelfth-wettest in a series from 1910; similar to 2007 but not as wet as 2008; spring was relatively dry. The summer was wet (the third disappointing summer in a row) and comparable to 2008. It was the wettest July on record in England and Wales. 2009 was a sunny year across the UK; it was the twelfth-sunniest in a series from 1929. March and December were particularly sunny compared to normal.

January	January was cold in the south of the UK but it was generally a quiet start to the year.
February	February was a month of two halves - very cold at the beginning and milder at the end. Parts of England saw the heaviest snowfall since 1991 with South East and London particularly affected.
March	It was an unsettled start to March but with mean temperatures slightly above the seasonal norm for most of the country, particularly in the second half of the month.
April	April was warm and dry for much of the UK.
May	May had usual, but variable, weather.
June	June was warm but stormy, with thunderstorms bringing flash flooding. The month ended with a heatwave. Parts of the UK were hit by thunderstorms.
July	June's heat wave did not last long into July. Despite talk of a "barbeque summer", the month was a washout with persistent rain and widespread flooding across much of the country.
August	August was the 'wettest ever' in UK. The unsettled weather continued through August before a return to drier weather.
September	Remnants of Hurricane Danny brought wet and windy weather to southern and western parts of the UK at the start of the month. Despite this, it was the driest September in England since 1997.
October:	An uneventful month weather-wise.
November	More rain and more flooding. Widespread downpours meant that it was the wettest November since 1914. Strong winds during the middle of the month caused damage to trees and buildings, and disrupted travel and transport.
December	December saw the beginning of the longest cold snap since 1981, one that was to last well into 2010. Heavy rain and snow caused significant travel disruption across the country, particularly affecting travel over the Christmas period.

Table 3. Monthly UK Weather Summaries 2009

Website References:

http://www.metoffice.gov.uk/climate/uk/2009/january.html
http://news.bbc.co.uk/weather/hi/uk_reviews/newsid_8509000/8509161.stm

The weather recorded at Sheepdrove Farm over the calendar year 2009 is summarised in Figure 5.

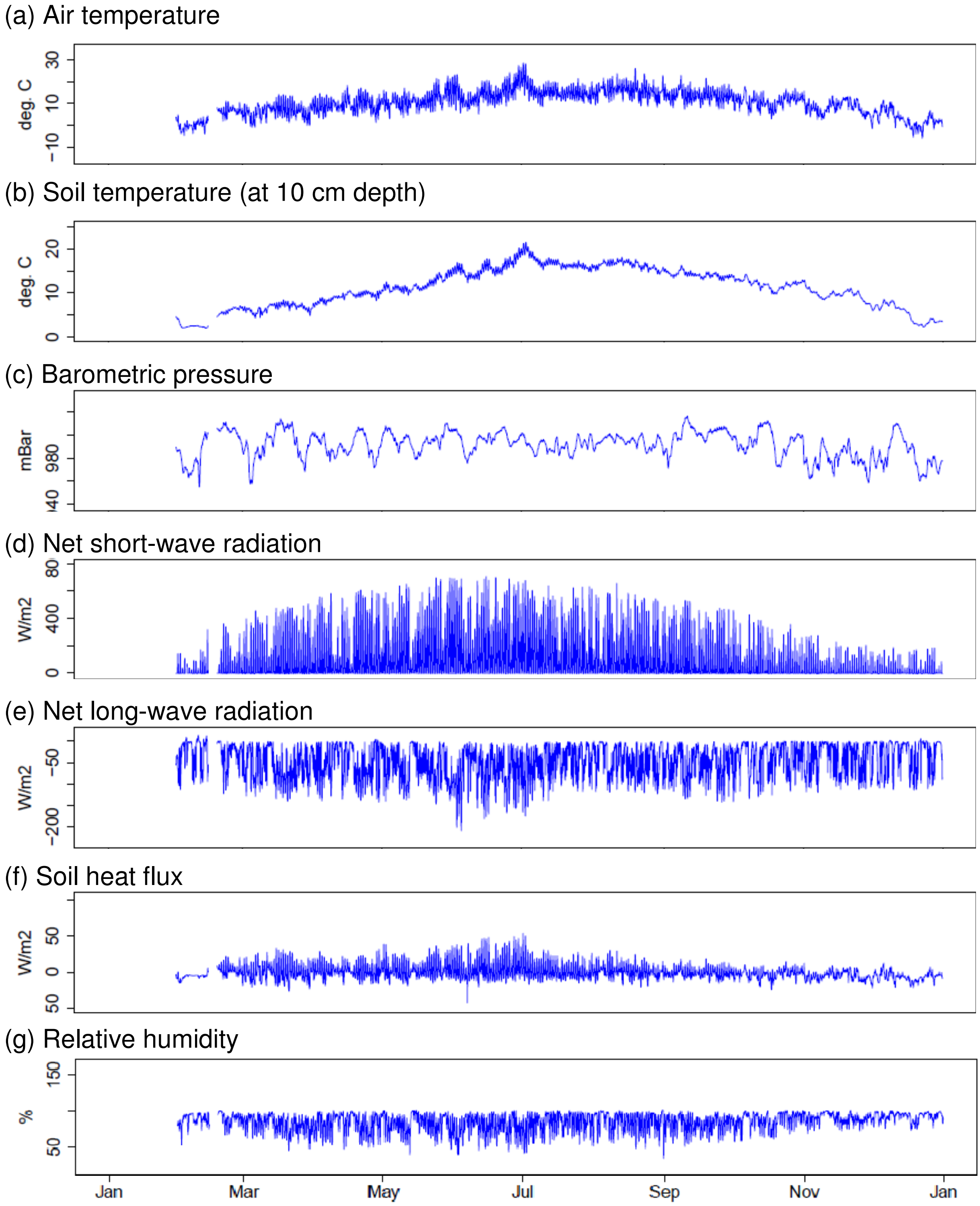


Figure 5. Weather in 2009 (Sheepdrove Farm AWS)

The effects of the rainfall combined with evapotranspiration can be seen in the following sections on groundwater recharge, river flow and soil moisture data.

Groundwater and River Flow

Figures 6 and 7 shows the varying aquifer levels and flows in the groundwater-fed River Lambourn over the period 2003 - 2009. This period was one of extreme weather variability, commencing with the winter flood levels of 2002-2003, the drought years of 2003-2006, followed by the exceptional flood peak in July 2007 (Fig. 6.) occurring during a highly unusual double peak for both river flows and groundwater levels (Fig. 7.) followed by the more “normal” years of 2008 and 2009. The period of study has captured many different hydrological conditions and this adds to the value of the datasets providing an integrated set of observations of river, soil and groundwater and the weather driving those changes.

Groundwater level was recorded hourly in 2 piezometers in the Pang catchment using Minitroll pressure transducers vented to the atmosphere. Checks were performed with manual Diptone readings. Beche Park and Grimsbury Wood are woodland locations on 1-2m of clay with flints. At Beche Park the water table was between 62m and 79m below ground level and at Grimsbury Wood the water table was 39m to 49m below ground level.

There is a close similarity between River Lambourn and groundwater levels (cp Figures 6 and 7). The river is essentially acting as a low level drain removing groundwater from the catchment. The same is true for the River Pang; hence groundwater levels at Grimsbury flatten out as they decline towards the elevation of the Pang (77m. aod. at Frilsham Meadow & 68m. aod. at Bucklebury Ford, 3km ENE & ESE of the Grimsbury respectively)

Under normal summer conditions the groundwater level drops steadily during the summer months almost regardless of rain since evaporation will generally be greater than rainfall. However, in 2007 the exceptional rainfall of late July resulted in considerable recharge of the aquifer shown by a double peak for this year. It is also worth noting that although the groundwater signal in both of these deep boreholes is usually very damped, the groundwater level reacted immediately (within hours) to the rainfall of July 20-21.

The borehole levels at Grimsbury Wood also react rapidly to other individual rainfall events as can be seen by the spikes in the graphs indicative of preferential flowpaths (Figure 7). Sinkholes are known to exist in the Pang Valley and the role of very high hydraulic conductivity pathways in the Pang has been studied (Maurice et. al. 2006).

