Environmental and Agricultural Geophysics

RAS Specialist Meeting

Friday 9 May 2025 Burlington House, London

Royal Astronomical Society

Contents

Sponsored by

https://www.atkinsrealis.com

https://rskgeosciences.co.uk

https://www.geomatrix.co.uk

https://stryde.io/

About

Environmental and Agricultural Geophysics

The rise of the field of agro-geophysics seeks to apply geophysical methods to help characterise the shallow subsurface (often focussed on soil and water properties) with the ultimate aim of informing land management strategies. Several UK-based geophysics researchers are already working to explore the use of geophysical methods in this field, and with the advent of emerging technological developments such as 4D real-time electrical monitoring, Distributed Acoustic Sensing (DAS) and Large-N seismic node deployments becoming more commonplace, now is an ideal time for geophysics and environmental facing researchers to work together with the British farming community to explore how science can be utilised to help them face current challenges to food production in the UK.

In this meeting we invite those with an interest in learning about, or who are already working on agricultural geophysics to discuss ongoing work and consider directions of future research/collaboration with international experts in agro-geophysics as well as specialists from environmentally facing disciplines including soil science, hydrology and agriculture as well as British farmers who can speak directly on the issues they face.

Keynote Speakers

Barry Allred is a retired Research Agricultural Engineer, having worked 25 years for the U.S. Department of Agriculture (USDA) - Agricultural Research Service (ARS) - Soil Drainage Research Unit in Columbus, Ohio, USA. He is also an Adjunct Assistant Professor in the Food, Agricultural, and Biological Engineering Department at Ohio State University. He is a licensed professional engineer and professional geologist. His geophysics research with USDA/ARS focused largely on agricultural drainage system mapping and golf course infrastructure assessment using both ground-penetrating radar and drone aerial imagery. He additionally studied aspects of soil electrical conductivity measurement using resistivity and electromagnetic induction methods to assess soil properties and transient shallow hydrologic conditions. He developed the concept and served as lead editor for the first book devoted to the topic of applying near-surface geophysical methods to agriculture (Handbook of Agricultural Geophysics - CRC Press). He has previously served as President of the Environmental and Engineering Geophysical Society, was the past-Editor-in-Chief of *Fast*TIMES (an online near-surface geophysics news magazine), and is currently the Editor of the Ohio Journal of Science (peer reviewed scientific journal for the Ohio Academy of Science).

Sarah Garré investigates soil-water-plant interactions and is an active participant in the societal debate on water and agriculture . She embarked on her journey into agrogeophysics with a PhD from Forschungszentrum Jülich, where she utilized electrical resistivity tomography on large undisturbed soil columns to non-invasively assess solute transport and soil-plant interactions.

As a professor at the University of Liège, Sarah established a research group dedicated to applying and developing geophysical techniques to address various agronomic questions, including plant competition in intercropping systems, mulching, the impact of tillage methods, biochar, and agroforestry.

Since 2020, she has been a senior researcher at ILVO and a member of the ILVO Center of Expertise for Agriculture and Climate. At ILVO, Sarah played a pivotal role in establishing the open-access research infrastructure HYDRAS, which makes belowground phenotyping accessible to a wide range of researchers and companies.

Organizing committee

Dr Jenny Jenkins	Durham University	jennifer.jenkins@durham.ac.uk
Dr Jessica Johnson	University of East Anglia	jessica.johnson@uea.ac.uk
Kevin Davidson	Birkbeck, University of London	kevin.davidson@bbk.ac.uk

Timetable

10:00–10:30	**Welcome & Opening Remarks**		
10:30–11:00	KL	**Barry Allred** U.S. Department of Agriculture	Agricultural Geophysics in North America – Past, Present, and Future
11:00–11:15		**Kevin Davidson** Birkbeck, University of London	High-resolution soil moisture monitoring: the potential of large-N seismology
11:15–11:30		**Andrew Curtis** University of Edinburgh	Seismic gradiometry for near-surface characterisation of seismic velocity and mass density
11:30–11:45	**Coffee**		
11:45–12:00		**Russell Swift** British Geological Survey	Geoelectrical monitoring of soil moisture in agricultural settings
12:00–12:15		**Adrian White** British Geological Survey	Long-Term ERT Monitoring of Soil Moisture Dynamics: Implications for Climate Resilience and Land Management
12:15–12:30		**Jim Whiteley** AtkinsRéalis	Safeguarding the natural and built environment through geophysical monitoring
12:30–13:15	**Lunch**		
13:15–13:45	KL	**Sarah Garré** Flanders Research Institute for Agriculture, Fisheries and Food	Closing the phenotyping gap with non-invasive belowground field phenotyping
13:45–14:00		**Dan Evans** Cranfield University	UAV-based multiband Synthetic Aperture Radar for soil moisture assessment
14:00–14:15		**Jess Johnson** University of East Anglia	Forecasting Coastal Cliff Collapse using Distributed Sensing
14:15–14:30	**Break**		
14:30–14:45		**Anton Ziolkowski** University of Edinburgh	Minimising Drilling Risk for Geothermal Energy
14:45–15:00		**Stefan Nielsen** Durham University	Exploring Environmental Geophysics Through Student Projects: Challenges and Opportunities
15:00–15:30	**Panel Discussion**		
15:30	**Closing Remarks and Tea**		

