



# North Wyke Farm Platform

## Fine Resolution (15-minute) Meteorological Data



## User Guide



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# The North Wyke Farm Platform: Fine Resolution (15-minute) Meteorological Data

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**Description:** The North Wyke Farm Platform (NWFP) was established in 2010 to study and improve grassland livestock production at the farm-scale. The NWFP uses a combination of environmental sensors, routine field and lab-based measurements, and detailed management records to monitor livestock and crop production, emissions to water, emissions to air, soil health, and biodiversity. The rich NWFP datasets help researchers to evaluate the effectiveness of different grassland (and arable) farming systems, which in turn, contributes to the development of sustainable, resilient and net zero land management strategies. This document serves as a user guide to the meteorological data (MET) captured at a 15-minute temporal resolution from the North Wyke Farm Platform (NWFP). The guide gives details of the instrumentation, sensor calibration and data collection and is associated with other dedicated user guides that detail the design, establishment and development of the NWFP, and the quality control process of datasets.

**Site:** North Wyke, Okehampton, Devon, UK. Geographic location: 50.76944, -3.90138; 50°46'10" N, 3°54'05" W.

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## Table of Contents

1	Introduction .....	1
2	Instrumentation .....	2
2.1	Monitoring Meteorological Data.....	2
2.2	Data Telemetry and Acquisition .....	3
2.3	Sensor Downtime Log.....	4
3	Sensor Calibration and Data Harmonisation .....	4
4	Data Portal.....	4
5	Citing the Data .....	5
6	Appendices .....	6

## List of Figures

Figure 1.	Map of NWFP showing systems as of 2015-2019 (first system change period).....	1
Figure 2.	Dedicated Meteorological Instruments. ....	2
Figure 3.	Example of graphical display by the addVantage Pro software of rainfall and air temperature data.....	3

## Appendices

Appendix A.	Meteorological variables monitored site wide. ....	6
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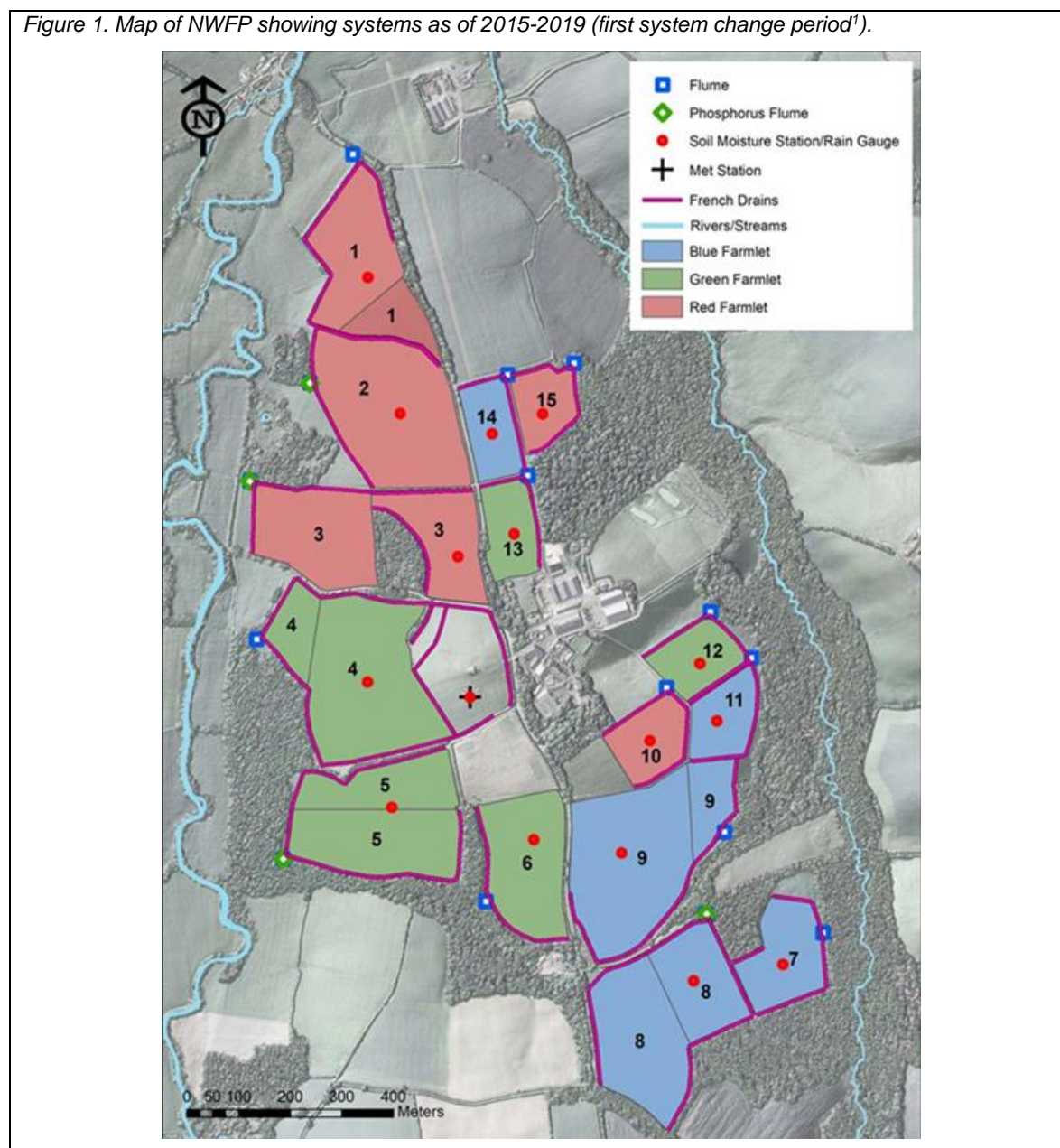


