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Groundwater flow and saltwater intrusion model as a management tool for Llobregat aquifers, Barcelona, Spain.

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Water Framework Directive (WFD) 2000/60/EC of the European Parliament establishes the basis for Community action in the field of water policy. Water authorities in Catalonia (Agència Catalana de l'Aigua) are designing a management program to improve groundwater state and to assess the impact of infrastructures and city-planning activities on the aquifers and their associated natural systems. The objective is to describe the role of groundwater modelling in addressing the issues raised by the WFD, and its application on the Llobregat Delta.

A result of intensive pumping of freshwater during the second half of the XX^{th} century was the salinization of an important part of the Llobregat Delta aquifers. Salinization was aggravated and accelerated by the excavation of an inner dock of the Barcelona harbour that caused a further inland progression of seawater intrusion. Because of this pumping ha to be reduced drastically. In addition, new urban development and infrastructures are planned. These actions will affect the shallow and main aquifers of the Delta. Specifically the model was used to:

1. Characterization of aquifers and the state of groundwater by integration of existing knowledge and new hydrogeological information. Inverse modelling allowed us to reach an accurate description of the paths and mechanisms for the evolution of seawater intrusion.

2. Quantification of groundwater budged (mass balance). This is especially relevant for those terms that are difficult to asses, such as recharge from river infiltration during floods, which we have found to be the most important term.

3. Evaluation of groundwater related environmental needs in aquatic ecosystems. The model allows quantifying groundwater input under natural conditions, which can be used as a reference level for stressed conditions.

4. Evaluation of possible impacts of territory planning (Llobregat river course modification, new railway tunnels, airport and docks enlargement, etc.).

5. Definition of management areas.

6. The assessment of possible future scenarios combined with optimization processes to quantify sustainable pumping rates and design measures to control seawater intrusion.

The resulting model has been coupled to a user friendly interface to allow water managers to design and address corrective measures in an agile and effective way.