Tuesday morning keynotes part 2 and virtual fieldtrip 1

14 July 2026, 10:02am

48m 7s

Gianni Vesuviano started transcription

Gianni Vesuviano 0:03

It's in the wrong mode.

Srinidhi Jha 0:07

Just a second.

I hope you can see it now.

Gianni Vesuviano 0:28

Not at the moment.

Yes.

Srinidhi Jha 0:40

All right.

Yeah, ready to begin whenever you say.

Gianni Vesuviano 0:45

Yes, you can begin now. Thank you.

Srinidhi Jha 0:47

All right, so...

Hi everyone. My name is Srinidhi and I work at the UKCEH in the water resources and the drought group. And as Gianni mentioned, I'm basically going to talk very briefly about droughts here, understanding associated drought risks and how climate change potentially are going to

Srinidhi Jha 1:09

govern the potential amplification of drought risks under increasing temperature.

So just to begin, I have briefly mentioned here some of the recent examples of the droughts worldwide. This is from the drought hotspots around the world report from

2023-2025. And as you can see, the recent examples of droughts worldwide have been spread in other conventional regions, which are
also not very conventionally. For example, dry, semi-arid, or arid. All of us know what happened in the United Kingdom in 2025. We witnessed one of the hottest summers on the record. We witnessed one of the driest springs on the record since 1893. Similarly, Amazon Basin, which
also is not definitely known for scant rainfall or water scarcity. Also witnessed record low levels in its rivers and that resulted in mass fish mortality. Not just hydrological indicators, but also when it gets combined with the hot extremes, the compound hot and dry extremes form it can also be super catastrophic in nature.
Spain, for example, in 2023 also witnessed catastrophic impacts on its agricultural sector. Olive harvest dramatically going down by 50%, causing the doubling of prices. Tourism sector was badly hit. And it's not just about hydrometrological indicators. The nature of drought goes
beyond this and the impact also goes beyond this hydrological or hydrometeorological setup. When you combine it with the socioeconomic vulnerability on the ground, for example, in a country like Somalia, the number can go up to 4.4 million, for instance, which is the number of people that might be facing crisis level food insecurity as of 2025.
And if I say these are some other things from the recent past, I should also mention here.
are not looking very nice for the future as well. 75% of the world's population is projected to be affected by droughts by 2050, as the UNCCD 2022 report says.
So it is inevitable that we try to understand droughts on all these three timescales. We should learn from the past. We keep an eye on the present in terms of monitoring early warning and also brace ourselves for the future so that we have better preparedness against the potential implications or potential risks of the drought.
And you and we at UKCEH have been doing quite a few things on all these three timescales. And in the slides, forthcoming slides, I'm briefly going to share with you some of the examples from these three timescales. But before I go ahead, I would quickly like to mention this very interesting report if you are interested in having a look.
This basically mentions 5 droughts that changed human history over the period of time. If you're interested in knowing how drought shaped human migration, fall of

civilizations, current state of human health, human economics and human social status, please have a look at this report.
But for this particular presentation, I will not go that far back in the history. We'll try to focus at least in the past for the year 2025. And we'd like to have a look what was happening in terms of drought in 2025. So we started quite okay in the beginning of the year. In January, things were looking quite
nice in terms of dryness. We were having good rainfall. In fact, January was a wet month for many regions of the country. But as the spring started approaching, by the time spring came, we already were witnessing one of the driest ones, as I said, since 1893. And when the summer came, high temperature combined with the dry implication.
the dry conditions, we technically had one of the most impactful droughts UK has ever faced. In terms of impact, 46 drought permits were granted to water companies. 15 key reservoirs, even by the end of September 2025, were showing below 50% full. Twenty percent of England's canal network were temporarily closed, and 9 million was the number of people who were affected by hose pipe bans.
A bit closer look on some of the indicators which might tell you what was happening in 2025, summer and spring. This is about the river flow. This is about the river flow and you can compare 2025 data, which is in the black line, with other dry years, so 1976, 2018, and 2022, represented by
red, orange, and a bit greyish line here. And you can easily see that the black line technically goes well below than the other lines towards the spring and definitely towards the summer. Also, especially many of, most of the stations in most part of the country,
were showing below normal, exceptionally low or notably low flows. Things improved a bit in the summer, particularly towards the western north side of the country, but definitely notably or exceptionally low summer flows were observed, particularly in the east. Similarly, for the soil moisture, this is
showing the difference between the northern sites and the southern sites. You can see a clear distinction between these two set of sites. Black line again represents the year 2025, and you can compare it with other years here. The way soil moisture was behaving, soil moisture indicator was behaving,
was a bit similar to what was happening in 2022, as you can see in the red line. But overall, the clear distinction definitely says that the southern sites were behaving entirely different from the northern sites, and they had way higher plant water stress