# 1 Introduction

This document provides a guide to the instrumentation and data collection process used to capture the meteorological data (MET) produced at a 15-minute temporal resolution on the NWFP (Figure 1). Information on the site characteristics, design and development of the NWFP, and the quality control (QC) system for the data can be found in the following User Guide documents available on the NWFP website:

- NWFP\_UG\_Design\_Develop.pdf
- NWFP\_UG\_QC.pdf

Figure 1. Map of NWFP showing systems as of 2015-2019 (first system change period<sup>1</sup>).



<sup>1</sup> Green farmlet = permanent pasture, Blue farmlet = high sugar grass/clover; Red farmlet = high sugar grass, and later converted to arable in autumn 2019 (start of second system change period). In November 2017, phosphorus was measured at catchment or flume 3 in addition to flumes 2, 5, & 8. From autumn 2023 onwards phosphorus will be measured on all catchments. Numbers represent catchment number. Note some catchments consist of multiple fields.

## 2 Instrumentation

### 2.1 Monitoring Meteorological Data

Dedicated meteorological equipment [Adcon, OTT HydroMet GmbH, Vienna, Austria] record the following data at 15-minute intervals:

- Precipitation (mm; installed April 2013)
- Air temperature (°C; installed April 2013)
- Relative humidity (%; installed April 2013)
- Wind speed (km h<sup>-1</sup>; installed April 2013)
- Wind direction (in degrees; installed April 2013)
- Solar radiation (W m<sup>-2</sup>; installed in May 2014)

In April 2015, a more accurate Pluvio rain gauge [Adcon, OTT HydroMet GmbH, Vienna, Austria] was installed that can provide precipitation (mm) data at 1-minute intervals but is currently reported at 15-minute intervals. These data complement those recorded by the tipping

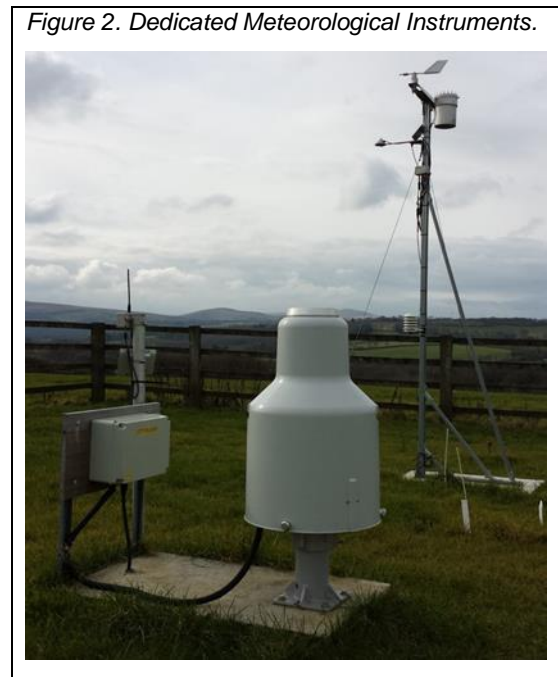
bucket rain gauges on each of the 15 NWFP catchments. Specifications for the meteorological instrumentation (Figure 2) are given in Appendix A.

Live data (and some summary statistics) are available in the link below. However, it should be noted that these data have not been through the QC process.

<http://exadcon.rothamsted.ac.uk/livedata/collection.jsf?template=weather&node=4826&units=metric>

Co-located next to the dedicated meteorological instrumentation are official UK Meteorological Office instruments which collect data on a daily basis only. North Wyke has hosted these instruments since 1981, however these data are not available on the NWFP data portal, but monthly climate averages can be obtained from:

<https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcj0z3b55>.