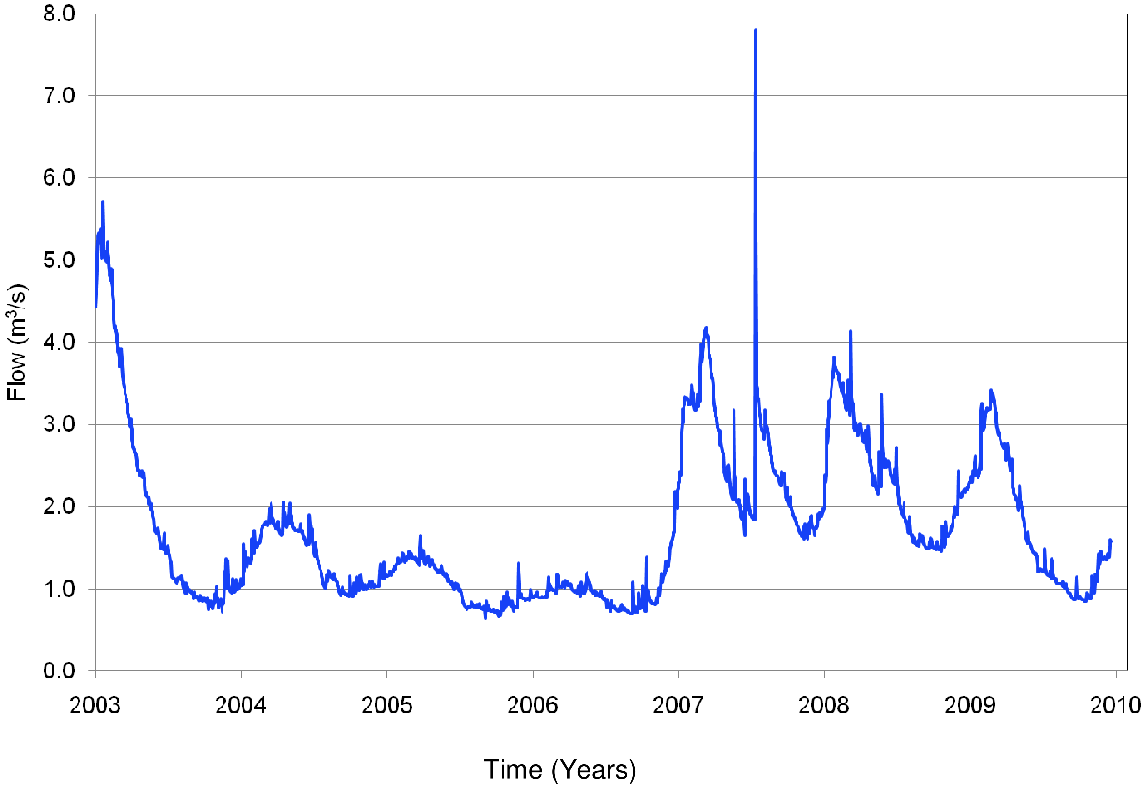


Figure 6. River Lambourn flow (m^3/s) at Shaw, 2003-2009

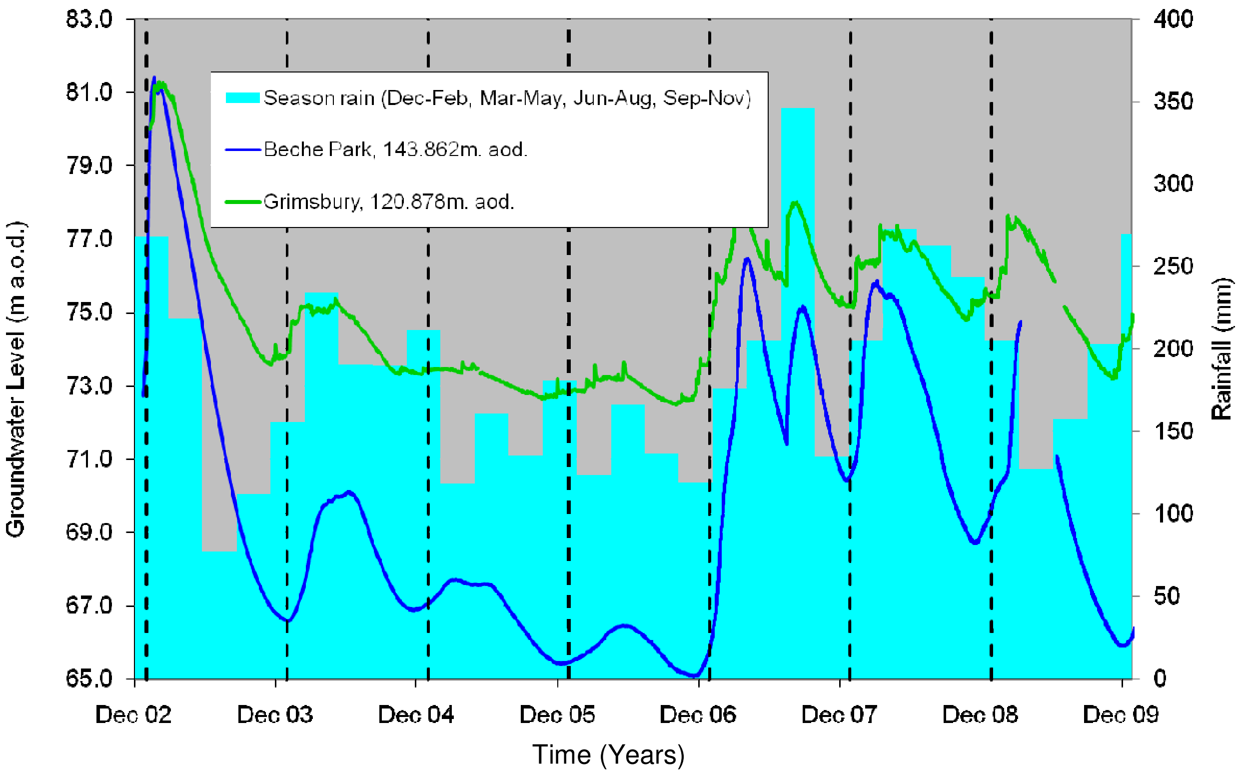


Figure 7. Groundwater levels and rainfall, 2003 - 2009

Pang Lambourn: Soil Moisture and Soil Tension Data

Soil moisture and soil tension instruments were installed at 7 sites in the catchments in 2002/3, to encompass three different land covers: woodland, arable and pasture. Along with rainfall data, the soil measurements from these sites would enable the determination of evaporation and recharge to the aquifer, from different land coverages with different depths to the water table. These are important factors when assessing the water resources of a catchment. Although the measurements were not designed to detect or quantify climate change, detailed analysis would be able to assess the possible effects of climate change on local water resources under differing climate change scenarios. In groundwater fed catchments, recharge of the aquifer will determine groundwater levels and thus river levels and flow and water quality.

The neutron probe measurements were made fortnightly at each site using a Didcot Instruments Neutron Probe. Sampling depths were 10cm apart down to 0.8m then 20cm apart down to 2.2m, then 30cm apart to 5.2m then if applicable 50cm apart. These measurements were complemented with 15 minute logged data *profile probes* (at 10, 20, 30, 40, 60 and 100 cm depths) measuring soil moisture via the capacitance of the soil from tensiometers (*Equitensiometers* at 1, 2, 3, 4 m depths, and *purgeable tensiometers* at 20, 40, 60, 80, 100, 120 cm depths).

Neutron probes remain the primary independent measure of soil water content changes and so the following sections concentrate primarily upon these data records, using the whole period of record to provide context.

Pang Lambourn Soil Water Content: Time-Series Plots.

3-D time series plots were produced for the 22 neutron probe access tubes installed in the two catchments, across 7 sites in 2002 (not counting 3 tubes, at West Ilsley which were destroyed by ploughing early in the study). The periods of data vary in length from just under 2 years duration to over 7 years. The land use and soil type differences, along with the extremes in rainfall experienced between 2002 and 2010 in southern England, explains the evident diversity of the plots for individual tubes (Figures 8 – 12).

The colour plots show the volumetric water content (%) ranging from red indicating dry conditions to dark blue representing very wet soil. The x-axis shows time (in calendar years) and the y-axis shows the depth below ground level (the dotted horizontal lines indicate the depths at which readings were made). This provides a succinct way of clearly representing the changing soil water contents both down the profile and through time.

The frequency distribution for each tube shows the probabilities of water content values (y-axis) occurring within given 10% increments (x-axis); the black open histogram being for the complete set of Pang Lambourn neutron probe data and the solid red histogram shows the data obtained at that site. Thus individual tubes may be readily compared.

Many of the tubes exhibit strong layering of soil moisture values mainly due to changes in the porosity of the soil with depth. This can indicate changes in soil type, soil-chalk boundaries for instance, areas of impermeability (perhaps a clay layers or gravel lens) or just the heterogeneity of the soil. For instance, a large flint near a tube would depress porosity and thus the highest soil moisture values for this tube, whereas a large void, would increase values most noticeably during wet periods and rapidly depress them when the cavity emptied. Time series of the total water content in sub-depths of the soil profile (0-1m, 1 – 2m, 2 – 2.9 m, and >2.9m) are also included to show the variability of water contents; generally the shallow layers are the most dynamic with relatively small changes at the deeper layers, although the wooded sites (Beche and Grimsbury) showed greater variation at depth due to rooting.

Looking at the plots as a group a few points can be made regarding the variation between sites and over years. Frilsham Meadow soils (river gravels, pasture, high water table) are very dry compared with the rest of the sites while Highfield Farm soils (clay lens, organic soil) are very wet. Grimsbury Wood soils (tertiary deposits/clay) exhibit the most pronounced seasonal signature at significant depths. Sheepdrove Farm soils (thin, chalk) show the least variation. The tube at Beche Park (clay with flints) shows soil moisture variation down to the greatest depths.

Other plots show the monthly rainfall recorded at Sheepdrove and examples of equitensiometer, purgeable tensiometer and profile probe values over the period of record. The soil water values are shown in logger units as we finalise the calibrations for each instrument. In the site instrumentation plans, dark green circles represent purgeable tensiometers (logged at 15-minute interval) while light green circles represent puncture tensiometers which are manually read during site visits (approximately fortnightly). Analysis of chemistry data from the suction samplers (yellow circles) is beyond the scope of this study,

Sheepdrove Farm (Neutron Probe Tubes 1 & 2).

(Thin soils – Andover series. Heavily flinted. Soil under grass over Chalk)

Soil water patterns for two adjacent sites at Sheepdrove Farm are shown in Figures 8 and 9. For the shallower readings in both neutron probe tubes, similar seasonal patterns are observed and the 2003 drought clearly visible, with depressed soil moisture readings seen for the entire depth of tube 1 by the end of the summer and down to 3m+ for tube 2. The poor summer of 2008 is also apparent with neither tube showing very dry soil conditions this year even for the shallowest depths.