in this region. So this was very quickly about the past. How do we observe droughts in the present, how do we monitor it? I will try to discuss with you now. So, in terms of drought monitoring and early warning systems, over the recent years, there has been some really nice advancements in the field here at UKWIR, and I have, I will be sharing

Just a couple of examples from that. This is the UK Water Resource Portal, operational since 2020. And the portal provides basically different information related to hydrometeorological data in near-real time and the whole wealth of drought indicators. So this technically tells you that

in terms of rainfall, river flows, soil moisture and groundwater, how bad they are or how good they are as compared to...

these indicators in the long term average of the past. But in terms of decision making and policy making, it's just not important to know about what was happening in the past, but also it is important to know what will happen in the next or in the near future. And of course, this is very well served by

our operational forecasting tool. This is the hydrological outlook, operational since 2013. And we provide information on river flows and ground water levels on coming months, so on the scale of one to three months and beyond. And of course, these tools have been very widely used by different decision makers, policy makers, and public in the end.

Also very much useful as the results you were looking at in the previous slide were taken from these hydrological outlooks for the drought of 2025.

There has been a lot of improvements in the water source portal. These are some of the planned and future developments for the portal here. Apart from looking at the conventional drought indicators, we have also tried to incorporate indicators which tells us about vegetation conditions. So vegetation conditioning index, temperature conditioning index, or vegetation health index, for example.

We have been also incorporating standard precipitation and evapotranspiration index, super important when we are talking about rising temperature with climate change. And not just these indicators on observing the hazards from the hydrological or hydrometeorological perspective. We have also been trying to incorporate

the drought impact forecasting framework into the water resources portal so that we just not know about the state of drought or the stage of drought, but we should also be able to know about what potential impacts these drought conditions can bring.

Talking about different indicators, of course, I showed you there is, I showed you

some of the information about what we have been doing in the UK, but we have also been involved in producing really nice indicators or really nice data sets for understanding droughts on a global scale. This is the data which has been, which was developed by our ex-colleague Ivan Noguera.
And this is global multi-indexed data set, very high resolution, especially and temporally. So by high resolution, I mean 10 kilometre scale especially and on a weekly temporal resolution. And beyond the classical indicators such as SPI, SPEI, this also includes vapour pressure deficit or these kind of indicators, which are super crucial
in order to understand what implications drought might have, for example, on plant productivity, vegetation greening, etc. Now, this not just allows us to have a look at what is happening on seasonal scale, monthly scale, but also allows us to have a look at what happens on the flash drought time scale, so what drought can do on a
on a weekly basis and flash charts has been really one of those hot topics these days. So this data set is already available at EIDC and the paper is already out if you're interested.
to have a look. So, as I said, we have been looking at different kinds of indicator, different kinds of drought types, utilisation of these indicators to understand what is the state of drought or the stage of drought. It's not just we who are looking at these different kinds of indicator, but Environment Agency also have been involved in looking at these indicators.
and they have a framework which they release, through which they release different drought alerts for 14, 15 main regions across the UK. They try to look at these indicators and classify droughts into these four, five drought stages. So normal, prolonged dry weather, drought, severe drought and recovery.
And when the release alert, of course, this can be utilised by decision makers and policy makers or other relevant stakeholders in time. But what EA has been witnessing over the period of time that sometimes what has been happening on ground in terms of indicators, so for example, if the rainfall is still showing
okay, okay levels, but on ground people are reporting that there is impacts in terms of drought. So for example, low crop yields, low soil moisture, etc. That means that whatever they are observing in terms of indicator was quite not matching sometimes in terms of alerts, what they were releasing.
And that was actually causing tricky issues in terms of what action should we take, what action might not be taken. So there is definitely some kind of human decision