KL: Keynote Lecture

List of Abstracts for Talks

Agricultural Geophysics in North America – Past, Present, and Future

Allred, B. J.[1]

KL

[1.] U.S. Department of Agriculture, Agricultural Research Service

Geophysical methods can be valuable agricultural tools having many potential applications. Generally defined, agricultural geophysics is the application of proximal and/or remote physical quantity measurement techniques utilized for agricultural purposes. The horizontal/vertical scales and transient/spatial variability complexities for agricultural geophysics differ compared to petroleum, mining, hydrological, environmental, and other types of geophysical investigations. One of the earliest applications of geophysics to agriculture in North America was testing in the 1930s on the use of resistivity methods to determine gravimetric water content. Research on soil salinity assessment with resistivity and electromagnetic induction methods began in the 1960s. The 1980s saw ground-penetrating radar (GPR) first employed for soil survey mapping. Integration of global navigation satellite system (GNSS) technology with resistivity and electromagnetic induction methods aided precision farming starting in the 1990s. Some of the more recent agricultural geophysics developments include soil volumetric water content mapping with ground-penetrating radar, field-scale soil water content monitoring with cosmic ray neutron probes, soil compaction determination across farm fields with an instrumented mechanical resistance blade system, on-the-go optical and radiometric sensors for measurement of various soil properties, etc. Future advancements in agricultural geophysics will likely involve multi-sensor geophysical platforms, geophysical sensors directly combined with precision farming equipment, drone mounted geophysical sensors that reduce survey time and alleviate field access/trafficability concerns, increased employment of geographic information systems (GIS) for better integration of multiple-source geophysical datasets, and improved artificial intelligence (AI) capabilities for improved analysis/interpretation of geophysical data. Research on the use of proximal and remote sensing technologies for mapping subsurface drainage systems in farm fields will be highlighted as a means to emphasize some on the more recent developments in agricultural geophysics.

High-resolution soil moisture monitoring: the potential of large-N seismology

Davidson, K. J.[1]***, Hammond, J. O. S.***[1]***, Lane, V. S.***[2]***, Finch, L. E.***[2]***, Kendall, J.-M.***[3]***, Walker, A. M.***[3]***, Ogden, C. S.***[4]***, Han, C.***[1]***, Wu, J.-C.***[1]***, Ryan, D.***[1]***, Doherty, K.***[5]***, Tranter, N.***[5]***, O'Toole, T.***[5]

[1] Birkbeck, University of London [2] SEIS-UK [3] University of Oxford [4] University of Leicester [5] Stryde

The Critical Zone (CZ) is the "living skin" of our planet, extending from the bottom of the water table to the top of the tree canopy. A key parameter in the CZ is soil moisture, which directly impacts agricultural strategies including irrigation, water management and field workability. Soil moisture is traditionally measured either in-situ, using local point sensors or at catchment scale by satellite data. Both methods have drawbacks in temporal or spatial resolution. Seismic methods, which use the omnipresent ambient noise field as a source, have been used to monitor soil moisture content at catchment scale. We can use a new type of seismic sensor to extend the method to high temporal and spatial resolutions to bridge the gap in the conventional approach.

In December 2022, in partnership with Stryde, UK-CEH, and SRUC, we deployed an array of 1600 seismic nodes at spacings between 5m and 10m for one month in Dumfries, Scotland. The site hosts a Critical Zone observatory, recording real-time data on soil moisture along with other meteorological data.

