



Monitoring and prediction

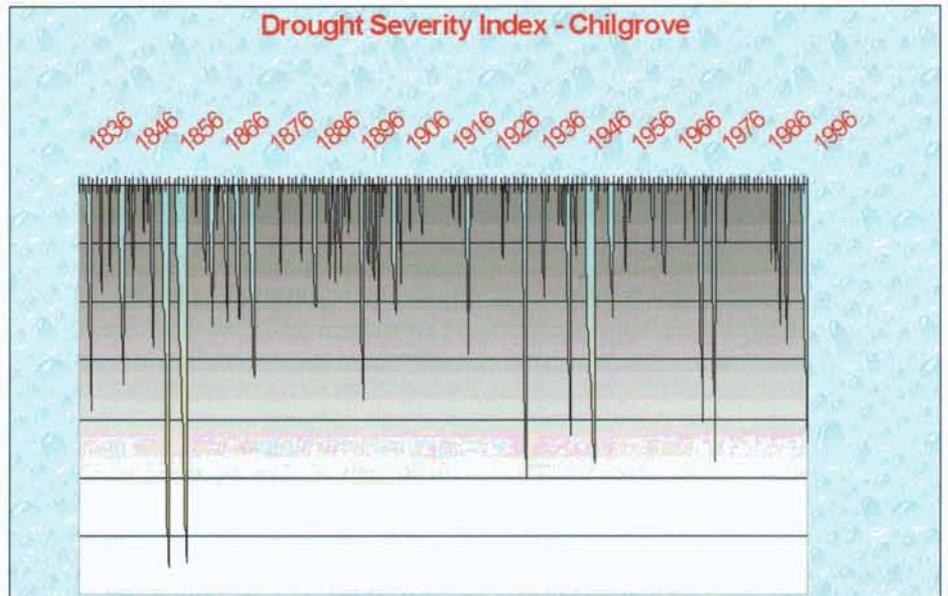
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All too often, it seems, parts of Britain are gripped by drought, with an accompanying barrage of publicity, images of dried up rivers and exhortations to save water. If we look beyond the dramatic headlines there are several interesting scientific questions to be answered, with implications for everyone. Are droughts becoming more frequent, and if so why? What effect does drought have on water resources and the environment? How can we manage the impacts of drought?

The BGS plays a key role in answering these questions through its work on the monitoring of groundwater levels. Thousands of boreholes and wells are monitored by the regulators, the Environment Agency, Scottish Environmental Protection Agency and the Department of the Environment (Northern Ireland). The BGS uses the measurements for a small set of wells chosen to be representative of the most important aquifers for public supply. These wells are mostly located in parts of the aquifer where natural responses to rainfall are the main influence on water level, where there is not much pumping.

UK drought



Drought severity index at Chilgrove, Sussex, where monitoring has gone on since 1835. The index is derived by comparing measured groundwater levels with average levels.

The measurements are used to produce monthly hydrological summaries, bringing together our data with information on rainfall from the Meteorological Office and on river flows from the Institute of Hydrology. The summaries give planners and the public an up to date picture of water resources availability. By comparing actual conditions with the behaviour of aquifers in previous droughts we can go some way to predicting future conditions.

“... the current 1997 drought is one of the most severe on record...”

The earliest regular groundwater level measurements in the world were started in the Chilgrove well in Sussex in 1835. We can use the measurements to examine drought frequency over 160 years. Comparing measured levels to average levels generates a groundwater drought severity index. The index is a measure of how severe a drought is and how long it has lasted. The picture that emerges is complex. It shows that in this aquifer the current 1997 drought is one of the most severe on record, but it also shows that severe droughts are not uncommon, and droughts in the 1840's and 1850's were much worse than

anything experienced in this century. More research will be needed before we fully understand the patterns of drought in the UK, and before we understand the role that global warming may play.

In the Chalk downlands of Southern Britain water levels can vary by tens of metres between summer and winter. These large variations lead to large changes in the amount of water that flows into streams on the chalk. When groundwater levels fall the upper reaches of the streams dry up. As levels rise again in winter these sections flow again. Streams that show this behaviour are called bournes. The annual drying out of river beds in these streams is quite natural, but in a drought, with low groundwater levels, sections of the stream that are normally wet may dry up. Man may influence these processes through pumping of groundwater for supply, which can lead to a lowering of the water table, or through changing land use, which can reduce the amount of rainfall that reaches the aquifer.

The challenge for the hydrogeologist is to use the abundant water available in our aquifers without adverse effects on the environment. By managing groundwater and surface water together as a single system, there is great scope for reducing the effect of drought in the future.