making role involved in it beyond the role of these indicators. And Environment Agency basically wanted us to come up with a methodology which could allow machine to learn from
how EA experts think, Environment Agency experts think, and if that can be incorporated into the model, we might have a better framework to release those alerts. So in order to know what EA experts think before releasing the alert, we did a good survey with those experts about indicators.
about the temporal characteristics of those indicators, about the spatial characteristics. So for example, how long do they wait before looking, before releasing a particular alert? How long do they look at one particular indicator before releasing the alert? What is the extent of 1 particular spatial extent of a particular indicator they look at?
before releasing alerts. So these kind of questions were asked or at all there are other factors beyond these indicators which Environment Agency considered before releasing those alerts. So for example, it could be media interest, it could be what's happening in the neighbouring EA drought region, what is happening in terms of impact on the ground. So what we did, we provided an enhanced machine learning framework
work to improve the year drought alert system by not just incorporating those hydroclimatic indicators, but also incorporating the inputs based on what experts think about these indicators. I'm not going to the details of the methodology, but basically provided outputs technically for three different things. One,
We provided a drought simulation model for the observed period of 2017 to 2025. We also tried to reconstruct historical drought stages up to 1995. And of course, we wanted to see if we can forecast droughts in real time for at least three months lead time.
These are some of the examples here. Upper line represents the observed and the lower row represents the modelled. And as you can see, our model for the test period of 2023 to 2025 were quite good in detecting the very impactful 2025 droughts also. Again, some of the results,
These are representing the normal prolonged dry weather or the drought stages. As you can see, the dashed line represents the simulated ones and the area fill colours represent the simulated ones. And these are the fraction of areas per year in different drought stages for training and testing period.
On the forecast, on the forecasting level, these are some of the results from January

2025 to November 2025. The accuracy was quite nice. We were able to accurately predict 53 out of 63 actual drought events. So on the x-axis, you are looking at January 2025 to November 2025. And on the y-axis, these are the different regions. So the more red you see in this plot, technically it means that the more correct drought events were captured by the forecasting model.

So far, so far I have been talking about different drought indicators, how to understand or monitor droughts in terms of its stages or in terms of how the hydrometeorological indicators behave. But of course, in terms of decision making or in terms of policy making, it is also important to know

how these indicators or how these drought stages, what are the impacts are going to be related to these drought stages. So inevitably, what matters is that how efficient we are going to be in linking the drought indicators or drought stages with the impacts on ground. Of course, it has limitations because unlike the drought stages or drought indicators, we do not have ample amount of data.

in terms of impact, but we at UKCEH have been trying to provide some better toolbox to basically incorporate lagged drought indicators and drought impacts together with some machine learning framework to predict the drought impacts beforehand. This was done in a couple of projects like IRIS and MONARK.

And some of the nice results which were produced by Burak Bulut has already been out in the paper, if you are interested in reading. And these are some of the results. For example, for London, here you are looking at the number of impacts observed and predicted.

from 1970 to the recent past. The grey areas represent the test period. I mean, the models were not trained for this particular period, and you can easily see that the model accurately presents the impacts or the timing, the number of impacts at accurate time scale. In terms of severity,

The models were also behaving nicely, but in terms of likelihood of the impacts, there were potentially some false negatives, but overall, the model shows good potential in predicting the impacts on ground.

This was done for, this was the result for one city, but we also tried to see if we can regionally forecast drought impacts on ground. So these are the observed outcomes for different regions in the UK, and these are the predicted outcomes. These are, of course, for the lead time of three months of scale.

