# SPECIAL ISSUES IN GROUNDWATER

**Luis Silveira**
*Department of Fluid Mechanics and Environmental Engineering, Faculty of Engineering, Montevideo, Uruguay***.**

**Keywords:** climate change, urban hydrogeology, scales dependent, in situ techniques.

**Contents**



## 1. Introduction

Water is an essential element for life in all his forms. Sustainable social and economic human development depends on the availability of clean freshwater. Nevertheless, the world shows an increasing trend of pressure on the use of freshwater resources for human consumption, agricultural irrigation and industries. The consequence in many regions of the world is that water is rapidly becoming a scarce resource. However, water is still used wastefully in many regions of the world. To avoid a global water crisis, more efficient ways of dealing with water quality and management are required. Public awareness, better understanding and sound research are therefore required for achieving an adequate supply of water as well as to preserve this treasure for the next generations.

Hence, this final section of the theme Groundwater includes a series of articles concerning special and innovative subjects that cannot be grouped into a classic "topic level" as developed in the previous sections. For this reason, as Honorary Theme Editor, I found suitable to include a section on "special issues in groundwater". Nevertheless, I feel the need to clarify that this section does not try to be exhaustive, but only illustrative, exemplifying some of the topics that have worried groundwater scientists during the last three decades of the twentieth century and the first years of the twenty-first century. I extend, therefore, my excuses to all those researchers who may feel forgotten by the partiality of this selection.

The five articles included in this section are sufficiently descriptive of the approached subject. Thus, I feel that this section does not require the development of a global "topic level" as in previous sections. Therefore, the reader should only find below, a shallow justification of the selected subjects and a brief presentation of each of them.

## 2. Brief presentation of selected issues

### 2.1. Climate change and hydrogeology

Climate change or global warming has been the subject of worldwide research since the last decades of the twentieth century. Studies focus on present, future, and past climates as well as on the links between different ecosystems and climate, and assessment of the impacts of climate-change scenarios and/or climate variability on water, food, and energy resources. Particularly, the hydrologist must resolve climate change in terms of precipitation, evapotranspiration, infiltration and recharge, and runoff changes at the relevant spatial scales, as well as water quality. Principal climate change impacts related to groundwater are those potential impacts of climate change that may significantly affect communities and the environment due to their effects on the quality and quantity of regional groundwater resources. Thus, the contribution of H. A. Loaiciga discusses the effects of climate change on regional groundwater processes, taking into account that the inability to resolve accurately the consequences of climate change on hydrologic fluxes constitutes the main source of uncertainty in any study of climate-change/hydrologic interactions. The focus is on regional aquifer systems, and on the methods to link large-scale climate-change processes to groundwater recharge and to simulate groundwater flow and solute transport in a warmer climate. Uncertainties associated with climate-change scenarios are discussed. The author provides a critical analysis of the state-of-the-art in the analysis of climate change and its hydrologic consequences, and highlights the associated limitations. Finally, an example about the Edwards aquifer system in Texas, USA, illustrates a specific procedure and the existing capabilities to assess the potential impacts of a warming climate on regional-scale aquifer systems.

### 2.2. Urban hydrogeology

The increase in overall population and the demographic flow from rural environments to urban centers during the twentieth century resulted in high percentage of world population living in cities (e.g. 60 cities over 5 million and a few of them in the range 15 to 20 million inhabitant, and 3500 million inhabitant occupying less than 1% of the Earth surface). The critical issue of supplying water to these large metropolitan areas, the exploitation of urban groundwater and sound management of global water resources are the focus of the contribution of X. Sanchez-Vila. Groundwater is often neglected, either due to cultural or technical reasons. Nevertheless, groundwater has a number of characteristics that make it an alternative source favorable to exploitation for particular uses in cities, reducing the amount of water diverted from locations quite far away. Therefore, his article analyses the particularities of hydrogeology in urban areas, including environmental, social and economic aspects. The effects of urbanization on availability and quality of groundwater resources are summarized as well as the importance of temporal and spatial scales compared with hydrogeological studies in rural environments. Urban hydrogeology is revealing itself as an emerging field requiring research to examine the water supply systems of large cities in order to improve understanding of the issues at stake and to develop fresh strategies, policies and tools for sustainable management of water resources in urban centers.

-
-
-



**Bibliography**

Consult the respective articles of this topic.

**Biographical Sketch**

**Luis Silveira** was born in Montevideo, Uruguay in April 1949. He started to study engineering in his native country, but in early 1974 he fled from the military regime and arrived in Sweden, where he obtained the status of political refugee. After learning Swedish, he resumed his studies. He became a Swedish citizen in 1978. The following year, he obtained an M.Sc. degree in Hydraulics and Environmental Engineering, at the Royal Institute of Technology, in Stockholm, Sweden. After his graduation, he worked on groundwater in a Swedish consulting and constructing firm. In 1980, he took a six-month international postgraduate course in Barcelona, Spain, for deepening his knowledge of groundwater hydrology. Back in Stockholm, he continued working on groundwater projects in Scandinavia as well as at an international level.

With the return of democracy, he moved back to Uruguay in 1988. There he joined the Hydrology Group at the IMFIA (Department of Fluid Mechanics and Environmental Engineering), Faculty of Engineering, University of the Uruguay Republic. Since then he has lectured in Surface Hydrology and Groundwater Hydrology and worked with several applied research projects concerning both surface hydrology and groundwater. During this activity he established a cooperation programme with the Royal Institute of Technology to strengthen the human resources from IMFIA. Then, he continued his postgraduate studies and finally in 1998 he defended his Ph.D. thesis on “Hydrological Modelling of Natural Grasslands with Small Slopes in Temperate Zones”, at the Royal Institute of Technology, in Stockholm, Sweden. Today, he is Titular Professor and head of the Hydrology Group. His main academic and professional interests are chemical-biological techniques for “in situ” groundwater treatment, hydrological modelling of both surface water and groundwater, hydrology of flatlands, forest and urban hydrology, hydrological applications of multivariate analysis and integrated water resources management.

He likes to listen to classical music, jazz and instrumental tango music while he performs his research work. In his free time he likes to read fiction books, watches movies (especially European ones), and enjoys life with his child Sebastian and his wife Patricia.