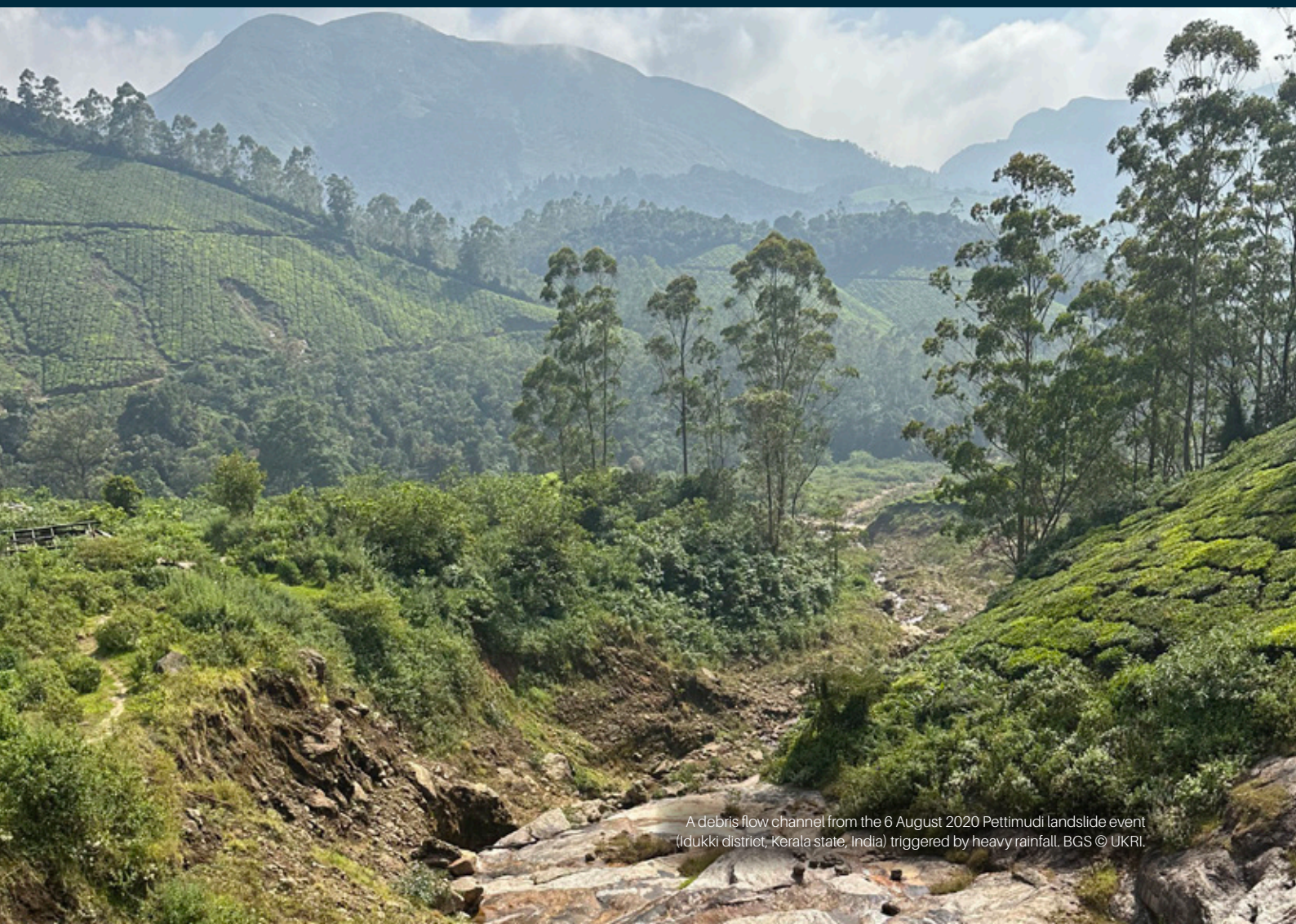
British Geological Survey

BRITISH GEOLOGICAL SURVEY

BGS International Geoscience Research and Development programme

Mid-term highlights 2024



A debris flow channel from the 6 August 2020 Pettimudi landslide event (Idukki district, Kerala state, India) triggered by heavy rainfall. BGS © UKRI.

Overview

The BGS International Geoscience Research and Development (IGRD) programme aims to increase community resilience to natural and anthropogenic hazards, and facilitate the sustainable use and secure supply of Earth's natural resources.

Working across three research and innovation challenges (RICs), the programme works internationally with partners to co-produce geoscientific research analysis to:

- improve the understanding, detection and forecasting of multi-hazard environments to support disaster risk management
- increase the understanding of how global demand for energy and mineral resources can be met with minimal impact on the environment and society, whilst addressing the transition to net zero
- provide solutions for sustainable land and water-resource management to help rural and urban communities adapt to climate change, land-use change and urban development

The IGRD programme is funded by NERC's National Capability International Initiative from 2022 to 2026.

