Geohazards can be the cause of a lot of costly damage to property and, even in Britain, a threat to life. **Andy Gibson** and **Matthew Harrison** describe how vital information on geohazards is being made available, in plain English, to us all.

At the cutting edge

Although Britain is a relatively safe country, recently untroubled by large earthquakes or large-scale landslides, there is a growing perception that we are all under an increasing threat from geohazards. Other *Earthwise* articles have highlighted how we have carried out a National Geohazard Assessment (GeoSure) to determine the level of hazard across the country and provide that information to government, industry and consumers (see page 36). Here, we describe some of the research carried out to build, inform and update these models.

A geohazard is any geological event or feature that can pose a danger to life or property. The BGS Shallow Geohazards Team carries out research into the geohazards that affect Britain and ways that we can monitor and model them. We outline below a few aspects of our research into landslides (including coastal erosion), shrink–swell and dissolution of soluble rocks (karst).

Landslide research

Landslide research at the BGS has three important components — surveying, monitoring and databasing. Surveys are carried out to identify the extent and nature of landslides across the country. This is done using satellite imagery or aerial photographs, supported by field investigations. As well as locating and describing individual landslides, these surveys explore the relationship between geology, landscape and environment to define landslide 'systems'. Understanding these systems is a crucial step in understanding shallow earth processes, and how they might evolve in the future. This systems approach is taken further by detailed monitoring of landslides around the country. Most of these slides are at the coast, where erosion causes landforms to evolve rapidly and we can measure processes that would otherwise take place over decades or centuries. Combining information gathered from a range of techniques including global positioning systems (GPS), geotechnical testing, and the pioneering use of terrestrial laser scanning helps scientists to build a detailed understanding of landsliding and coastal erosion and how these might be affected by climate change.

Central to this research is the BGS National Landslide Information Centre. In addition to the information described above, the centre collates landslide information from BGS teams involved in new surveys, together with media reports, academic research, site investigations and reports from members of the public. The information is stored in the BGS's National Landslide Database. At the moment, the database contains 14 000 records and grows by 1000 records every year. The landslides team is currently updating information, such as name, location, style, activity, and damage for each record. At the moment, the database

The impact of coastal erosion at Aldbrough, North Yorkshire in 2006. The site is one of fourteen long-term sites regularly monitored and modelled by the Shallow Geohazards Team.

is mainly used to carry out validation of other BGS datasets and support information for academic research. When, in the near future, the process of data validation is completed, the database will be more widely available to those who need detailed information about landslides.

Karst research

Dissolution of soluble ground (often called karst) affects those parts of Britain underlain by chalk, limestone, gypsum or salt. The hazard arises because these rocks dissolve when in contact with water. Dissolution may happen very quickly in the case of salt or gypsum, or over thousands of years in some types of chalk. The holes formed by this process may be tens of metres across. In a similar fashion to landslides, karst research involves surveying, monitoring and databasing. The karst team identify affected areas using a combination of aerial photographs, reports and old maps. Where necessary, this is supported by a field investigation. All of the information is stored in the BGS's National Karst Database, from where it is accessed and used to create hazard maps.

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Ground-shrinkage research

Shrink-swell is perhaps the geohazard that causes the most widespread damage in Britain, often contributing to subsidence damage that affects many houses built on clay strata. However, the movements that cause this damage may be very small; damage is often caused by the accumulation of movements over months or years. So research into this hazard cannot be carried out using the methods described above. Instead, we have identified those rock-types most prone to shrink–swell behaviour and are systematically sampling, testing and modelling their mechanical properties. Using information in the BGS's National Geotechnical Properties Database, the shrinkage behaviour of each rock-type can be modelled across the country to provide a hazard map. Ongoing research is continuing to refine these models and to improve our understanding of how clay soils will shrink and swell under different climate change scenarios.

Using a high-resolution laser scanner to measure landslide activity — the scanner helps to measure very small changes in the cliff surface which is vital in order to understand how the coast reacts to different climate patterns.

Public access to BGS geohazard research

Since 2005 over a million people have accessed the results of this research by purchasing some form of ground condition report — usually when buying a new house or building an extension. Although many consumers do not realise it, they are actually accessing the latest BGS research.

Using a geographical information system (GIS), the distribution and degree of shallow geohazards has been modelled across the whole country. The research described above is used to identify the factors which cause shallow geohazards. The Information Products team then combine this information with the BGS digital map (DiGMapGB) to give the whole country a GeoSure rating for six different shallow geohazards — slope instability, shrink–swell, dissolution of soluble ground, compressible ground, collapsible ground, and running sands. The model is then fine-tuned using the local knowledge gained through a BGS network of regional geologists and by the experience of the research teams involved in the classification of geological units and model methodology.

When someone buys a BGS-supported ground stability or environmental report, an automated system generates a list of the hazards that might affect the chosen location. Where there is a significant potential for one or more hazards, this is highlighted and the nature of the hazard is described in plain English. Where there is thought to be a very significant hazard, the customer is given advice on finding further help. The high usage of these reports demonstrates that the shallow geohazards research we do is vital. Feedback from many of the customers is also used to refine the outputs. Along with reaction to our academic publications, this feedback is a powerful driver for focusing further research to be able to quickly respond to national needs.

For more information, contact:

Andrew Gibson, BGS Keyworth
Tel: +44(0)115 936 3007
e-mail: agibson@bgs.ac.uk