Layering is also visible for each tube although this in fact is more a reflection of the soil structure/inhomogeneity than of rainfall, drainage and evaporation. For instance the porosity of the soil at a certain depth will be greatly affected by large flints near to the tube. This explains how the layering in the graph for two tubes just 20m apart can be so different. The spatial heterogeneity of soil moisture at this site and the availability of measurements will be important during future evaluation of data from the COSMOS system (Evans et al, 2010), a new commercially available sensor that enables spatially-averaged soil moisture to be measured over a diameter of 690 m, greatly increasing the possibility of representative measurements.

The equitensiometer (2m depth) also shows clear seasonal pattern. Greatest soil tensions were experienced at the end of 2003 and the soil can be seen to wet-up every winter to similar levels except 2006 and to a certain extent 2005. During this period there was concern about rainfall deficits having developed and drought conditions a possibility. After 2006 though climatic conditions were much wetter, especially in late July 2007. This exceptional event/period can be clearly seen and high soil tensions did not develop again until late in 2009. Although somewhat noisy, the signal from the purgable tensiometer (40cm depth) does show genuine sensitivity to rainfall events.

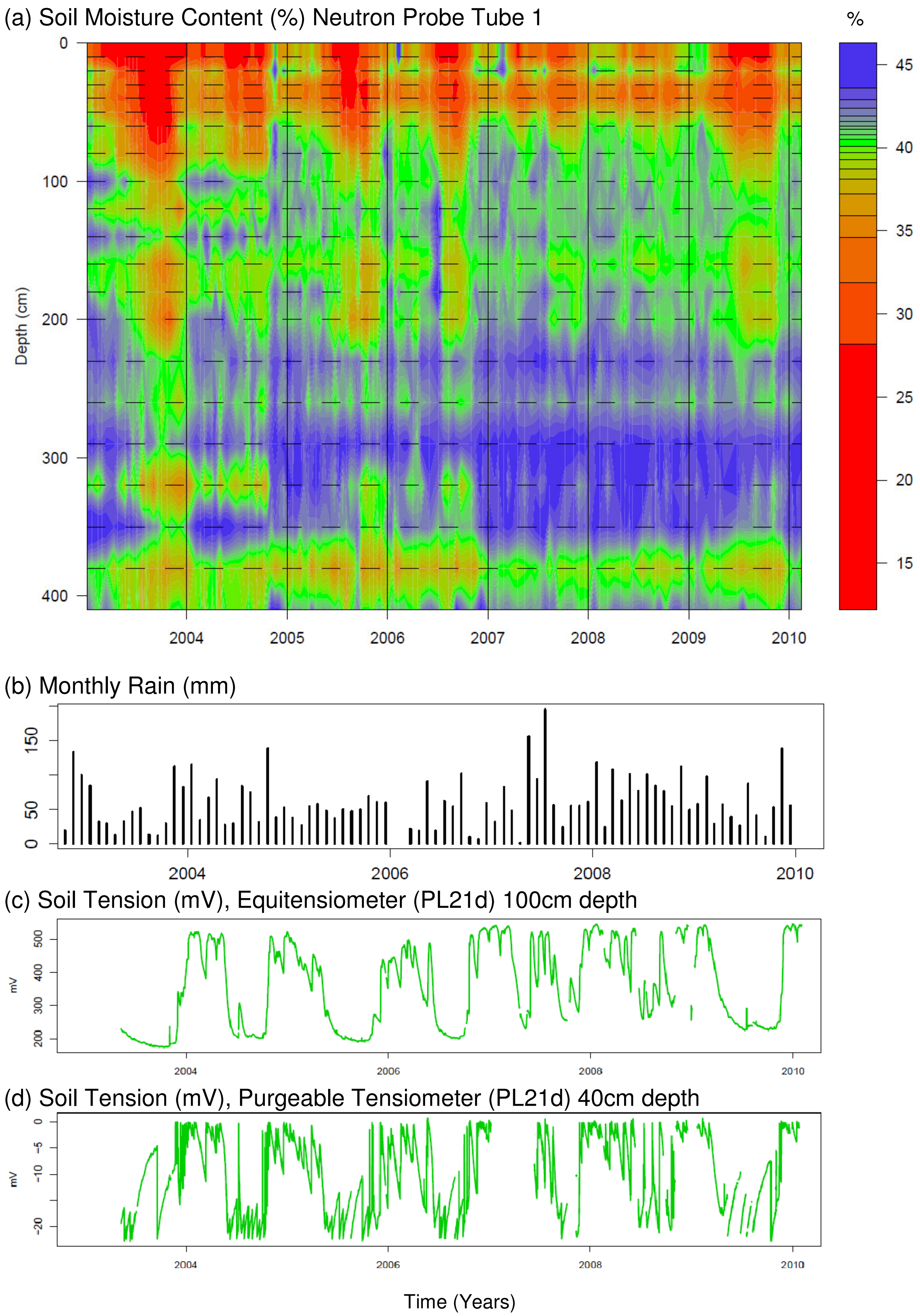
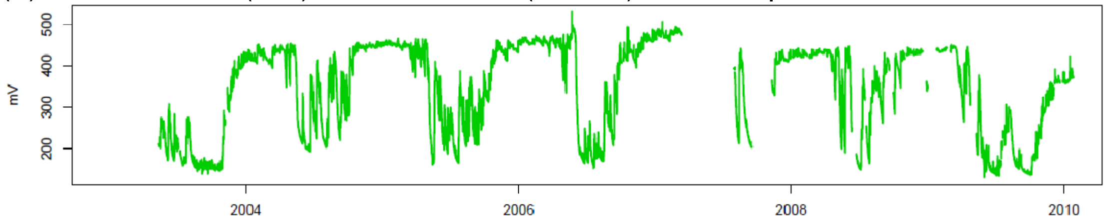
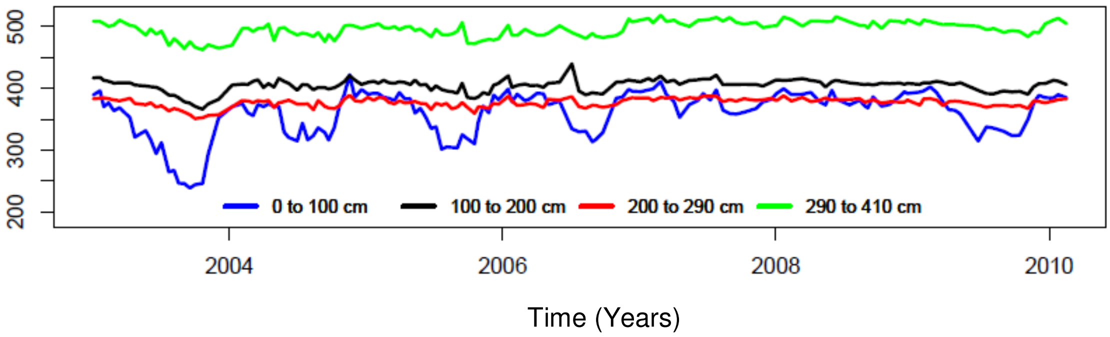