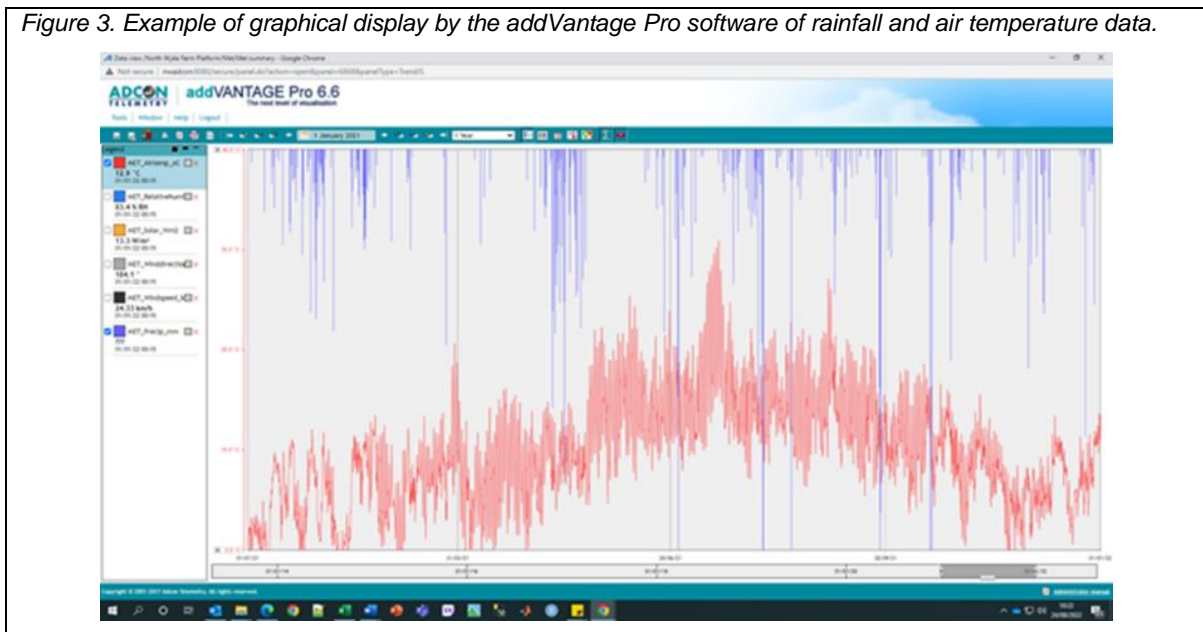
## 2.2 Data Telemetry and Acquisition

Central to the NWFP experiment is the communication network that provides continuous data transfer from the weather sensors. Currently, the telemetry network collects data every 15 minutes. Transfer of data from the meteorological sensors is via remote telemetry units (RTUs) [Adcon, OTT HydroMet GmbH, Vienna, Austria], which collect in-field data at configured intervals and transmit via UHF radio. Other telemetry components supplied by Adcon, OTT HydroMet GmbH include:

1. A centrally located base-station (A850 Gateway) which manages the RTU network, receiving the data as well as having the capability to send commands back to the RTUs if required.
2. Software (addVantage Pro), which collects, stores, processes and displays the data via its integrated web server.

Raw data are collected from loggers in the field every 15 minutes and hosted by Adcon addVANTAGE pro software, allowing for visualisation (Figure 3), data processing, automated control, event alarming and data export/distribution. An extension running within the software automatically creates and exports weekly CSV files for each parameter for archive and subsequent QC procedures.

Figure 3. Example of graphical display by the addVantage Pro software of rainfall and air temperature data.



## 2.3 Sensor Downtime Log

A log of all sensor downtime issues is maintained in MS Access where input forms and restricted fields are used to ensure that the correct and required data is recorded. The information includes details on the location, the sensor, the start and end times the sensor was not functioning correctly, information about the problem and the required QC action (e.g., set recorded data as missing or add a 'unreliable' flag to the data). Exports from this worksheet are automatically used as part of the QC process. The sensor downtime log also serves as a useful reference when trouble shooting current sensor issues.

## 3 Sensor Calibration and Data Harmonisation

Many sensor calibrations or harmonisations directly relate to the QC of the 15-minute data. To see how this relates to the QC of the 15-minute data in detail, refer to the user guide to the QC system entitled NWFP\_UG\_QC.pdf.

Given there are co-located met stations, periodic comparisons are conducted to check for consistency between alternative MET measurements. Differences can sometimes be of genuine concern (and flagged as such) while, more commonly, differences reflect unavoidable measurement error (see [Appendix A](#)) of the particular device (and not flagged).

In this respect, it has been noted that the solar radiation values have shifted slightly since July 2018, resulting in some night-time values being greater than zero, but still relatively small in relation to daytime values. Thus, depending on the nature of the use of this data, it may be worth considering setting solar radiation values before sunrise and after sunset to zero.

