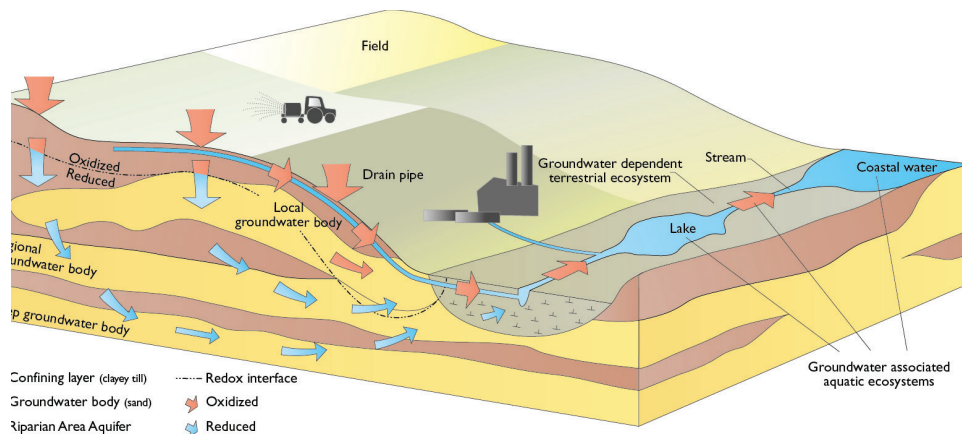


MODELS AS DECISION SUPPORT AND MANAGEMENT TOOLS



Summary

Physically distributed and coupled groundwater-surface water modelling on local and regional scales is a strong tool for decision making and climate change impact assessments on a multi-disciplinary background. Scenario building tools such as conceptual models (see figure above) and coupled groundwater-surface water- and salt water intrusion models are necessary complementary tools for integrated water resources management and climate change impact assessments. This includes assessments of groundwater quantitative and chemical status and threshold values according to the Water Framework and Groundwater directives. Further scenario building tools can be useful for identifying adaptation measures and institutional barriers, and for assessment and timing of adaptation measures including their implementation uncertainty, robustness and tradeoffs.

Models applied on e.g. the Wadden islands, are used to forecast hydrological conditions, sea water intrusion and the ability to extract fresh groundwater for water supply in a future climate. Furthermore, they were used to assess groundwater threshold values and chemical status, and possible nutrient management options based on the ecological status of associated surface and coastal waters. In this way, cost-efficient measures can be planned and sustainable ecosystem services can be safeguarded.

What enabled implementation?

- » Model building on a hierarchy of scales depending on the purpose of the model. Local scale issues calls for more detailed local scale models.
- » Reliable parameters based on documented measurement techniques are vital data for the models.
- » Cooperation between institutions and countries made it possible to transfer best practice between countries and combine results from a large range of different methods in the pilot studies.

What were the barriers to model implementation?

Easy access to accurate and high quality data collected in model areas are cornerstones of the quality and reliability of any model. Examples of on-line data sharing and visualisation from all CLIWAT pilot areas can be found in the lower part of the first page of the CLIWAT website through the link "online Geomodels". Data for models can have more than one purpose and can here be evaluated by stakeholders and visualised interactively. The sharing must be done through a common database. Such data sharing and visualisation possibilities is not yet generally available in Europe and transferability is therefore not as smooth as possible. In addition the formats of data are not completely compatible. Online data sharing and visualisation of geological, geophysical and geochemical data like demonstrated on the CLIWAT website should be continuously developed and improved.

Modeling the impacts of projected climate change on groundwater and dependent terrestrial and aquatic ecosystems can be done in 3D numerical models illustrated by the conceptual model above . Read more about the application of conceptual and numerical models e.g. for assessment of seawater intrusion at higher sea levels, flooding and climate change impacts on groundwater and aquatic ecosystems etc. in the CLIWAT Handbook, the CLIWAT special issue of Hydrology and Earth System Sciences (http://www.hydrol-earth-syst-sci.net/special_issue149.html) and in the CLIWAT newsletter #5 of June 2011.

How to overcome the barriers?

- » Sampling of the right data and efficient data exchange and visualisation is important.
- » A common database and data platform would increase the possibility and efficiency of data transfer.
- » Improving the conditions for working together across regions in Europe e.g. on transnational case studies will stimulate the transfer of knowledge and concrete collaboration across borders.
- » Clustering as a means of transferring methods between disciplines has been proven to be a good tool. Facilitations and workshops are good but rather costly. An increase in the use of virtual meetings would bring down the time spent on travelling and increase the potential for meetings.
- » Increase in open-mindedness and education within institutions, to promote the uptake of new methods.
- » Building administrative and political decisions on a sound scientific basis gathered in models should be supported by the political decision makers across Europe.
- » By modelling it is possible to include uncertainty, scale issues, sensitivity and thresholds in the decision making.

More Information

» **Rolf Johnsen**
Senior Consultant
Central Region Denmark
rolf.johnsen@ru.rm.dk

» **Klaus Hinsby**
Senior Scientist
GEUS
khi@geus.dk

» www.cliwat.eu

European Union  The European Regional Development Fund

**The Interreg IVB
North Sea Region
Programme**

*Investing in the future by working together
for a sustainable and competitive region*