We perform coda-wave interferometry to detect relative velocity changes in the top few meters of the soil of < 1% within a 10m spatial area at a temporal resolution of 30 minutes. Our study shows negative correlations with soil moisture (r 0.6-0.7) that are closely linked to rainfall. We see this relationship break down 1 day before a period of significant local flooding. We attribute this to the soil becoming fully saturated at depth earlier than at the surface, suggesting a possible application in monitoring for flood risk. Through the use of a dense array of sensors we can scale out our approach to provide high-resolution monitoring of the entire study site, highlighting lateral variation in soil structure and drainage. Seismic velocity in soil is highly affected by both soil type and water table depth.

Our findings lie within the boundaries predicted by laboratory models for the conditions during our experiment. This suggests that with further constraints on soil type and water table depth it may be possible to directly calibrate seismic velocity to soil moisture at spatial scales not previously possible.

Seismic gradiometry for near-surface characterisation of seismic velocity and mass density

Curtis, A.[1]**, *Faber, M.***[1]

[1.] University of Edinburgh

With the advent of large and dense seismic arrays, novel, cheap, and fast imaging and inversion methods are needed to exploit the information captured by seismometers in close proximity to each other, and to produce results in near real time. We have developed a sequence of fast seismic methods for dispersion curve extraction and inversion for 3D seismic models, using only passive seismic sources. This is based on wavefield gradiometry, wave equation inversion, and machine-learning technology. We apply Helmholtz wave equation inversion using measured wavefield gradients, and the dispersion curve inversions are based on a mixture of density (or any other probabilistic) neural networks (NNs). We assume that a single surface wave mode dominates the data, and derive a nonlinear relationship among the unknown true seismic wave velocities, the measured seismic wave velocities, the interstation spacing, and the noise level in the signal. This relationship can be solved for unknown true seismic wave velocities using fixed point iterations. We use NNs to approximate the nonlinear mapping between dispersion curves and their underlying vertical seismic velocity profiles. The networks turn the retrieved dispersion data into a probabilistic, 3D seismic velocity model in a matter of seconds. In recent work we have shown that estimates of mass density are also available using the same gradiometric data under an acoustic approximation: a trade-off between density and velocity can be removed by firing a known source.

Geoelectrical monitoring of soil moisture in agricultural settings

Swift, R. T.[1,2]**, *Chambers, J. E.***[1]**, *Meldrum, P.***[1]**, *Boyd, J.***[1]**, *Wilkinson, P. B.***[1]**, *Kuras, O.***[1]**, *Sandram, I.***[3]**, *White, A.***[1]**, *Whiteley, J.***[5,1]**, *Watlet, A.***[6]**, *Magwero, N.***[4]**, *Harrison, H.***[1]**, *Inauen, C.***[7]**, *Dashwood, B.***[1]**, *Uhlemann, S.***[8]**, *Nalivata, P.***[4]**, *Chimungu, J.***[4]**, *Nguyen, F.***[2]**, *Lark, M.***[9]

[1.] British Geological Survey [2.] University of Liege [3.] Feed the Children [4.] Lilongwe University of Agriculture and Natural Resources [5.] AtkinsRéalis [6.] Luxembourg Institute of Science and Technology [7.] Alfred Wegener Institute [8.] University of Bremen [9.] University of Nottingham

The importance of understanding soil moisture storage and movement in the unsaturated zone cannot be understated. Point sensors are commonly used to quantify soil moisture for agricultural applications. They are able to log moisture over time at a high temporal resolution, but due to the small volume of soil sampled by each sensor they lack spatial resolution, potentially causing any heterogeneities to be missed.

Electrical geophysical methods are sensitive to soil moisture, leading them to be well suited to studying moisture variability in soils. The electromagnetic induction (EMI) technique has been widely used in agriculture. It can quickly cover large areas, but can have limited sensitivity at depth, particularly in wet soils. In order to study changing in moisture over time, repeat surveys are required, meaning that the technique requires repetitive effort and so lacks temporal resolution.

The Electrical Resistivity Tomography (ERT) technique provides areal coverage less quickly than EMI, but has a high spatial resolution and better sensitivity as depth increases. Recent innovations in ERT instrumentation have allowed the semi-permanent deployment of ERT monitoring systems that enable the collection of multiple measurements per day, thereby facilitating high temporal measurement rates that can capture rapid, dynamic moisture processes in the subsurface.