## 4 Data Portal

The NWFP Data Portal (<https://nwfp.rothamsted.ac.uk/>) allows accessibility to the core NWFP datasets to not only Rothamsted Research but also the wider research community. The data are open access and free to download but users are required to register their interest.

For information on the latest version of the 15-minute datasets and the changes since the last version, please refer to the User Guide entitled 'NWFP\_UG\_QC.pdf' available on the NWFP website:

<http://resources.rothamsted.ac.uk/farm-platform-national-capability/data-portal-guides-and-information>.

In addition, the website offers a wealth of online, and regularly updated information to complement the data.

## 5 Citing the Data

If you choose to use any of datasets provided by the NWFP in a publication, please cite:

- Orr, R. J., Murray, P. J., Eyles, C. J., Blackwell, M. S. A., Cardenas, L. M., Collins, A. L., Dungait, J. A. J., Goulding, K. W. T., Griffith, B. A., Gurr, S. J., Harris, P., Hawkins, J. M. B., Misselbrook, T. H., Rawlings, C., Shepherd, A., Sint, H., Takahashi, T., Tozer, K. N., Whitmore, A. P., Wu, L. and Lee, M. R. F. (2016). *The North Wyke Farm Platform: effect of temperate grassland farming systems on soil moisture contents, runoff and associated water quality dynamics*. *European Journal of Soil Science*, 67, 4, 374-385. ([doi:10.1111/ejss.12350](https://doi.org/10.1111/ejss.12350)).

In addition, if using data from the baseline period please cite:

- Takahashi, T., Harris, P., Blackwell, M. S. A., Cardenas, L. M., Collins, A. L., Dungait, J. A. J., Hawkins, J. M. B., Misselbrook, T. H., McAuliffe, G. A., McFadzean, J. N., Murray, P. J., Orr, R. J., Rivero, M. J., Wu, L. and Lee, M. R. F. (2018). *Roles of instrumented farm-scale trials in trade-off assessments of pasture-based ruminant production systems*. *Animal*, 12, 8, 1766-1776. ([doi:10.1017/S1751731118000502](https://doi.org/10.1017/S1751731118000502)).
- Orr, R. J., Griffith, B. A., Rivero, M. J. and Lee, M. R. F. (2019). *Livestock Performance for Sheep and Cattle Grazing Lowland Permanent Pasture: Benchmarking Potential of Forage-Based Systems*. 9, 2, 101-118. ([doi:10.3390/agronomy9020101](https://doi.org/10.3390/agronomy9020101)).

For the datasets used, please cite the latest version of the relevant User Guide PDF document(s), listed in the table below, that describe the establishment and development of the NWFP, and the various datasets produced in detail. The link to these can be downloaded from the NWFP website. Note that the User Guide entitled 'NWFP\_UG\_Design\_Develop.pdf' should be cited irrespective of the dataset used.

Data used	Main title of User Guide PDF document
All datasets	NWFP_UG_Design_Develop.pdf
15-minute time-series datasets (water, soil moisture, meteorology)	NWFP_UG_Hydrology&WaterQuality_Data.pdf NWFP_UG_SMS_Data.pdf NWFP_UG_MET_Data.pdf
Greenhouse gases	NWFP_UG_EC_GHG_Data.pdf NWFP_UG_GreenFeed_Data.pdf
Field surveys	NWFP_UG_FieldSurvey_Data.pdf
Livestock	NWFP_UG_Livestock_Data.pdf
Field events	NWFP_UG_FieldEvents_Data.pdf

Also, please include the following sentences in the acknowledgments section:

*“The North Wyke Farm Platform is a UK National Capability supported by the Biotechnology and Biological Sciences Research Council (BBS/E/RH/23NB0008).”*

*“We acknowledge the interests of the Ecological Continuity Trust (ECT), whose national network of LTEs includes the experiment on which this research was conducted.”*



## 6 Appendices

*Appendix A. Meteorological variables monitored site wide.*

<b>Meteorological Variable</b>	<b>Method</b>	<b>Units</b>	<b>Range</b>	<b>Resolution</b>	<b>Accuracy</b>
Precipitation (2013-2015)	Tipping Bucket	mm	0 – 100 per hour	0.2	0-50: ±1%
Precipitation (since 2015)	Weighing	mm/15-minutes	0.1 – 500 per hour	±0.01	±0.05
Air Temperature	Thermistor	°C	-40 - 60	0.01	±0.1
Relative Humidity	Capacitance Humidity element	% RH	0 - 100	0.1	0-90: ±1.0; 90-100: ±2.0
Wind Speed @ 3 m height	Anemometer	km h <sup>-1</sup>	1.44 - 270	0.01	±0.8
Wind Direction @ 3 m height	Magnetic Hall Element	Degrees	0 - 360	0.1	±2.5
Solar Radiation	Pyranometer	W/m <sup>2</sup>	0 - 1600	0.1	±1.8%