



Geophysics research and education in the UK: Comments for the Wakeham Review of UK Physics Research

Geophysics research and education in the UK

Geophysics is simply the study of the physics of the Earth, but it is inherently multidisciplinary in nature and straddles subjects as diverse as geology, seismology, meteorology, planetary sciences, oceanography and geodesy. Geophysicists go on to a broad range of careers in subjects of economic and societal importance, including those in natural resource exploration, satellite based Earth observation, natural hazard mitigation, archaeological studies, conservation and climate studies, and military applications. Most geophysicists will have studied pure physics at some stage of their education.

The state of ‘Geophysics education in the UK’ was recently (2006) reviewed in a report prepared by Professor Aftab Khan and commissioned by the British Geophysics Association (BGA), a joint association of the Royal Astronomical Society (RAS) and the Geological Society of London (GSL). Much of this submission highlights issues raised in this document (which is also attached).

There is currently an unprecedented demand for geophysicists, which is especially acute in the oil and mineral industries. The BGA review highlights the growing demand for well-trained geophysicists. Despite this need the number of undergraduate students studying geophysics at UK universities is declining. Many world-class degree programmes at leading universities have recently closed due to small class sizes (e.g., the MSc in exploration geophysics at the University of Durham). Part of the problem is a general unawareness of what geophysics is and how one embarks on a career in this field. Another problem is that many science students entering university are ill prepared to study geophysics, often lacking A-level physics and mathematics.

Although the term ‘geophysics’ is not widely understood by the general public, there is a keen awareness and interest in topics such as earthquakes, volcanoes and natural resources. Such subjects engage young minds, but there is a general misconception that

the best preparation for studying such topics lies in geology or even geography courses at the high school level, when in fact physics and mathematics are the most appropriate preparatory courses. Once at university, geophysicists go on to develop a broad range of strengths in subjects including pure physics, mathematics, numerical methods, computing and geology. Consequently, there is a rich supply of career options open to graduate geophysicists.

Geophysics research within the UK has traditionally taken a high-profile position on the world stage. Some 40 years ago UK scientists played a leading role in pioneering research in seismology, geomagnetism and numerical modelling that led to the acceptance of plate tectonics. Most leading UK universities have strong research groups in geophysics, which can be found in Earth Sciences, Geology, Physics, Geography and even Mathematics departments. Most of the researchers in these groups will have studied pure physics at some point in their education. For example, a common route to a PhD in geophysics is through an undergraduate degree in physics. Furthermore, many researchers with PhDs in pure physics go on to research careers in geophysics, both in academia and industry. Shell, for example, employs many researchers with doctoral degrees in physics. Unfortunately, physics students are often unaware of geophysics. They do not realise that a physics degree provides ideal preparation for research and a career in geophysics, and that there is chronic demand for students with such training.

Most university research in geophysics is funded through NERC. Geophysics in the UK has a strong international profile and geophysicists generally do well in ‘blue-skies’ funding streams. This is underscored by the fact that most recent Earth science publications in prestigious journals like Nature or Science involve more numerical aspects of Earth Sciences, rather than traditional geology. However, there is virtually no mention of geophysics in the NERC mission statement or within any of the NERC thematic programmes. This is even more paradoxical when one considers that geophysics plays a pivotal role in research into natural hazards (e.g., earthquakes), natural resources (e.g., oil exploration) and waste management (e.g., monitoring the storage of nuclear waste or CO₂ sequestration), all important economic and societal issues identified by the government and funding councils. Part of the problem is that there is little lobbying for geophysics from organisations such as the RAS and the Institute of Physics (IOP), as they are normally dealing with other funding councils within RCUK. Indeed reaction to the recent STFC funding debacle has shown how the RAS and IOP can lobby funding councils. Geophysics has lacked a cohesive voice and representation within NERC from the RAS, IOP and the GSL.

In summary, I would like to make the following recommendations:

- Geophysics should have a higher profile in organisations like the Institute of Physics (IOP) and the Royal Astronomical Society (RAS). There needs to be an enhanced awareness of how important physics is in the training of geophysicists and that geophysics can provide a viable and stimulating career in both pure and applied areas. These organisations also need to better highlight the importance of physics within the remit of the Natural Environment Research Council (NERC).

- There needs to be more funding put into basic labs and equipment for geophysics education and research. Large-scale investments in universities tend to concentrate on buildings and large-scale facilities and it has been very difficult to obtain funds for smaller items of equipment, both for research and teaching purposes. Few departments have modern portable seismographs, gravity meters, magnetometers, resistivity equipment and ground penetrating radar, despite such equipment only costing between £5k and £50k. In some ways it is easier to get a new building than a new magnetometer. UK universities need an investment in geophysics equipment so that a new generation of undergraduates can be enthused and trained.
- There is limited funding for training postgraduate researchers in geophysics. Industry is increasingly funding studentships, but there is a need for funding for pure research, which is not straightforward to achieve within the NERC strategy. Furthermore, postgraduate training at the MSc level is not financially viable for most departments due to the high investment in staff time required, despite the demand for graduates from such programmes. UK funding councils need to re-evaluate how such degree programmes are funded, perhaps in consultation with industry.
- Finally, there needs to be more emphasis on geophysics in the high school and undergraduate physics curriculum. Students would benefit from the knowledge that a strong background in physics can lead to a rewarding career in geophysics and that there is an industry need for such scientists.