The International Geoscience Research and Development programme aims to deliver strategic science through its international partnerships. The programme provides vital information and knowledge to address global environmental challenges.

IGRD has made great progress in its first two years through the forging of partnerships in academia, industry, and government, and with communities in locations around the world.

The highlights in this report provide a snapshot into the growing momentum of the programme and demonstrate the international impact of its outcomes.

DR MICHAEL WATTS, PROGRAMME LEADER, BRITISH GEOLOGICAL SURVEY.

IGRD at a glance

The programme has a global focus, with projects in more than 15 countries across sub-Saharan Africa, South and South-east Asia, and South America.

At the end of year two, the IGRD programme had produced:

- 36 academic publications
- six products or tools
- 14 non-academic outputs

Additionally, the programme:

- presented at 90 events, including an invited presentation at COP28
- participated in 126 engagement activities with external stakeholders
- ran a further 56 co-produced events with partners, including training and capacity-building activities

IGRD research has been cited in five policy or practice documents and 330 academic publications. Finally, in a partner survey, all 23 respondents reported a positive change in their capacity as a result of being involved in the IGRD programme. Our research is directly influencing stakeholder decisions, awareness or understanding, with many more developing pathways to influence.

Examples include:

- the first national-scale hydrological model of the Philippines, which was developed with the National Water Resources Board and used to assess the water resources of Boracay Island
- a new observation network for long-term groundwater monitoring, developed with the Zimbabwe Environment Management Authority
- a new committee involving both agricultural and lake-management sectors, for improved land management around Lake Victoria
- expert advice to various global networks:
  - » European Volcano Observatory Network
  - » International Civil Aviation Organisation
  - » UNESCO working group on urban subsidence
  - » Waterloo Foundation's Stop the Rot campaign


Alpacas in the Andes, Peru BGS © UKRI.

Research and innovation challenge one: living in multi-hazard environments

Novel detection and forecasting of hazards

The IGRD programme is analysing large-scale datasets using artificial intelligence (AI) to develop new approaches for the detection and forecasting of hazards.

Highlights

- Libraries of subsidence signals, generated using AI methods to process and analyse InSAR satellite data, are being extended from Hanoi, Bandung and Kuala Lumpur to identify subsidence hazards in expanding cities across the world. This will ultimately inform planning decisions and mitigation strategies in areas prone to urban subsidence
- Analysis of satellite imagery using AI is helping to identify areas where landslides are triggered by earthquakes. This approach was applied to produce rapid landslide inventories following the 2023 earthquakes in Morocco and Türkiye/Syria to facilitate disaster response
- Working as part of a global network to strengthen the capture, analysis and reporting of information on multiple hazards and impacts relating to seismic and volcanic events to help support disaster risk management

Understanding and managing multi-hazard interactions

In areas exposed to the combined impacts of hazards, including earthquakes, landslides and volcanic activity, IGRD is improving our understanding of how these hazards interact, to enable preparedness, effective response and recovery.

Highlights

- Developing multi-hazard case studies in the Philippines to inform the national hazard assessment (HazardHunter PH), which is used by planners, developers and other stakeholders to prepare for and mitigate the effects of multi-hazards
- Playing a key role in the provision of advice to Government on multi-hazards in the UK Overseas Territories. This stems from our research on volcanic and landslide hazards, which has provided improved understanding of the extent and severity of potential eruption scenarios, as well as landslide risk to people and infrastructure
- Working with local communities, humanitarian organisations and government partners in Malawi, BGS is exploring ways in which geoscience information can support disaster recovery in areas prone to multiple hazards

Geographical spotlight: Indonesia

- Improved understanding of volcanic and seismic hazards in Indonesia is enabling in-country partners to more effectively monitor hazards and communicate risk to local communities, increasing preparedness for future events

Bandung city in Indonesia. The Lembang fault crosses the northern parts of the city. BGS/UKRI.

Research and innovation challenge two: resources for the future

Sustainable mining and raw material supply

The IGRD programme is working across South America, sub-Saharan Africa and South-east Asia to develop improved understanding and exploitation of critical mineral resources, whilst also developing approaches to ensure responsible sourcing.

Highlights

- In Zambia, we are working with academic and government partners to support capability and identify new critical mineral resources, leading to further work under a UK/Zambia partnership. The programme is also developing approaches for assessing human-health risks associated with copper and cobalt mining in the country
- We are developing novel geophysical methods for monitoring slope stability of mine tailings in the Philippines, working towards an early warning system for tailings dam failure
- In The Gambia, where informal mining of construction sand is an increasing issue, good practice guidance is being developed with partners to improve resource management and policy for responsible sourcing of this raw material, which is essential for development

Energy resources for the transition to net zero

IGRD is helping to unlock the potential of the subsurface to facilitate the energy transition to net zero through geothermal energy and carbon capture, utilisation and storage.

