INESON LECTURE 2009

Thursday 15 October 2009
The Geological Society, Burlington House, Piccadilly, London

A Joint Meeting of the International Association of Hydrogeologists
& the Hydrogeological Group of the Geological Society

PROGRAMME

12.45 Registration and coffee

13.30 Welcome
Willy Burgess, Chair - Hydrogeological Group, Geological Society

Introduction
Jane Dottridge, Chair – International Association of Hydrogeologists, British Chapter

13.45 Hot moments and hot spots of reactive transport and transformation at the aquifer-river interfaces of UK lowland and upland rivers
Stefan Krause, Earth Science and Geography Department, Keele University

Hyporheic zones as the direct interface between aquifers and rivers represent areas of spatially and temporally variable groundwater and surface water mixing. Due to the different chemical composition of groundwater and surface water mixing within the streambed sediments, hyporheic zones are often characterised by steep redox gradients with a high potential for attenuation or enrichment of nutrients and pollutants. This presentation is discussing results of investigations of the hyporheic nutrient attenuation potential of several UK lowland rivers in dependency of hyporheic flow paths, redox conditions and residence times.
Based on experimental and modelling studies from plot to reach scales, a hypothesis for the explanation and prediction of hyporheic attenuation and enrichment hotspots and hot moments is proposed and discussed. Furthermore an outlook is provided on potential up-scaling strategies, based on the combination of novel distributed sensor networks and coupled hydro-geological numerical models, to transfer process knowledge and understanding from a local to a regional, more management relevant scale.

14:05 Asymmetric Abstractions: The Palestinian-Israeli Water Pumping Record
Mark Zeitoun
School of International Development, University of East Anglia

The increased attention given to international transboundary aquifers may be nowhere more pressing than on the western bank of the Jordan River. Hydropolitical analysis of six decades of Israeli and Palestinian pumping records reveals how ground water abstraction rates are as asymmetrical as are water allocations. The particular hydrogeology of the region, notably the variability in depth to ground water, variations in ground water quality, and the vulnerability of the aquifer, also affect the outcome. The records confirm previously drawn conclusions about the influence of the agricultural lobby, and indicate an apparent co-evolution of water resource variability and politics

leading to increased Israeli pumping prior to negotiations in the early 1990s. The effective limit of the Western Aquifer Basin set by the terms of the 1995 Oslo II Agreement is found to be regularly violated, thereby putting the aquifer at risk. The picture that emerges is one of a transboundary water regime that is much more exploitative than cooperative and that risks spoiling the resource as it poisons international relations.

14.25 The impacts of abstraction and climate change on groundwater resources in Asian Mega-Deltas: evidence from the Bengal Basin

Mohammad Shamsudduha
UCL

Groundwater levels in shallow aquifers underlying Asian mega-deltas are characterised by strong seasonal variations associated with monsoon rainfall. For the Ganges-Brahmaputra-Meghna (GBM) Delta of Bangladesh, seasonal variability and long-term trends over the period of 1985 to 2005 are resolved in a newly compiled dataset of weekly groundwater levels using a nonparametric seasonal-trend decomposition (STL) technique. Seasonality dominates observed variance in groundwater levels but declining groundwater levels (>1 m/yr) are detected in: (1) urban and peri-urban areas around Dhaka in association with abstraction for municipal water demand; and (2) north-central, northwestern, and southwestern parts of the country (0.1 to 0.5 m/yr) where intensive abstraction of groundwater is conducted for dry-season rice cultivation. Rising groundwater levels (0.5 to 2.5 cm/yr) are observed in the estuarine and southern coastal regions. These analyses reveal, for the first time, the unsustainability of irrigation supplied by shallow aquifers in some areas of the GBM Delta and the hydrological impact of seawater intrusion in coastal aquifers associated with sea-level rise.
Current research is focused on the impacts of climate change which may amplify observed seasonality and trends in groundwater levels through an increase in rainfall intensities, sea-level rise, and groundwater abstraction to meet agricultural and municipal water demands.

14:45 Geothermal Energy - Recent developments, future opportunities

Ryan Law (Geothermal Engineering)

Geothermal energy is becoming a hot topic worldwide; whether it is for heating homes, cooling offices or electricity generation. Is this resurgence justified? Do we understand the resource and are we using it correctly? The United Kingdom has been slow to pick up on the geothermal trend but momentum is growing. Shallow geothermal systems are increasingly proposed for new buildings and deeper resources are being re-evaluated for large district heating projects and electricity generation. The role of a hydrogeologist in the design of geothermal systems is increasingly important, particularly for systems situated in fractured rock formations.
Deep geothermal electricity generation is an emerging technology that pushes the boundaries of geology, hydrogeology and rock mechanics. Such a project is planned for 2010 and will help to put the UK back at the forefront of geothermal research.

15:05 Hydrogeological research for carbon capture and storage

Dr Simon A. Mathias
Department of Earth Sciences, Durham University

There is an increasing desire to reduce anthropogenic greenhouse gas emissions worldwide. One way of doing this is to implement carbon capture and storage (CCS), an important emerging technology. This involves capturing CO2 at the point of generation, compressing it to a supercritical fluid, and injecting it into a suitable permeable geological

formation. Target formations include depleted oil and gas reservoirs, saline aquifers and deep-sea sediments. At a superficial level this can be viewed as simply reversing the petroleum extraction process. However, as with the geological disposal of radioactive waste, we need to understand how the subsurface will react to pressurisation with an acidic aggressive fluid both during the period of injection and for hundreds or possibly thousands of years thereafter. A vital aspect of CCS is the development of appropriate performance assessment tools which will allow quantification of trap integrity and longevity. To date much of the technical basis supporting our understanding of CCS is based on hydrogeology. Here I will examine several recent developments in hydrogeological science associated with CCS and identify some of the important challenges that must be addressed if mankind is to ameliorate some of the effects caused by burning ever increasing quantities of fossil fuels.

15.30 Tea

16.00 Ineson lecture 2009

Hydrogeological science over the past thirty five years - Where will the next ten years lead?

Denis Peach
British Geological Survey

The science of modern hydrogeology has developed under the influence of resources and water quality drivers, often enshrined in legislation, since the 1960's, but do we the hydrogeologists really understand our aquifers well enough to make adequate predictions of the impacts of climate and other environmental changes on the groundwater system. Are our models fit for purpose? Should groundwater specialists be working in other disciplines to make sure the hydrological cycle is properly imbedded in environmental science research, planning and policy? In short what lies ahead for hydrogeologists and research and practice in groundwater science in the next decade. I take a stroll through my career in groundwater spanning over 35 years examining the science in UK and internationally and mapping the course it has taken and make some forecasts of where hydrogeologists may need to focus in the next ten years.

17.00 Discussion

17.30 Drinks reception (in the Lower Library)