Figure 8. Sheepdrove Farm, Soil Moisture, 2003- 2009

(e) Soil Moisture (mV), Profile Probe (PL21a) 10cm depth



(f) Layer: total water depths (mm) Neutron Probe Tube 1



(g) Site instrumentation plan

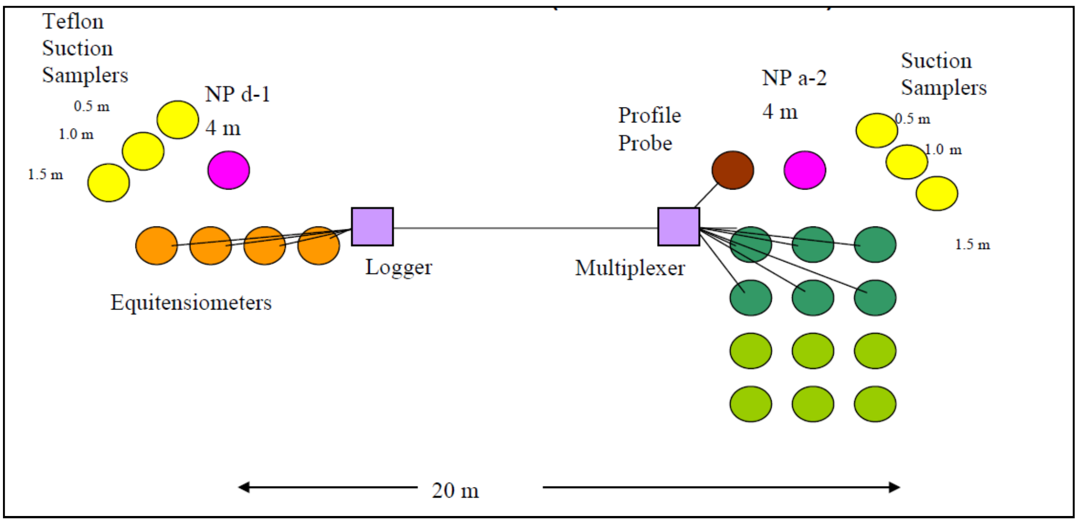


Figure 8. contd.(1) Sheepdrove Farm, Soil Moisture, 2003- 2009

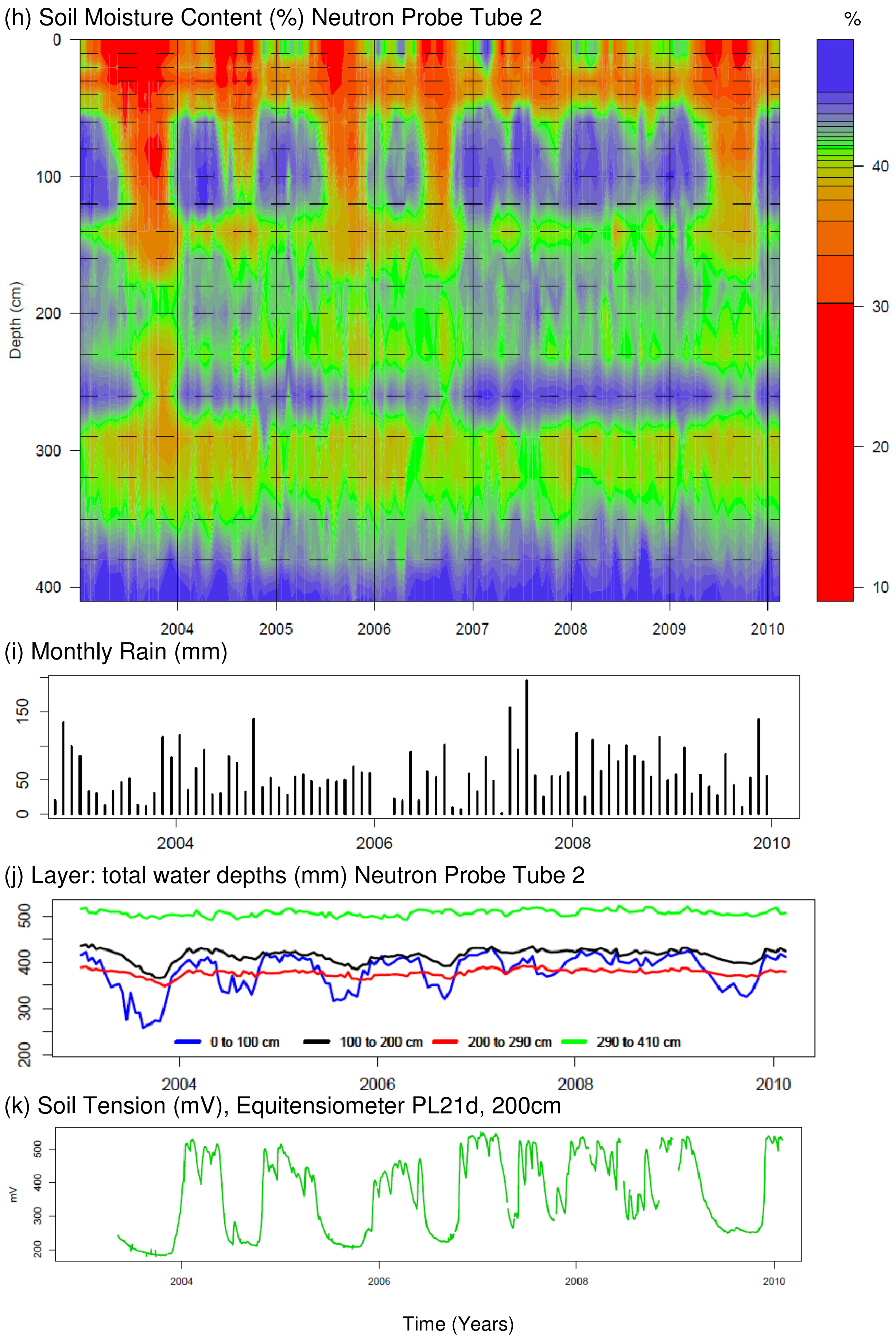


Figure 8. contd.(2) Sheepdrove Farm, Soil Moisture, 2003- 2009

(l) Frequency Analysis Tube 1 (m) Frequency Analysis Tube 2

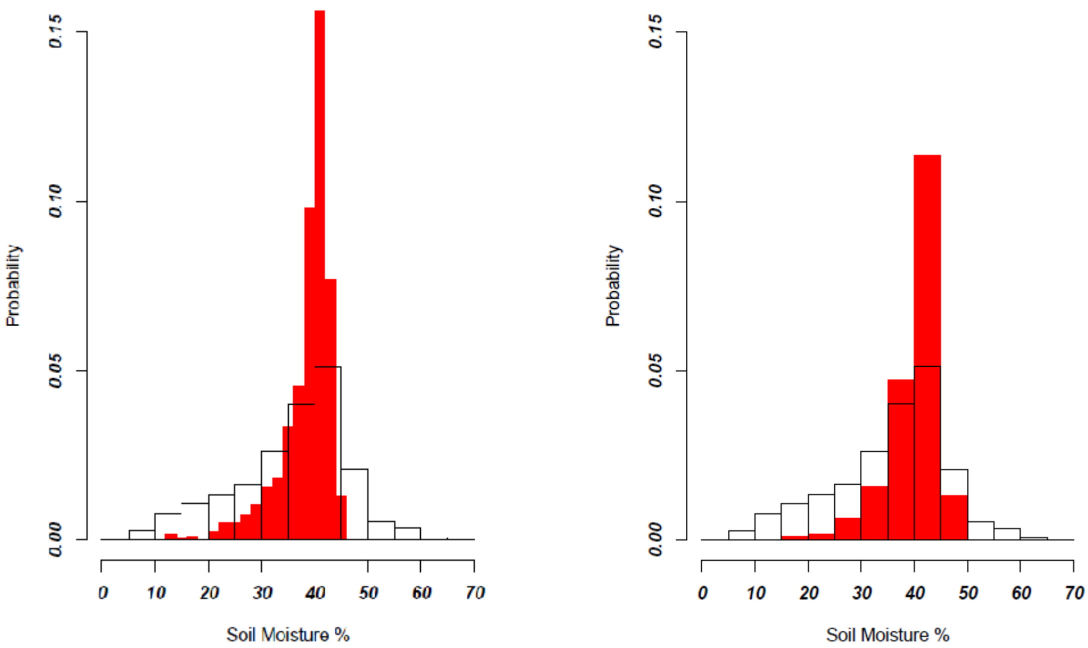


Figure 8. contd.(3) Sheepdrove Farm, Soil Moisture, 2003- 2009

Grimsbury Wood, Neutron Probe Tube 1

(Palaeogene deposits – mapped as Wickham 3 (stagnogley) mainly deep clay)

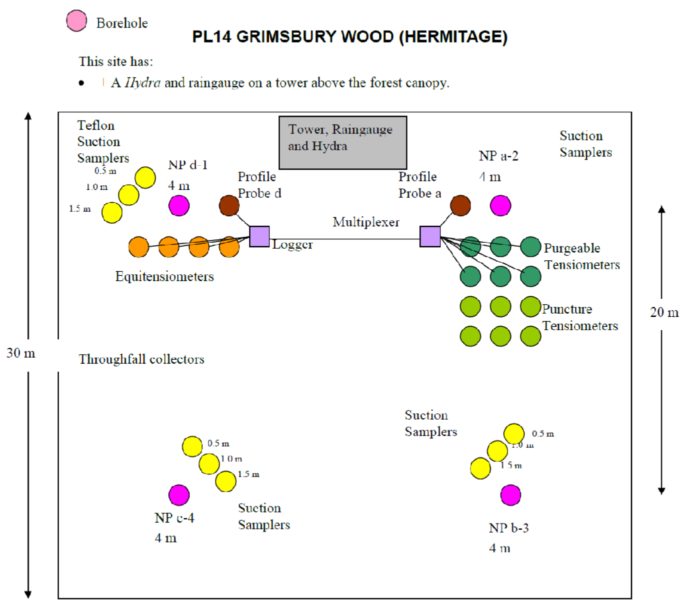
For the contour plot for Grimsbury Wood NP Tube 1 we note that the seasonal / annual pattern here (clay with flints) is more pronounced than at Sheepdrove Farm, being drier for longer in the summer and wetter for longer in the winter. The annual drying also extends more deeply than at Sheepdrove and this will be greatly influenced by the roots of the trees. The low rainfall totals from 2003 to early 2007 are demonstrated by dry soils at around 250cm depth during this period. Also clear is a wetter band at 120cm. This may be due to a tree root near the tube at this depth or perhaps be due to a layer of soil with increased porosity or an underlying impeding layer of lower hydraulic conductivity.

The equitensiometer data shows a very regular pattern at 1m depth with only 2007 showing a markedly different signature. Soil tensions in 2007 and 2008 did not reach the generally similar maxima obtained during the other years of the study.

Unlike at Sheepdrove Farm the purgeable tensiometer does not demonstrate short term sensitivity to rainfall events. In fact, for the majority of the measuring period the soil either showed tensions close to zero, demonstrated by the dominant flat plateaus in the graph, or tensions at the limit of what the instrument can record, shown by the similar soil tensions reached in the majority of the years. Spikes due to purging of the instrument can also be seen and these have been left in the data set as removing them is an overly subjective task. Close analysis of the measured tension after routine purgings could give beneficial insights into the local soil characteristics.

A graphical comparison of the water held in the top metre of soil for each of the 4 Neutron Probe tubes at Grimsbury Wood has been included. Tube 3 is consistently the wettest and is the tube nearest to a large tree. Tube 4 exhibits the lowest moisture content which is particularly noteworthy during the dry summers of 2003 – 2006.