So of course, when we evaluate regional drought patterns.

at zero-month lead time predictions align very closely with the observed impact,

especially in the central and the southeastern England region. But of course, when we go a bit further in the lead-time scale, the models definitely show good predictability, but the accuracy decreases as we increase the lead time. However,
The prediction becomes, of course, the prediction becomes harder and the uncertainty also increases over longer time periods.
Now, we talked about past, we talked about present, and of course, with rising temperature and changing climatic condition, it is inevitable that we talk about the future. All of us know that there is El Niño right knocking at our door, end of 2026. It is expected to be there. And all of us know that El Niño is definitely associated with higher drought occurrences or more impactful drought occurrences across the world. With increasing temperature also most likely going to exceed 1.5 regions, 1.5 degrees Celsius globally as compared to the pre-industry level, it is very much important to incorporate the role of changing temperature.
in governing the occurrences of drought, how the implication of drought, and understand what are the implications of drought that might come into the future. So how does changing temperature influences the drought drivers? Because of the fact that all of us know that different drought drivers are connected to each other.
with different feedback mechanisms and when the changing temperature might occur.
They might influence the dependence between these drivers itself, and the non-stationarity caused because of the changing temperature might not just influence these individual drivers also, but the dependence between them. And I'm talking about non-stationarity that not just influences the shift in the mean.
or the overall magnitude of that particular indicator, for example, deficit in precipitation, it might not just change the overall magnitude of the deficit, but might also change the overall variance, how it is spread over the period of time or a space in nature. And as I said, it might also influence the dependence between these parameters, so evapotranspiration,
And soil moisture, for instance, soil precipitation and evapotranspiration, for instance, the dependence between them might also change with time.
These changes over the period of time, how much or how they can influence the likelihood of occurrence of a dry event. This is a quick example about that. On the top, you're looking at the likelihood of occurrence of univariate dry events, so basically precipitation related dry event occurrences. At
3 degree warming into the future, you can see there is good likelihood, particularly in

Europe, in the South American region, when I'm talking about univariate dry events. But when I combine or when I incorporate the dependence of these dry events on hot extremes, so when I'm talking about compound hot and dry extremes, when I incorporate the dependence between these two,
In the future, at changing, on a climate change scale at 3 degree warming, you can easily see that the likelihood multiplication factor climbs by many fold and the likelihood increases. Now you can imagine what implications it can bring in terms of overall risks, which we might witness into the future.
So it not just influences the hazard, as I said, in terms of its occurrences, or it just doesn't only govern how much the severity or the magnitude of drought is going to be, but also it also might influence the overall exposure which we might face into the future at different warming levels.
This is a quick example from, this is a quick example of some of the South Asian countries which can experience different drought exposure when we consider the role of climate change and when we ignore the role of climate change into the exposure of the cropland which might happen at different farming levels.
So here you are looking at the difference between drought exposure under climate change and without climate change considerations. So the more red you see, for instance, the more underestimation of exposure we might witness if we do not incorporate changing temperature into our statistical models. And of course,
It depends on what kind of indicator we are talking about. If you are talking about metrological drought here, the effect of temperature might be a bit less. But if you are talking about agricultural drought here, which are super crucial for croplands, you can see that increasing temperature heavily, heavily influences the drought exposure to the croplands in South Asian countries.
not just in Southeast, not just in South Asia, but also in Southeast Asia. Here you can see Myanmar, for example, forests in Myanmar might experience huge drought exposure.
huge exposure to droughts if we just take into account the changing temperature because of climate change.
So these were some of the results on a global scale, but we also tried to have a look at how changing temperature or climate change can influence how droughts evolve in the UK. So here we tried to have a look at hydrological droughts at different warming levels in the UK, particularly for rare droughts, which are more severe in nature. And

