

**PERMEABILITY REDUCTION TO PREVENT SALT WATER INTRUSION
IN A GROUNDWATER SYSTEM AT THE BASILICATA REGION, SOUTH
ITALY**

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ABSTRACT

The EU-project CRYSTECHSALIN (fifth framework programme) stands for *Crystallisation technologies for prevention of salt water intrusion*. The project is focused on the development of a new cost efficient and environmental-friendly technology to reduce the permeability of soil formations that are threatened by the intrusion of saline groundwater. An artificially induced in-situ crystallisation of slightly soluble minerals from oversaturated solutions will be used to create barriers within the formations and thus to protect the fresh water aquifers from salt water intrusion. Laboratory, numerical as well as practical in-situ experiments are being executed in this EC-project to describe the relevant phenomenae at different spatial scales. In this presentation, only work package five is discussed in detail, which is focused on the numerical creation of a hydrogeological and hydrogeochemical numerical model. The specific field test site of the working package under consideration is located in the coastal plain of the Italian region of Basilicata, South Italy, nearby the city of Scanzano. A regional density dependent groundwater flow model is developed to investigate the effects of permeability reductions. The computer code MOC3D (Oude Essink, 1998, 2001) is used for that purpose. This code is a version of MOC3D that has been adapted to simulate transient density-driven groundwater flow. It appears that a physical barrier will only be effective from a hydraulic point of view when the permeability reduction is relative high. Scenarios of injection/extraction well schemes are tested numerically to determine the possibility of in-situ mixing of solutions. A local model will be constructed to consider the relevant hydrogeological and geochemical processes in the subsoil: viz. precipitation and dissolution of solutes that is under influence of an inhibitor, which eventually will lead to the formation of slightly soluble minerals. For this purpose, reactive flow and solute transport are coupled with groundwater flow, as also changes in porosity and permeability are considered.

References

- Oude Essink, G.H.P., MOC3D adapted to simulate 3D density-dependent groundwater flow, In: *Proc. of the MODFLOW'98 Conference, October 4-8, 1998, Golden, Colorado, USA, Volume I, pp. 291-303, 1998.*
- Oude Essink, G.H.P., Salt Water Intrusion in a three-dimensional groundwater system in The Netherlands: a numerical study, *Transport in Porous Media*, **43** (1): 137-158, April 2001.

Keywords:

CRYSTECHSALIN, crystallisation process, prevention of salt water intrusion, reduction of hydraulic conductivity, 3D numerical modeling, variable-density groundwater flow, Italian test-site, Basilicata region

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