(a) Site instrumentation plan



(b) Frequency Analysis

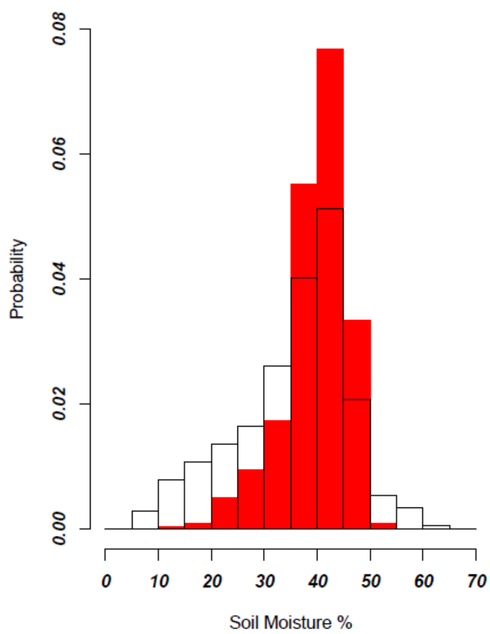


Figure 9. Grimsbury Wood, Soil Moisture, 2003- 2009

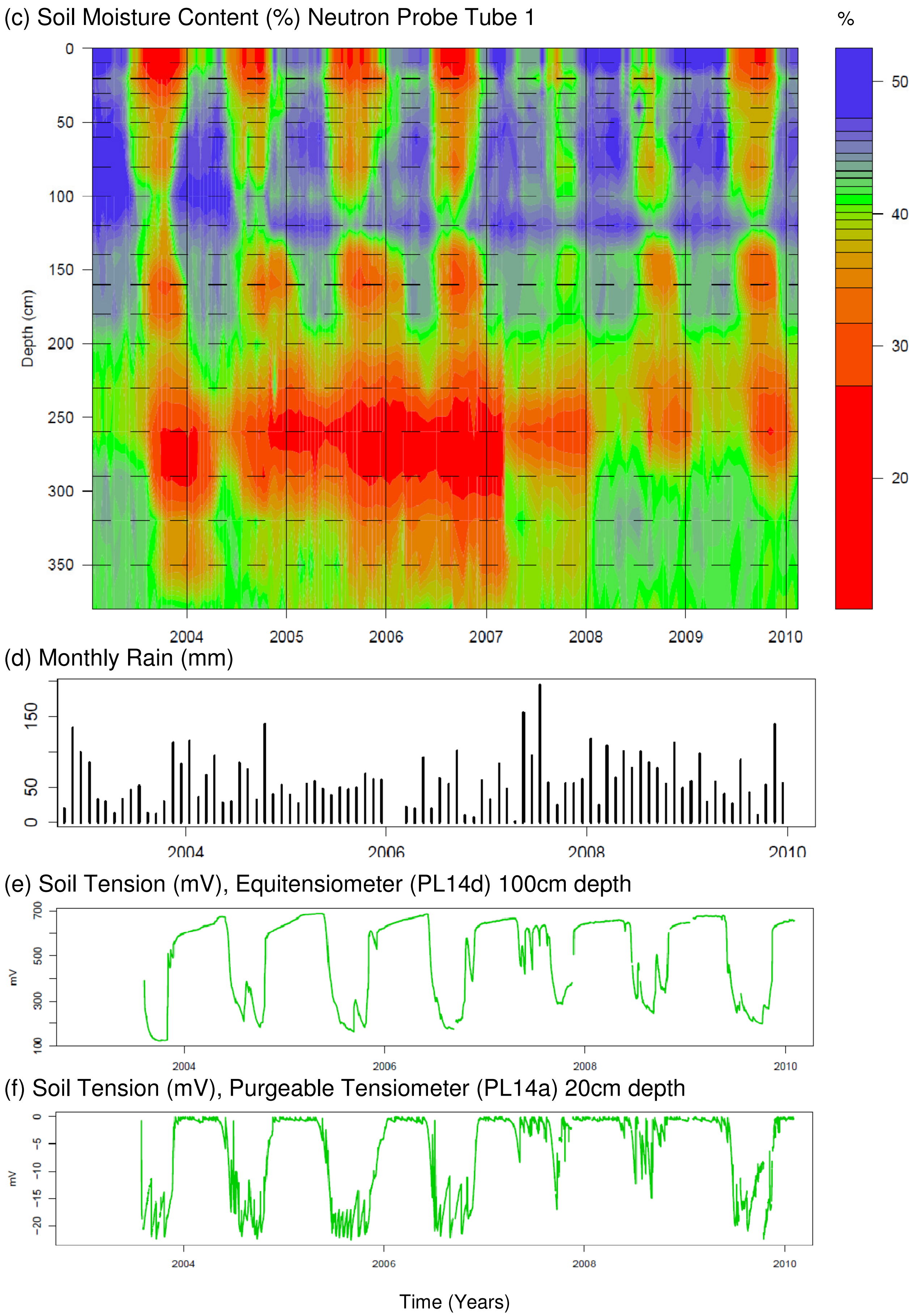
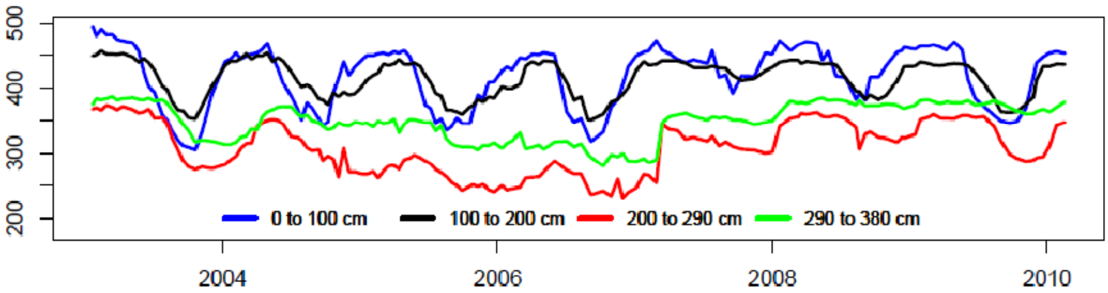


Figure 9. contd.(1) Grimsbury Wood, Soil Moisture, 2003- 2009

(g) Layer: total water depths (mm) Neutron Probe Tube 1



(h) Layer: total water depths (mm) 0cm to 100cm - Neutron Probe Tubes 1, 2, 3 & 4

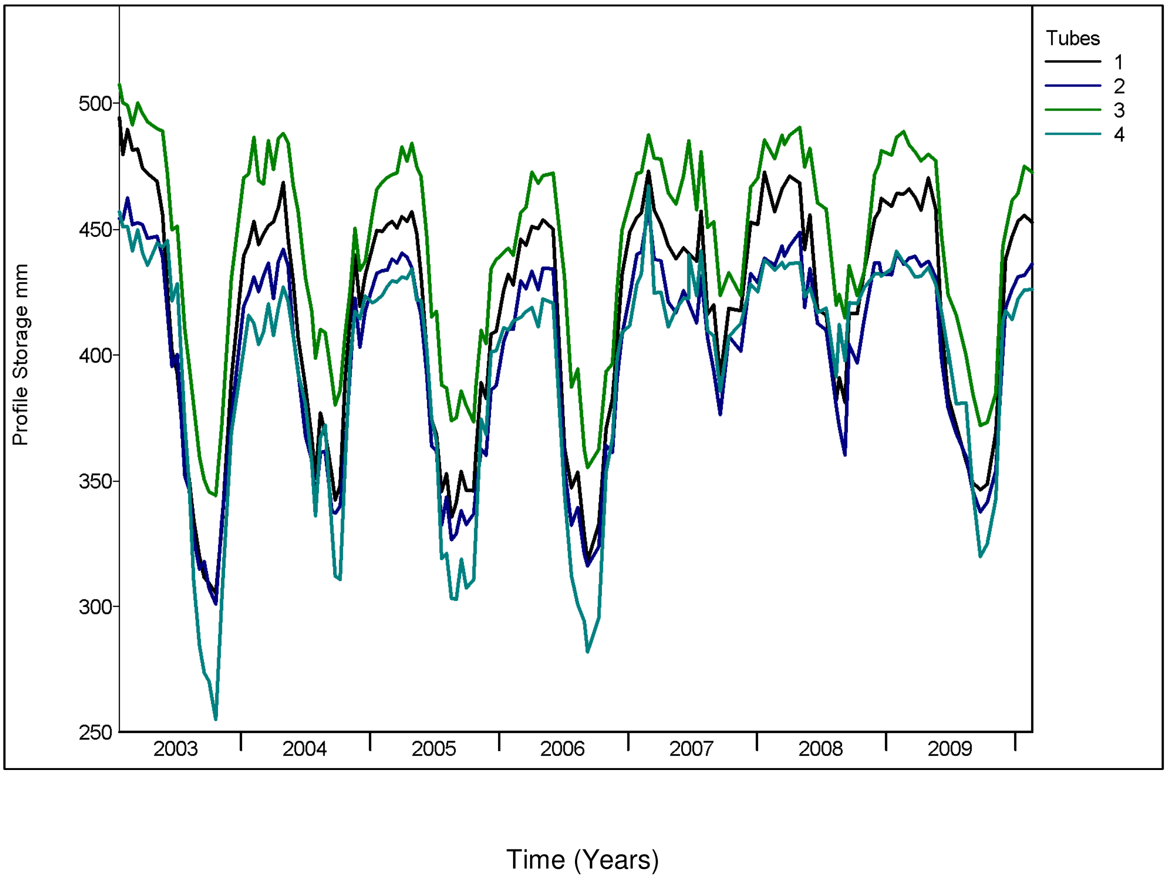


Figure 9. contd.(2) Grimsbury Wood, Soil Moisture, 2003- 2009

Frilsham Meadow Neutron Probe Tube 1

(Gravels, shallow water table)

The Soil Moisture Contour Plot for Frilsham Meadow Tube 1 has some features not seen in the plots for the other sites. The site here is near the River Pang (~50m) and thus groundwater levels are near to the surface. Instead of variations in rainfall, evaporation and infiltration determining the soil moisture water content with depth, it is the groundwater level which rises and falls and as it does, voids in the gravel matrix fill and empty. The porosity of the gravel matrix is high resulting in some water contents of >65%. However, the gravel drains readily resulting in some very low water contents down to 5-10%. Soil Water Content. Parts of the soil profile are usually either empty or full and the fast drainage means that the overall soil water content is lower at Frilsham than the other sites.