are of high interest to the policy makers because it can bring huge implications to water resources, reservoir planning, water supply and drought preparedness. We were technically interested in the rare droughts also because of the fact that the existing methodologies which we conventionally use is unable to incorporate the changing
temperature effect into the occurrence or evolution of drought. And it is also important when we are talking about these super rare droughts, how do we incorporate the uncertainty which might occur because of the super reality of these events.
Some of the quick results from that, here you are looking at the percentage change in the mean non-stationary 500-year return level of the drought. So here you're looking at in the rows at different warming level, 1.5 degree, 2 degree and 3 degree across different drought characteristics, so duration, severity and intensity.
and across different seasons. You can easily see that the percentage change or the higher magnitude of, for example, drought severity is going to be there when we go towards higher warming. And of course, it depends on what kind of what season we are talking about. It looks like spring and summer are going to be highly severe when we talk about high
higher levels of warming in the future. And the rare droughts are going to be more impactful in these particular seasons of the month. But having said that, this particular plot on the right side also represents that how much of a difference or underestimation or overestimation
can be associated with these drought types when we are looking at things in the future. So for example, for drought severity.
In the spring season, if we ignore the effect of rising temperature at 3 degrees in the UK, you can easily see that the difference in the percentage change in the return levels is quite higher for drought severity. So there will be higher risk of underestimating drought severity, particularly in the spring and summer season. Across the country, so...
The key message out of all is that it is important for us to incorporate the role of changing temperature conditions in our drought risk assessment framework. It is important also to not just look at different kinds of indicator while monitoring in terms of drought monitoring or early warning. We should also be potentially looking for ways not just to look at
the drought stages or the state of drought, but also ways to model the potential

linkages between the drought hazard and the impacts on ground itself. And of course, as we saw, we should definitely learn from what has been happening on the past, because things are changing very rapidly and we should be mindful or we should be learning from what has been happening
not just in the far back in the future, but also what has been happening in terms of in terms of year as recent as year 2025. That was my last slide. Happy to answer any questions if you have. Thank you very much.

Gianni Vesuviano 26:57
Yes, thank you for the presentation, Srinidhi.
Are there any questions? If there are, either raise your hand or type them in the chat.
Okay, we got one from Martha.

Martha McKee 27:15
Yeah, hi, thank you so much for that talk. That was really interesting. I was just wondering, you kind of spoke earlier in your presentation about how you use these models in this data to help inform policy. And I am sorry to put you on the spot, but I was just wondering if you had any examples of things of like policy that has been affected by this data or

Martha McKee 27:36
It doesn't have to be big, just a small example, probably UK-based, I imagine.

Srinidhi Jha 27:40
Yeah.
Yeah, so yeah, I mean, there are many examples, I guess. Some of the examples which I did not really put in terms of straight away outcomes in terms of policy making, but I must mention, for example, we have been working a lot with UNCCD in terms of understanding what are some better methods to not just look at the drought in terms of NICE indicators,

Srinidhi Jha 28:04
but also in terms of how to combine these different indicators, exposure, vulnerability, to get better risk estimates. So we have been working with UNCCD and we have been suggesting new indicators to look at droughts. So one of the quick

examples of how our indicators were or how our inputs were incorporated into decision making is that
This UNCCD framework, we're technically suggesting that we should look at metrological droughts, so basically SPI, when we are reporting droughts, and there are many countries involved, more than 115 countries that has reported in the recent past. But

Srinidhi Jha 28:44
As we saw, metrological drought indicator might not be enough because maybe in some arid region or semi-arid region, SPEI or temperature has a bigger role to play. So the GMID data, which I just showed, which I just shown, were basically provided to UNCCD and some of the countries are now using those data sets to report

Martha McKee 28:59
Yeah.

Srinidhi Jha 29:04
basically having better flexibility or more flexibility in terms of reporting the hazard itself, but also not just reporting in terms of hazard. We are also involved in not just providing better indicators, but also giving people or these policymakers better ways to incorporate
the effect of changing temperature, as I said. So we are involved in some projects with some of the insurance companies in the UK, and we are also working with them in West Africa, in the country of Ghana. And one of the quick examples which I just wanted to share here is that these insurance agencies, when they release

Srinidhi Jha 29:44
payouts or they release policies, they make assumptions based on the statistical thresholds, which have been there since a long period of time. By statistical threshold, I mean that we have been conventionally, for example, looking at one particular threshold of, for example, SPI. So maybe negative 2.5 was the.