We present data collected using PRIME technology developed by the British Geological Survey (BGS). PRIME (PRoactive Infrastructure Monitoring and Evaluation) is an automated ERT instrument that has the capability to operate in remote locations and send the collected geoelectrical data directly to our office using wireless telemetry. To demonstrate the potential of ERT monitoring for agricultural applications, we show examples from two agricultural settings - one studying moisture movement at agricultural test plots in Malawi, and one studying moisture within pasture at our Landslide Observatory at Hollin Hill, Yorkshire.

Long-Term ERT Monitoring of Soil Moisture Dynamics: Implications for Climate Resilience and Land Management

White, A.[1], ***Stirling, R.***[2], ***Wilkinson, P.***[2], ***Wookey, J.***[3], ***Kendall, J.-M.***[4], ***Boyd, J.***[1], ***Chambers, J.***[1]

[1.] British Geological Survey [2.] Newcastle University [3.] University of Bristol [4.] University of Oxford

Understanding soil moisture dynamics is increasingly important as climate change drives more extreme and variable weather conditions. In the UK, hotter, drier summers and warmer, wetter winters are becoming more common, with major implications for land management, food production, and infrastructure resilience. These climatic shifts influence how moisture is retained and transported within soils, affecting everything from crop viability and water availability to the stability of natural and engineered systems.

To investigate these soil moisture–atmosphere interactions, we established a long-term monitoring site on a clay, grass-covered flood embankment near Hexham, Northumberland. A permanent Electrical Resistivity Tomography (ERT) system (PRIME), supported by environmental and meteorological sensors, has provided continuous, high-resolution data for over three years. ERT is highly sensitive to changes in soil moisture content, making it an effective tool for non-invasive, spatio-temporal monitoring of near-surface hydrological processes. Results show strong seasonal patterns, including the formation of a drying front in the upper metre of the soil profile during late spring, which deepens throughout the summer before being reversed by autumn rainfall. A robust correlation between ERT-derived drying front depth and a weather-derived soil moisture deficit enables us to predict subsurface drying from meteorological data. When combined with UKCP18 projections (RCP8.5), our findings suggest a significant increase in drying depths by the end of the century, with the record-breaking summer of 2022 (drying to 1.2 m) projected to become typical towards the end of the century, compared to today's average summer drying depth of 0.3m.

These results demonstrate the value of long-term, high-resolution geophysical monitoring in improving our understanding of soil moisture processes under changing climates. Insights from this work are relevant not only to flood defence management but also to broader land management strategies, particularly as UK agriculture adapts to climate-induced shifts in soil water availability.

Safeguarding the natural and built environment through geophysical monitoring

Whiteley, J.[1,2†]***, White, A.***[2]***, Wilkinson, P.***[2]***, Watlet, A.***[3,2†]***, Boyd, J.***[2]***,Oakley, S.***[1]***, Aston, K.***[1,4]***, Kuras, O.***[2]***, Meldrum, P.***[2]***, Dashwood, B.***[2]***, Uhlemann, S.***[5,2†]***, Chambers, J.***[2]

[1.] AtkinsRéalis [2.] British Geological Survey [3.] Luxembourg Institute of Science and Technology [4.] University of Leeds [5.] University of Bremen [†] BGS Honorary Research Associate

The natural capital of the environment is threatened by a range of natural and man-made hazards. Those stemming from changes in groundwater regimes and near-surface moisture dynamics are particularly susceptible to increasing prevalence and intensity as climatic patterns change. To better understand how these hazards evolve, methods of monitoring the subsurface that capture changes in key properties occurring over large spatial areas and over long time periods are needed. Recent developments in geophysical monitoring, particularly Electrical Resistivity Tomography (ERT) and Distributed Fibre Optic (DFO) sensing have opened up new opportunities for leveraging high-resolution spatiotemporal subsurface monitoring to characterise, monitor, assess, manage and protect our environment. In this study, we present two case studies using geophysical methodologies to monitor the environment; the first from a landslide in North Yorkshire, and the second from a flood defence in the Exe Estuary, Devon.

At the Hollin Hill Landslide Observatory operated by BGS, we deployed co-located ERT and DFO systems to monitor near-surface moisture content and strain, respectively. ERT provided time-lapse images of changes in moisture content, illuminating regions of the landslide experiencing significant increases in saturation, which is a known trigger for initiation of ground displacements at the site. Crucially, strain measurements show that displacement onset occurs after wetting; a well-understood mechanism, but one not previously observed in high-resolution at field-scale.