(a) Soil Moisture Content (%) Neutron Probe Tube 1

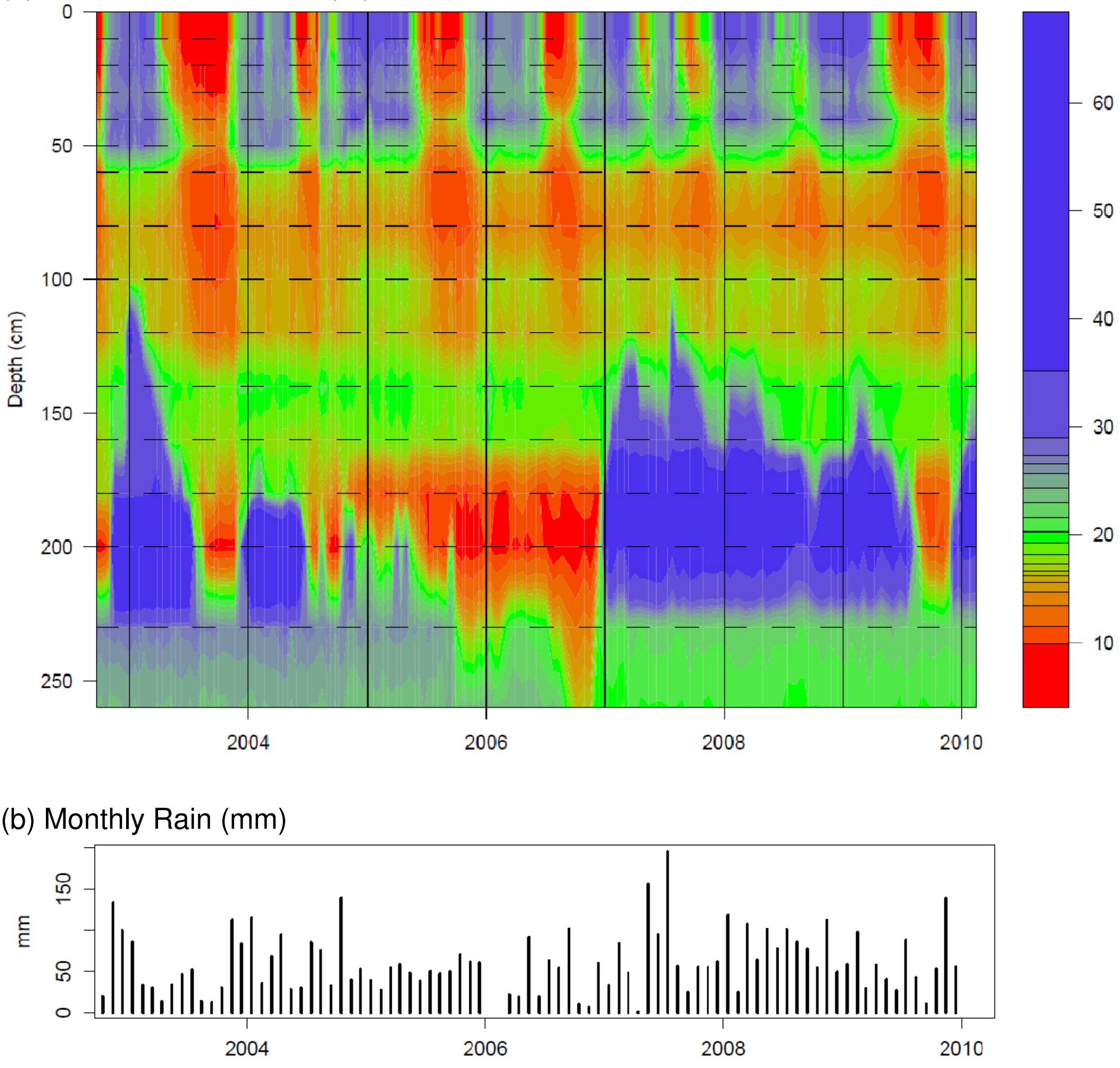
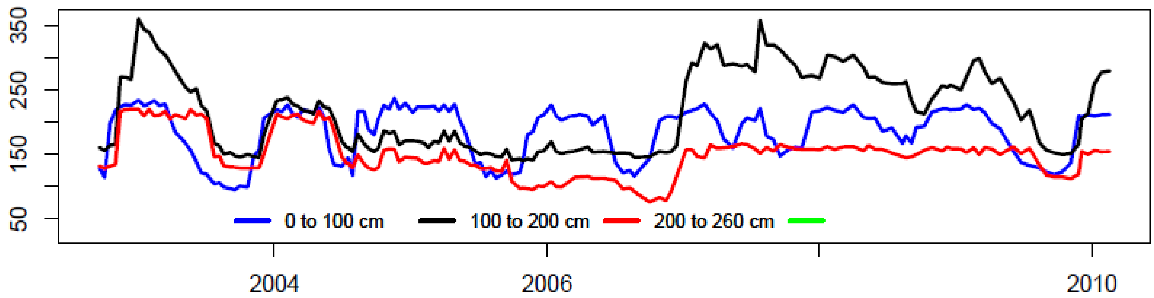
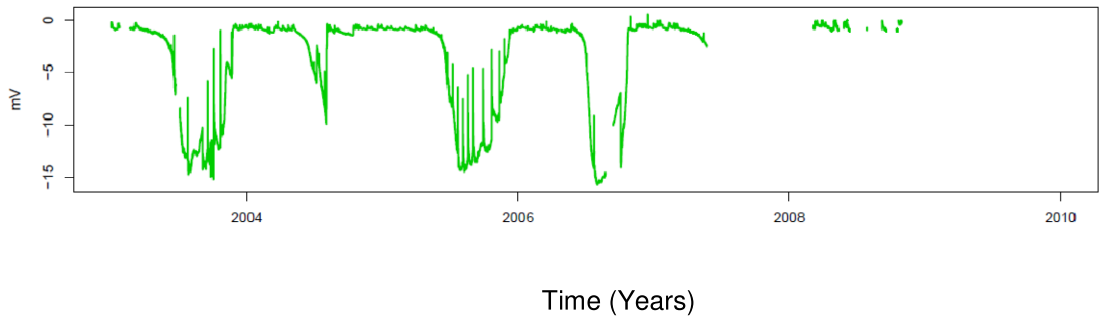


Figure 10. Frilsham Meadow, Soil Moisture, 2003- 2009

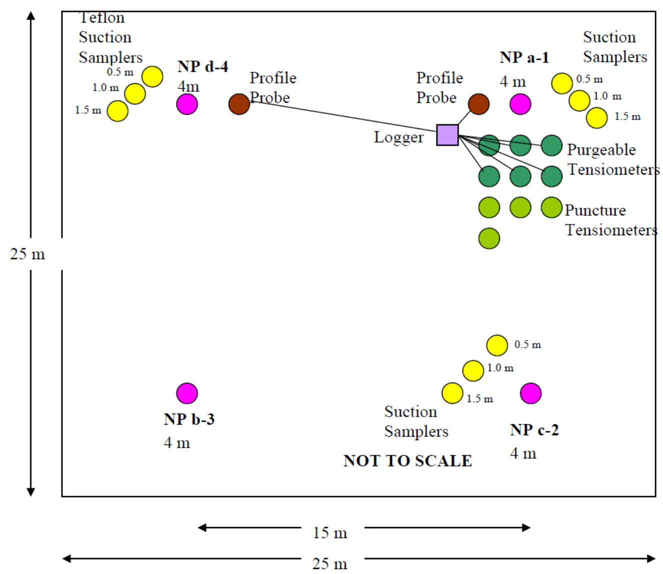
(c) Layer: total water depths (mm) Neutron Probe Tube 1