Srinidhi Jha 30:06
particular threshold which was always of interest. But with, because of this non-stationarity, because of changing temperature, this particular might, this particular

threshold might evolve over the period of time. And we have been able to suggest how much that change is going to be, not just for SPI, but for other different kinds of indicator.

Srinidhi Jha 30:26
And we are now coming up with a possible potential toolbox for those insurance companies. So these are some of the quick examples. Of course, there are some other examples for UK also. But yeah, for the interest of time.

Martha McKee 30:38
Yeah. No, thank you so much. That's very interesting. Thank you. Thank you for the talk.

Srinidhi Jha 30:42
Thank you.

Gianni Vesuviano 30:45
Okay, we have another question from Sebastian. Go ahead.

Yelesen, Sebastian 30:51
Hi, I've read some work on how extreme value analysis for heat waves has been done before and obviously it's quite a complex, you've got complex probabilistic dependence between the duration and the intensity and all of these factors.

Srinidhi Jha 31:02
Mhm.
Mhm.

Yelesen, Sebastian 31:10
What methods did you use? Have you used copulas or, what's it called, multivariate extreme methods that have been done before, like Heffernan and so on?

Srinidhi Jha 31:24
Yeah.

Yelesen, Sebastian 31:26
What did you use to come like to capture this complex dependence between all these drought factors?

Srinidhi Jha 31:33
Yeah, thanks for the question. So for the UK study, which you saw, I think I also mentioned the paper here. So in that paper, we have used non-stationary extreme value analysis. So basically, we tried to try to vary the location parameter of the extreme value
priority distribution over the period of time by just incorporating the changes in temperature. And since we were talking about very much rare droughts over 100 years, 500 years, it was inevitable that a lot of uncertainty will come. So we cooperated patient framework for that.
MCMC sampling to kind of provide more robustness on that front in terms of a technical uncertainty. So this was about the UK hydrological drought study and yes, for the global drought exposure.
Analysis for the results which you, which you see, which you saw those were based on the copula probabilistic copula-based model, aggregate copula-based model.
And, and yeah, we also use non-stationary, non-stationarity with the help with the help of framework, so technically just varying the location and shape parameter, location and scale parameter of these different drought characteristics to vary over the period of time.

Yelesen, Sebastian 32:55
Yeah, that's very that's very cool, because I've I think using GAMLSS to to capture movement of the parameters of a distribution with like a climate covariate is not something I've seen and discussed very much in in.

Srinidhi Jha 33:02
Yeah.

Yelesen, Sebastian 33:14
you know, hydroclimatic extremes research. Very nice. Thank you.

Srinidhi Jha 33:18

Thank you very much. I think there has been a lot of studies which have used GAMLSS. So the quick one which I remember is that people have tried to, for example, come up with non-stationary SPI, which has definitely used this GAMLSS framework. But yes, you are right about the fact that it might not have been used very.

very popularly in the bivariate or multivariate framework. But yeah, I think that can be super useful when we are interested in looking at compound events or how things evolve in the future, particularly when we are trying to associate hot extremes with these dry conditions in the future.

Yelesen, Sebastian 34:02

Thank you.

Gianni Vesuviano 34:07

Okay, so thank you. If there are no more questions, I'd like to thank Srinidhi again for the very interesting presentation. Next, we'll be going on a virtual field trip to the Wallingford Meteorological Station.

Srinidhi Jha 34:08

Thank you.

Thank you very much.

Thank you.

Gianni Vesuviano 34:27

And then once we've taken the trip, Steve, who you'll see on this virtual field trip, will be around in the Teams meeting to answer any questions you might have about it.

There he is. Hi, Steve.

Okay, so the virtual field trip is gonna...

Hello, my name is Steve Turner and I'm A hydrologist at UK Centre for Ecology & Hydrology, but I also manage the Wallingford Meteorological Station, which is where we are today. The Wallingford Meteorological Station has been here in Wallingford for 61 years now, since 1962. It is a Met Office Climate Network station.