Powderham Banks is a 200-year-old, significantly deteriorated flood defence, exhibiting increasing failure rates in recent years. Piping failures triggered by internal erosion, accelerated by increased seepage threaten the stability of the structure. The flood defence protects the RSPB Exminster and Powderham Marshes, a mainline railway and approximately 100 residences. An ERT monitoring system was deployed along 1.2 km of the embankment in order to locate sections of the embankment experiencing increased seepage, as well as to monitor the efficacy of low-cost repairs to the estuary face of the structure.

Closing the phenotyping gap with non-invasive belowground field phenotyping

Blanchy, D.[1], ***Lootens, P.***[1], ***Garré, S.***[1]

KL

[1.] Flanders Research Institute for Agriculture, Fisheries and Food (ILVO)

Breeding crops that are resilient to climate change is essential to adapt to the changing climate. To accelerate the breeding process, it is crucial to understand how plants respond to extreme weather conditions like drought or waterlogging in their natural production environments, specifically under field conditions in real soils. While there are several techniques available for aboveground field phenotyping in the field, non-invasive belowground phenotyping remains challenging.

In this presentation I present the results of a proof-of-concept experiment in the new HYDRAS (HYdrology, Drones and RAinout Shelters) open-access field-phenotyping infrastructure. This infrastructure integrates electrical resistivity tomography (ERT), drone imagery, and environmental monitoring, advancing to a technological readiness level that meets the needs of breeders and researchers. Results show that ERT can differentiate belowground plant traits among genotypes of the same crop species.

We demonstrate how this new infrastructure tackles issues related to depth resolution, automated data processing, and the extraction of phenotyping indicators. The findings indicate that electrical resistivity tomography can complement drone-based field-phenotyping techniques, enabling comprehensive high-throughput field phenotyping of entire plants.

UAV-based multiband Synthetic Aperture Radar for soil moisture assessment

Evans, D. L.[1], ***Candido, B.***[2], ***Marino, A.***[3]

[1] Cranfield University [2] University of Missouri [3] University of Stirling

Soil moisture is a critical factor in agriculture, drought response, and flood mitigation. It supports plant growth and sustainable farming, while in flood-prone areas, the soil's water retention capacity helps absorb excess moisture, reducing runoff and minimizing flood risk. As such, accurate soil moisture monitoring is key to informed irrigation and water management.

Monitoring methods include both in-situ and remote sensing techniques. In-situ approaches, such as volumetric and gravimetric sampling, deliver real-time, high-accuracy data but are spatially limited unless interpolated. Remote sensing, by contrast, offers broader coverage but typically at the cost of resolution and accuracy. It can complement ground data but struggles to capture short-term or small-scale changes, such as irrigation effects.

To overcome these limitations, we are developing UAV-RADAR—the first multiband Synthetic Aperture Radar (SAR) system deployed via drone. While SAR systems like Sentinel-1 are well established, mounting SAR on a UAV introduces a transformative approach to soil moisture monitoring. UAV-RADAR delivers high-resolution, rapid, and scalable data collection, with customizable flight paths for targeted applications and repeatable surveys for pre- and post-treatment analysis.

In this presentation, we will share our latest research and development progress on UAV-RADAR. Through data from proof-of-concept experiments, we will demonstrate its effectiveness across various soil types, terrains, and farming practices. We'll also highlight real-world applications and explore how UAV-RADAR can support global efforts like the International Soil Moisture Network.

Forecasting Coastal Cliff Collapse using Distributed Sensing

Johnson, J. H.[1], ***Bie, L.***[1], ***Seager, D.***[1], ***Whitelam, H.***[1]

[1.] University of East Anglia

Coastal erosion is widespread and around 28% of the English and Welsh coastline experiences erosion rates of at least 10 cm/year. Environmental change due to a changing climate will almost certainly lead to a significant increase in these erosion rates. For cliff coasts, much existing protection is expected to be abandoned. Cliff-top communities will have to live with increased erosion risk, making it crucial to understand erosional processes, including how and when they might threaten cliff-top buildings and other infrastructure, to facilitate sustainable management of defences and other resources.

Traditional methods of subsurface monitoring are restricted in either time or space. Distributed Sensing is a new technology that utilises optical fibre. Our system includes a distributed acoustic sensor (DAS) to record high-frequency ground motion, distributed strain sensor (DSS) to record slower ground deformation, and distributed temperature sensor (DTS) to capture temperature profiles and variations. The interrogator sends a series of pulses into the fibre at up to 100 kHz and records the return of the naturally occurring scattered signal. In doing this, the distributed sensor measures at all points along the fibre, with samples as closely spaced as 25 cm. In summer of 2023, we deployed 2 km of fibre optic cable on the North Norfolk Coast to monitor coastal processes.