(d) Soil Tension (mV), Purgeable Tensiometer (PL11a) 60cm depth



(e) Site instrumentation plan



(f) Frequency Analysis

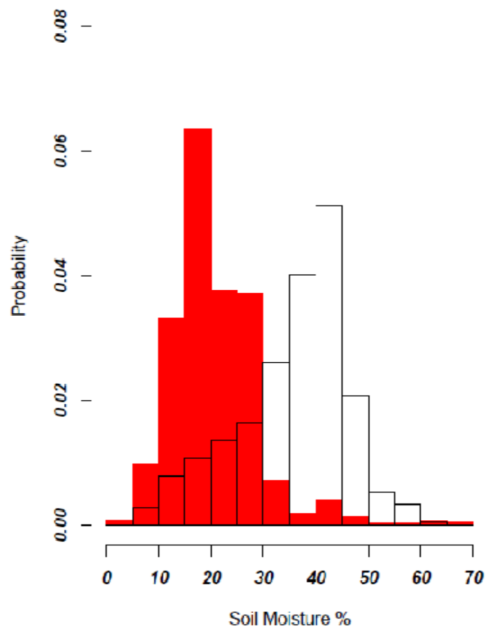


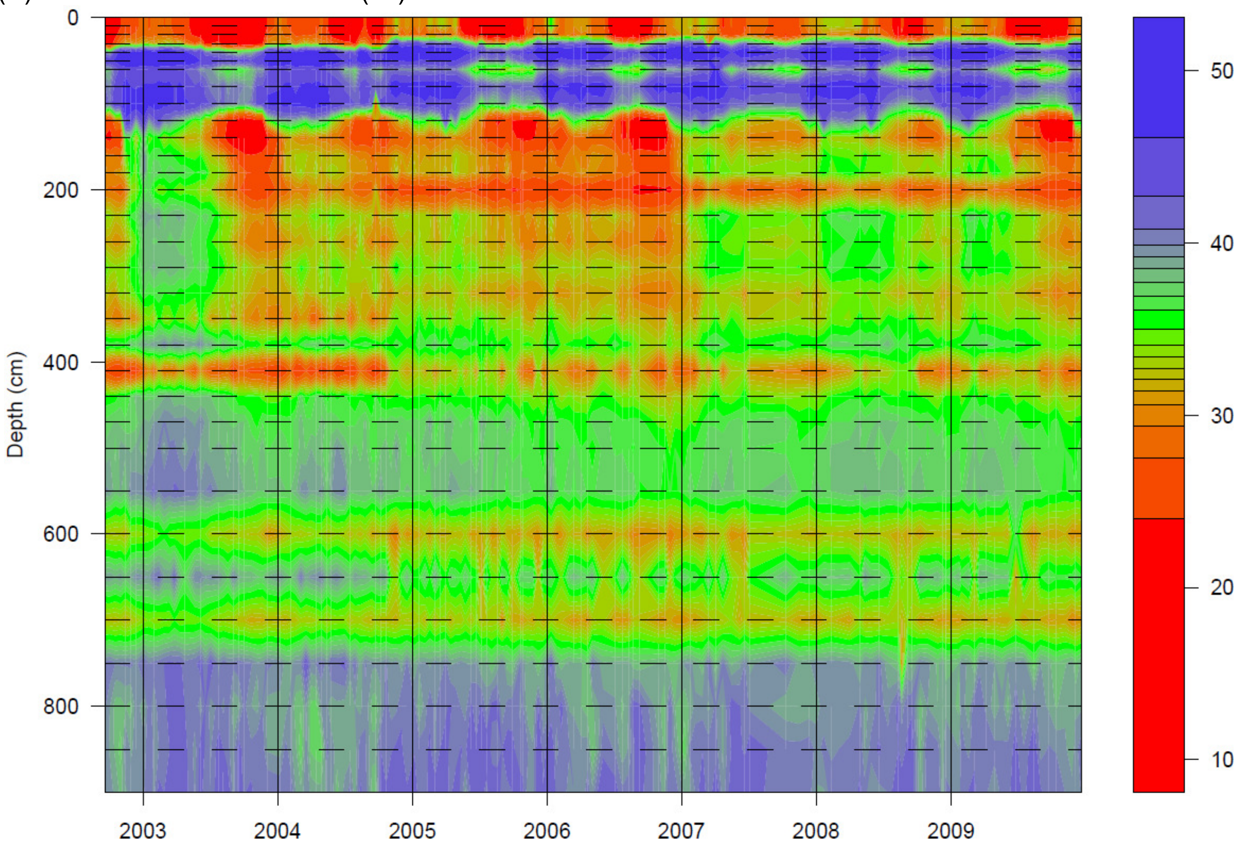
Figure 10. contd. Frilsham Meadow, Soil Moisture, 2003- 2009

Beche Park Wood Neutron Probe Tube 1

(Mixed deciduous woodland over Palaeogene deposits – mainly clay with some sands)

Tube 1 at Beche Park Wood was the deepest neutron probe tube in the study at 9m deep. The plot is dominated by the well-drained, dry soil in the top 40cm over a much wetter layer of clay with flints. The top soil layer was never very wet and the lower clay with flints layer never very dry. Below about 120cm down to 400cm most of the seasonal variation in soil moisture is seen, made possible by the tree roots extracting water from the soil at these depths. Below 400cm there is minimal change in water content.

(a) Soil Moisture Content (%) Neutron Probe Tube 1



(b) Monthly Rain (mm)

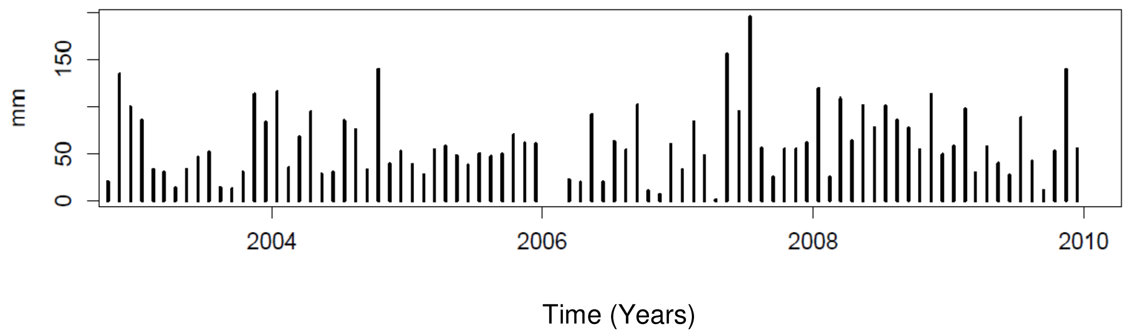
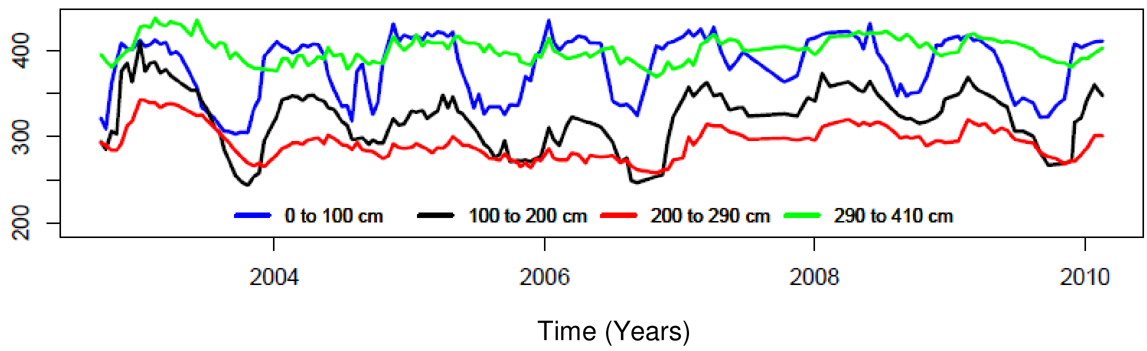
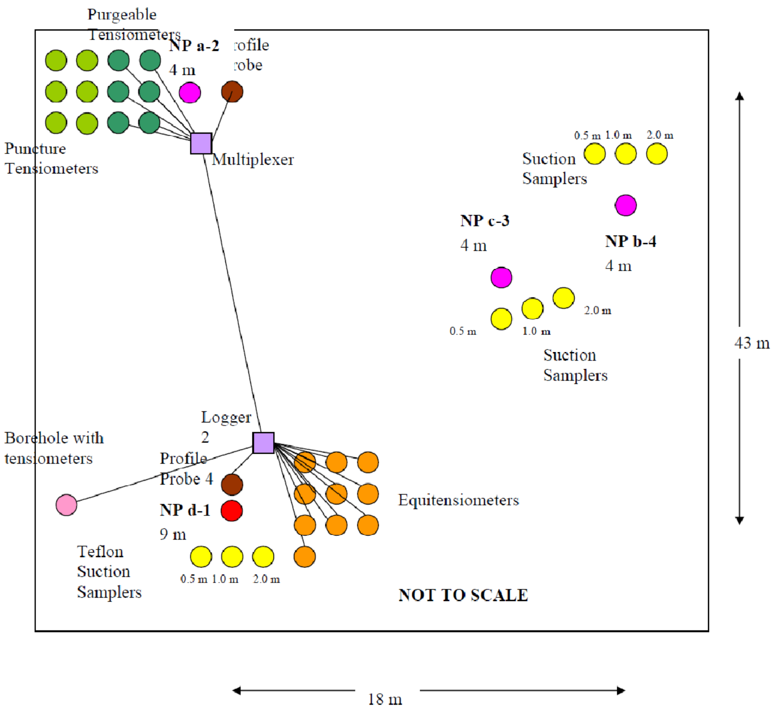