Highlights

- Demonstration of the use of novel rock-physics modelling techniques to identify zones of high geothermal energy potential in the East African Rift System. Working with partners in Ethiopia, this information will provide greater confidence in potential geothermal yields, helping to de-risk investment in geothermal drilling and production
- Working with partners in India to establish a national research programme that will provide an evidence base to support the development of subsurface carbon dioxide storage in the country

Brine lake in Laguna Verde, south-west Bolivia. BGS © UKRI.

Geographical spotlight: South America

- Lithium, exploited from salar brines in Argentina, Bolivia and Chile, is a key battery raw material and therefore essential for decarbonisation. Research to improve our understanding of salar groundwater systems is helping to inform responsible extraction of this critical mineral

Research and innovation challenge three: sustainable land and water-resource management

Water and food security

The IGRD programme is producing evidence to help unlock the potential of groundwater resources, and sustainable land management practices. This will support improved water and food security in sub-Sarahan Africa and south-east Asia.

Highlights

- Developing hydrogeological maps across sub-Saharan Africa to support sustainable groundwater abstraction, particularly from low-yielding basement aquifers, and to inform the ongoing shift towards solar-powered pumping on the continent. IGRD also continues to influence global initiatives aimed at improving the functionality of water points in sub-Saharan Africa
- Helping to guide decisions on water-resource management and protection in the Indo-Gangetic basin and the Philippines through improved understanding of groundwater systems and groundwater quality
- Working with partners in Kenya and Malawi to improve understanding of soil geochemistry and soil erosion processes, which will inform appropriate agricultural and land-management intervention strategies that will improve soil life span and increase food productivity

Urban planning

Working in close partnership with the Coordinating Committee for Geoscience Programmes in East and South-east Asia (CCOP), the IGRD programme continues to promote the use of urban geoscience data, information and knowledge to optimise the use of the subsurface and minimise the exposure of population and infrastructure to geohazards in urban centres.

Highlights

- Building on extensive experience in the UK to develop a new programme of research in South-east Asia to understand and provide solutions to issues associated with legacy mining in urban areas, for example subsidence and water quality
- Providing multiple inputs to a new programme of urban geological investigation in Kuala Lumpur, including the exploration of microbial-induced calcite precipitation to reduce landslide risk
- Working with partners in Kenya to analyse soil and sediment contamination to understand how pollutants move through the urban environment. The National Environment Management Authority is using the results to improve urban sanitation and waste disposal

Geographical spotlight: Zimbabwe

- Novel eDNA methods are being applied in partnership with the environmental regulators in Zimbabwe to monitor and understand urban groundwater contamination. Identifying pollution sources will help the regulators protect shallow aquifers, which are extensively used by marginalised urban communities

BGS and University of Zimbabwe sampling public water supplies in Harare, Zimbabwe. BGS © UKRI.

Partners

BGS is working with more than 70 partners from research, governmental and non-governmental organisations. Partnership working is fundamental to the IGRD programme's ability to deliver outputs, outcomes and impact from our research.

National Institute of Hydrology and BGS continue to work in close collaboration on complex research problems including salinisation and groundwater depletion in India. We are finding success together by exploring, innovating and finding solutions through our common goal.

GOPAL KRISHAN, SCIENTIST-E HYDROLOGICAL INVESTIGATION DIVISION, NATIONAL INSTITUTE OF HYDROLOGY, ROORKEE, INDIA.

So much can be achieved with collaboration and a working international team breaks much more than just academic barriers. The larger body of knowledge would benefit through building collaborations globally, as this work has demonstrated.