The Met Office have over 200 weather stations like this across the UK. They're split

into two categories. Fast responding sites, which inform our weather forecasts and the apps that we have on our phones. And we also have climate networks, which is like this one. The Met Office climate network is all about that long-term record. We're using manual instruments that have been the same for those 60 years and having those
Same manual instruments means that there aren't any changes added to the data set because of changes in equipment, and that means that we've got that control over the years. So, looking around us here at the Met site, this is a sort of ideal location to hold a weather station. We've got flat level ground, and...
There's no trees or buildings overshadowing the area. Trees, for example, if they were nearby, they might affect how much rain we catch in our rain gauges. And if they were buildings, the buildings absorb heat, so that would artificially increase our temperature measurements. The data we collect from the climate station helps us to understand
how the weather has changed over all these decades and can help us inform things like the changes that we're seeing from climate change.
So now we're going to have a look around the Met site and see what data we collect. Every day at 9 o'clock Greenwich Mean Time, an observer will visit the site to take these measurements, including Christmas and holidays, so that we have this consistent record. We use the anemometer and the weather vane
to measure the wind speed and direction. And also, when we're here at the site, as well as reading the instruments, we are making observations of the current weather. So we will assess how much cloud is in the sky and what the weather is doing at this current moment in time and look at how far we can see to determine the visibility at the site. So this is our Stevenson screen.
where we house our thermometers which measure the air temperature. It's painted white so it reflects the sunlight and it has these vents in the side which allow the air to pass through the Stevenson screen. Inside then we have four different thermometers.
We're measuring different types of air temperature. We have our dry bulb thermometer, which measures the current air temperature. We have our wet bulb thermometer, which is housed in a water reservoir. The difference between the two allows us to measure how humid it is. We also measure the minimum and maximum temperatures in the last 24 hours.
As well as the air temperatures, then we also measure soil and ground temperatures.

We measure the soil at 1 metre deep.
And also at 30 centimetres deep, we measure the minimum overnight temperature on concrete and on grass.
And we also measure the sunshine duration with our Campbell Stokes recorder. The glass ball here directs the sunlight onto a card, and when it's sunny, the card burns through, and we can use that to measure how long the sun has been shining for. And here's an example from a different day where it's burnt through.
The card for multiple hours.
We also have an automatic weather station here at the Met site and that measures everything we've just looked at. So at the top we've got an anemometer doing wind speed and direction. We've also got the temperatures up there as well.
We measure the sunshine duration and also the radiation. And the automatic weather station does this every 15 minutes. So all the data we collect at the Met site is then sent to the Met Office, who quality control the data, and then add it to their MIDAS open data set, along with over 200 other weather stations across the UK.
And one thing we haven't spoken about is rainfall. Here is our 30 centimetre standard rain gauge. Inside, the rain falls into this plastic bottle, which we then measure once a day to measure how much rainfall has fallen over the last 24 hours.
So also at our Met site, we are running a long-term rain gauge experiment. Here we've got three different rain gauges at different heights. This is the OTT Pluvio rain gauge, which is a weighing rain gauge, and it's effectively a set of scales which measures how much rainfall falls into it and converts that into how many millimetres of rainfall. We have one mounted at 1 metre.
Our second gauge is mounted at 30 centimetres and we've also got one mounted at the ground level. The reason we have them at three different heights is because the height of the rain gauge affects how much rain the gauge catches. And we found out that between the groundwater rain gauge and our one metre rain gauge, the difference between how much rain is captured
can be between 5 and 15 percent. That's important to know because quite often these days our standard 30 centimetre rain gauges are being replaced by these rain gauges mounted at 1 metre and that could introduce a step change into your record and cause homogeneity issues. So now we've seen how the data is collected, we're going to have a look at how the data is used.
I'm Maliko Tanguy and I work alongside Steve. I'm A spatial data analyst specialised in the study of droughts. All sorts of people interested in the weather and the climate