Figure 11. Beche Park Wood, Soil Moisture, 2002- 2009

(c) Layer: total water depths (mm) Neutron Probe Tube 1



(d) Site instrumentation plan



(e) Frequency Analysis

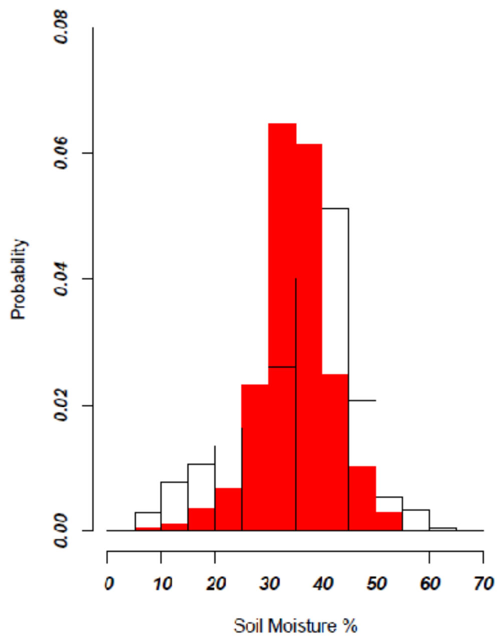


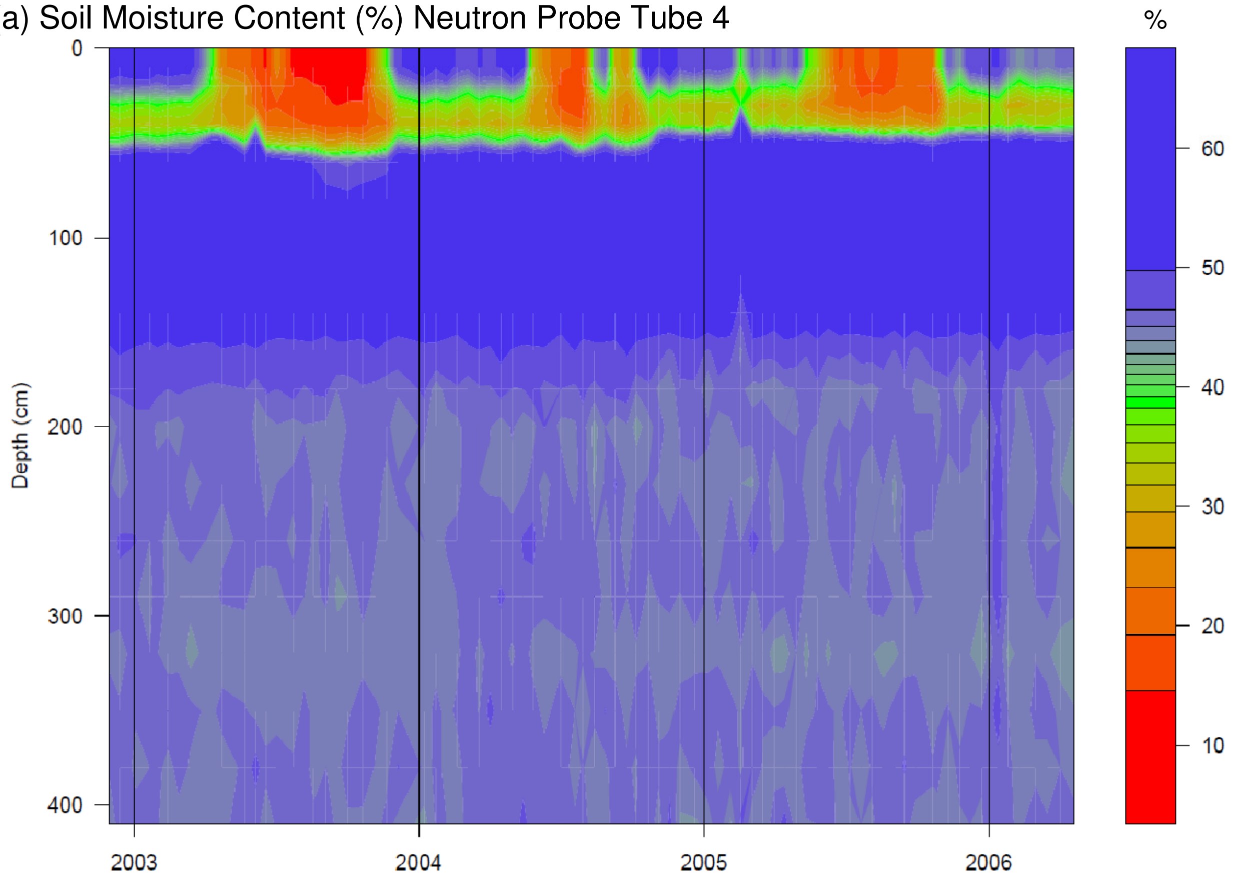
Figure 11. contd. Beche Park Wood, Soil Moisture, 2002- 2009

Highfield Farm Neutron Probe Tube 4

(Grass, Tertiary series geology, interbedded clays and gravels, with lenses, perched water tables and non-vertical flows)

The soils at Highfield Farm drain very poorly and much of the soil profile remains constantly wet throughout the year even during the drier years of 2003, 2004 and 2005. A raingauge was installed near the neutron probe tubes early in the study but the raingauge pit soon filled with water and the instruments were drowned and subsequently removed. The soils are very peaty here with high porosity and there appears to be a perched water table. Significant soil moisture variation only occurs in the top half-metre of the profile shown by the flat lines for greater depths in the graph showing layer water totals. The frequency distribution chart shows the vast majority of soil moisture content readings taken over three years were above 40%. Compare this to Frilsham Meadow where very few readings are above 40% soil moisture content.

(a) Soil Moisture Content (%) Neutron Probe Tube 4



(b) Layer: total water depths (mm) Neutron Probe Tube 4

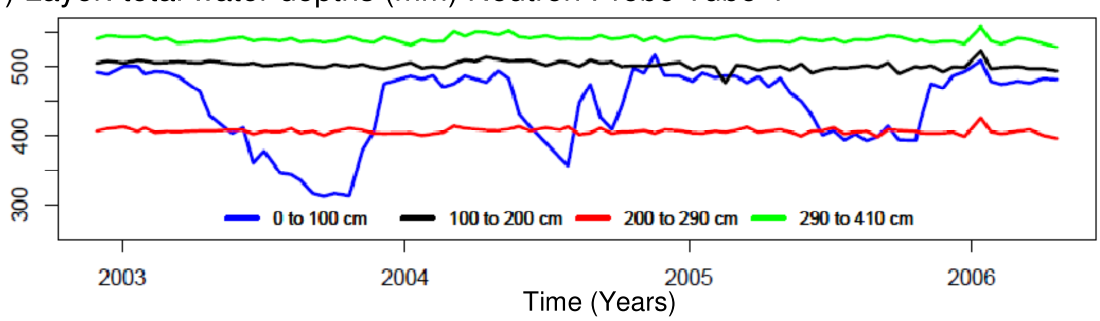


Figure 12. Highfield Farm, Soil Moisture, 2002- 2006

(c) Frequency Analysis

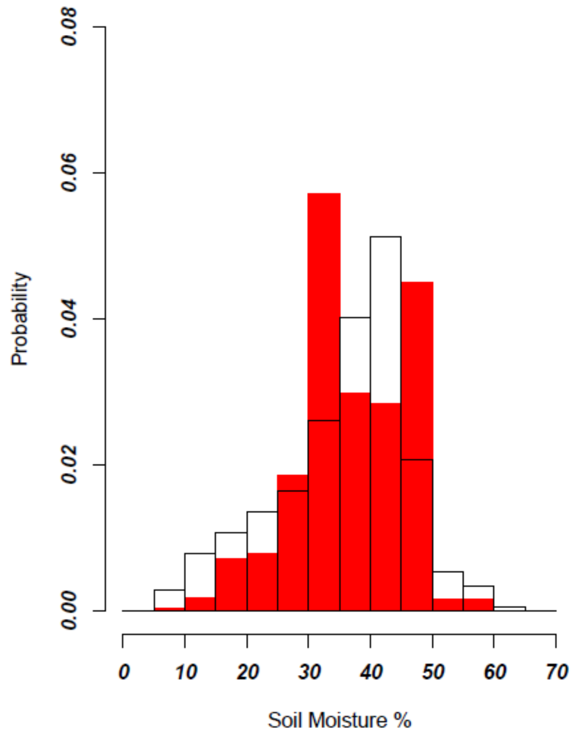


Figure 12. contd. Highfield Farm, Soil Moisture, 2002- 2006

Site Name	Easting (m)	Northing (m)	Site Code	Alternative site names used in the literature
Trumpletts Farm	451325	175000	PL10	
Frilsham Meadow	453825	173900	PL11	
Grimsbury Wood	451450	171950	PL14	Grimsbury Wood (Hermitage)
Lambourn at Shaw	447000	168200	PL15	
Highfield Farm	453925	170300	PL16	
Pang at Tidmarsh	463600	174775	PL19	
Sheepdrove Farm Recharge	435975	181425	PL21	Warren Farm or Stancombe Down
Sheepdrove Farm AWS	435675	181550	PL06x	Warren Farm AWS
Pikes Row	452675	173100	PL25	
Boxford	442700	172200	PL26	
Beche Park Wood	455750	177250	PL28	
West Ilsley	448675	183500	PL29	Folly Down

Table 4. Site Grid References

Future Outlook

To tie in with other research activities, including long-term water and carbon dioxide flux measurements at Sheepdrove Farm and monitoring at the Boxford CEH River Laboratory, monitoring is now concentrated in the Lambourn catchment. It is hoped to incorporate the historic data series of flux measurements at Sheepdrove Farm which will provide estimates of actual evaporation and hence recharge to the Chalk aquifer. The continuing flux measurements will be studied in relation to a COSMOS soil moisture sensor system which it is expected will be installed at the site in May 2011.

References

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