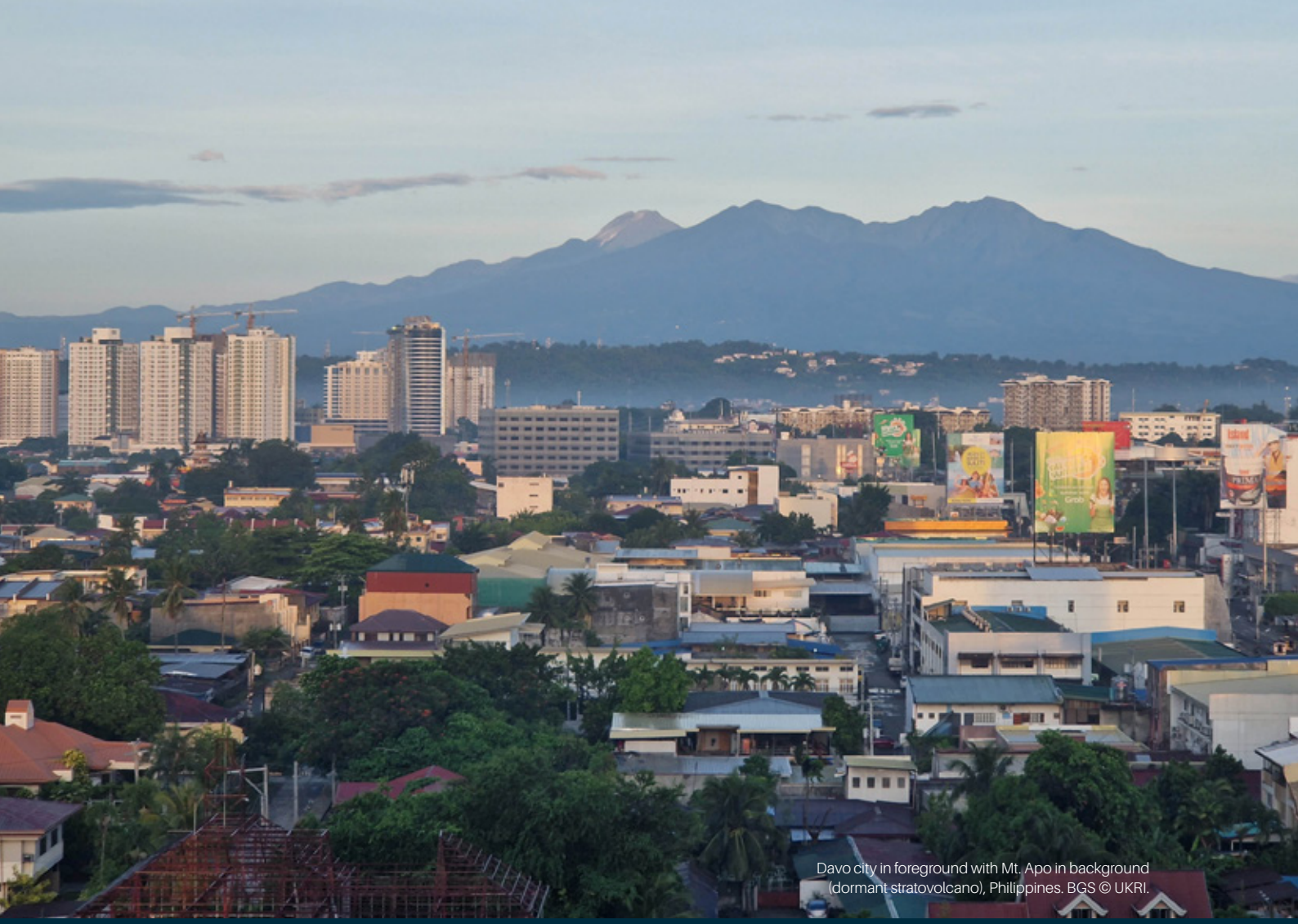
PROF ODIPO OSANO, UNIVERSITY OF ELDORET, KENYA.

Our collaboration with BGS has been transformative, yielding both scientific breakthroughs and tangible societal benefits. By combining our expertise, we've pushed the boundaries of geological understanding, particularly in seismic hazard assessment. This partnership has not only advanced our research capabilities but also translated into practical applications that enhance public safety and inform policy decisions. The impact extends beyond academia, influencing disaster preparedness strategies and infrastructure planning. It's a testament to how scientific collaboration can bridge the gap between cutting-edge research and real-world solutions, ultimately serving the greater good of our communities.

DR ENDRA GUNAWAN, INSTITUT TEKNOLOGI BANDUNG (ITB), INDONESIA.

The new partnership with BGS and Ateneo de Manila University is exciting to build translational research in support of this challenging issue and provide a linkage between academia, government and local stakeholders throughout the Philippines.

ROBERT MICHAEL DIFILIPPO, NATIONAL INSTITUTE OF GEOLOGICAL SCIENCES, UNIVERSITY OF THE PHILIPPINES.



Davo city in foreground with Mt. Apo in background (dormant stratovolcano), Philippines. BGS © UKRI.

Dr Michael Watts
Head of BGS Inorganic Geochemistry
Lead: IGRD programme
mwatts@bgs.ac.uk

Dr Susanne Sargeant
Disaster and development geoscientist
Lead: Living in multi-hazard environments
slsa@bgs.ac.uk

Clive Mitchell
Industrial minerals geologist
Lead: Resources for the future
cjmi@bgs.ac.uk

Andrew McKenzie
Groundwater information manager
Lead: Land-use change and adaptation
aam@bgs.ac.uk

Kirsty Upton
Hydrogeologist
IGRD monitoring, evaluation and learning
kirlto@bgs.ac.uk

For more information on the project, please scan the QR code.