Using machine learning techniques, we are constructing a database of seismic signals observed. These include nano-earthquakes associated with subsurface cracking to create a real-time map to show regions that are more seismically active and therefore more likely to see movement; and signals associated with mass movement to create a local magnitude scale related to the volume of rock affected. We are also using ambient noise from the nearby crashing waves to monitor the geomechanical properties of the subsurface as they evolve using seismic tomography. Strain and temperature monitoring give real-time information about deformation within the cliff structure.

Minimising Drilling Risk for Geothermal Energy

Ziolkowski, A. M.[1]

[1] University of Edinburgh

Geothermal energy uses heat from the earth for heating and power. Temperature in the earth increases with depth by about 30°C/km. To bring the heat to the surface, we need water in a porous permeable rock. Oil at the target depth is worth about $70 per barrel, while water at the target depth is worth about $1 per barrel. The risk/reward ratio for geothermal drilling is much greater than for petroleum drilling. It follows that the geothermal industry has a much greater need to reduce drilling risk. Investment in a geothermal project cannot normally be found until exploration and delineation drilling have demonstrated that the project is likely to be viable. The geothermal drilling target is hot water at depth. Water fills the pore space in rocks. It is ionised and conducts electricity. It increases the electrical conductivity of the rock. To minimise the risk of drilling a dry hole, we need a geophysical surveying method that can detect an electrically-conducting reservoir in the depth range 2-6 km. The multichannel transient electromagnetic controlled-source EM (CSEM) method can find subsurface conductors. By deconvolving the received electric field for the broadband input current, it recovers the impulse response of the earth, consisting of a positive impulsive air wave that travels to the receiver at the speed of light, followed by a positive dispersive ground wave. At source-receiver offsets greater than twice the target depth, the air wave reflected from the conducting target arrives before the ground wave and is a negative peak.

Exploring Environmental Geophysics Through Student Projects: Challenges and Opportunities

Nielsen, S.[1]***, Jenkins, J.***[1]***, van Hunen, J.***[1]***, Bithell, S.***[1]

[1] Durham University

Undergraduate and graduate student projects are used as a vehicle to test the use of geophysics in real-world problems in environmental and agricultural settings. This leverages the time and energy already dedicated to field-based teaching.The approach suits field surveys aimed at either short summative and formative activities (year 2) or more structured dissertation projects (years 3 and 4).

Since 2022-23, our annual geophysics field course in the coastal region of Morecambe Bay has been reshaped to assign student groups specific exploratory targets in farmland. We discovered that several of our made-up targets aligned directly with concerns of the local farming community. By engaging stakeholders through local outreach (including literal door-knocking), new collaborations were established and a range of student-led investigations emerged. These include the characterization of cultural (archaeological) heritage sites, plant root-system health, water table depth, mapping of peat, clay or bedrock horizons and geological structures, waterlogging and canal breach detection as a source of field flooding. Our toolkit combines seismic refraction, low-frequency GPR, electrical resistivity tomography (ERT), vertical electrical sounding (VES), gravity, magnetometry and gradiometry.

This approach offers several benefits: student motivation and ownership, strengthened academic engagement, community partnerships, development of long-term datasets through repeat investigations, incentive for students to remain for graduate-level training and develop their project to a higher level.

At the same time, challenges remain. These include inconsistent data quality, incomplete metadata, the risk of student discouragement with inconclusive results and frustration with equipment failures. Substantial effort and time is required of staff to ensure to ensure high-quality data, student and equipment safety and well-planned logistics. Moreover, follow-up analysis and write-up for publication often fall to academic staff once students have moved on. In this case key or contextual information may be missing, which makes it difficult to build a complete high-standard report.

Useful Information

Talks will be held in the Lecture Theatre, on the right-hand side as you come into the building. RAS staff will be at the door to sign you in and direct you.

Coffee breaks and lunch will be offered. Please contact the organising committee if you have any special dietary requirements.

Getting to Burlington House

Burlington House is situated off London's Piccadilly, approximately half-way between Green Park and Piccadilly Circus underground stations. The RAS offices are the first door on the left after you have walked under the archway.

- **Tube:** Jubilee, Piccadilly, Victoria, Northern, Bakerloo
- **Bus:** lines 14, 159, 23, 38, 453