use this data, which is freely available from the Met Office MIDAS dataset. The data collected at the Wallingford Met site has been specifically used as input for hydrological models.
algal bloom studies, water quality studies, and data centre cooling regime efficiency, to name just a few. One specific example of the use of this meteorological data is to monitor the hydrometeorological status in real time. So here I'm showing the UK Water Resource Portal.
which is maintained by UK Centre for Ecology & Hydrology. So this tool attracted quite a lot of attention during droughts, for example, the 2022 summer drought. This I'm showing retrospectively now what happened during that drought, but back then you were able to monitor what was happening in real time. The red parts are where the country is really dry, whereas the blue parts are where it's still wet.
So here I'm showing April, but if we click through the months, you can see how the drought evolved and which part were more heavily affected. Another example of the use of this meteorological data is that it is essential input for hydrological models, which then enables us to produce hydrological forecasts, such as the one produced within the UK Hydrological Outlooks. The UK Hydrological Outlooks is an operational product led by UK Centre for Ecology & Hydrology in collaboration with many other partners and we produce monthly forecasts which are particularly important to inform some decisions
around water management, especially during a drought. So here again, I'm showing the UK Hydrological Outlook Portal. And this is an example again of the 2022 spring-summer drought. That was the forecast back in April. So the red dots are showing that we expect low flows for the coming season.
Each month we would produce a new forecast. We look at the June forecast, we were still expecting very low flows, particularly in the south of the country. Scientists at the UK Centre for Ecology & Hydrology are continuously working to improve these predictions and long record of observations, such as the one collected at the Wallingford Met sites,
are essential to having confidence in those models. We hope you've enjoyed our tour of the Wallingford Met site. The data that we collect here adds to the extensive record and meteorological information over time and helps form things like hydrological models, trend analyses and can help us react in times of drought.
And in a changing climate where hydrometallurgical extremes are expected to intensify, our work becomes increasingly essential to help increase society's

preparedness.
Okay, well, thank you for the field trip to our Wallingford Met Station. Steve is here now to answer any questions you might have.

Steve Turner 44:29
Hi, Sam.

Sam Tulloch (PGR) 44:32
Hi, Steve. I'm curious to know about how, so you record things in an environment where the trees don't interfere with it, and in particular, it's away from buildings so that there's limited heat interference. If you're interested in monitoring,
like urban heat island effects and that kind of thing. Do you model that into like any kind of stuff you would want to do or is it something where you have to get a different station to monitor that specifically?

Steve Turner 45:08
Yeah, thanks for your question. It's a really nice question. And yeah, I think you're right in terms of there's different stations and different places. So there'll be some stations which might sort of have that influence of the urban heat index already included. And with
The Met Office climate stations, they are sort of graded by the Met Office on things like their exposure and how they are to sort of urban areas. So there is a way of looking at the gradings to see
to see kind of the status of a particular site, I suppose. And we do, we are quite in contact with our nearby Met Office climate sites. So we're in Wallingford in Oxfordshire. And as you saw on the film, it was kind of in a
a nice green field, although it's not so green at the moment, it's a bit dry. But we've got another Met Office site in Oxford and one in Reading. And they're a bit more built in more built-up environments and we share data between ourselves. And I haven't done an exact analysis in recent times, but I know last time we looked at it, we saw that the one in Oxford was sort of
consistently around 2 degrees warmer. That's just a bit of an estimate at the moment, but it's yes, I guess it's something we could look into to do a bit more of a specific analysis. But as I say, there are the gradings of the Met Office sites to help pick one, which

might be suitable for your application.
I hope that answers your question.

Sam Tulloch (PGR) 46:57
Yeah, thank you very much.

Steve Turner 47:00
No worries.

Gianni Vesuviano 47:05
Any other questions?
If not, then that was the last session that we had planned for this particular part of the workshop. Coming back after lunch at 1pm British Summer Time, we'll have a workshop on approaches to hydrological modelling.
That again will be in a different Microsoft Teams link, so check your timetables for that link. That will be in one hour and 10 minutes. So if that's the end of this session, then enjoy your break. Once again, thank you, Steve, and thank you, Srinidhi.
And see you after lunch.

Gianni Vesuviano stopped transcription