potato production halved from 1999 to 2010 due to the shutdown of the Pfanni factory in Munich and general socio-economic changes. Second, a reduction of livestock (cattle) of about 30% and a parallel reduction of grasslands was observed in the early 1990's. This change could be related to unprofitable milk prices and generation changes (younger people seek for more profitable and new job opportunities).

Best Management Practices

During our investigations in the pilot area Neufahrn and in close contact with relevant stakeholders, we identified that two major points are most relevant to ensure a safe handling of water resources in the future: *communication* and *cooperation*. Both keywords include that people have to be engaged in decision making contexts and relevant data has to be provided and easily accessible. Therefore, our proposed Best Management Practices are a *continuous monitoring of water related data* (including changes in land management operations) and *hydrological modeling*. Both help to continuously evaluate any changes occurring related to land and water management practices. The hydrologic model is said to enable producing on the fly results for land management implementation plans and supports decision-making. Implemented in a user-friendly environment like FREEWAT (www.freewat.eu, Fig. 3), it has the potential of public engagement in finding site-specific solutions. Therefore, we set up a first hydrological model that should be used as a base for the implementation of future land and water management scenarios. To make the model applicable to investigate land use change impacts on river – groundwater interactions, we started to monitor the Isar river water stage at two points in the pilot area (Fig. 4). Moreover, a further piezometer will be installed close to the river in order to better understand the hydrological processes in the pilot area. The implementation of the monitored data helps to enhance the representation of surface water properties in the model and to more reliably simulate the hydrological processes related to the Isar river.

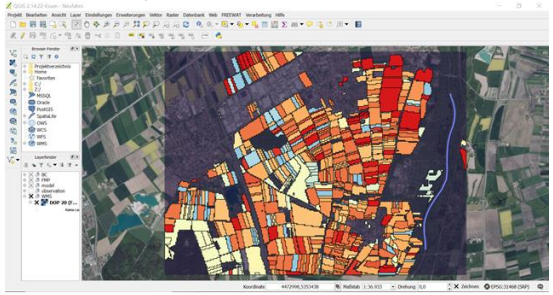


Fig. 3. FREEWAT modeling environment in QGIS.

Fig. 4. One of two new gauging stations in the Isar river.

Imprint:

Daniel Bittner
Prof. Dr. Gabriele Chiogna

Technical University of Munich
Chair of Hydrology and River Basin Management
Prof. Dr.-Ing. Markus Disse
Arcisstr 21
D – 80333 München

Interreg CENTRAL EUROPE
PROLINE-CE
European Union
European Regional Development Fund

Neufahrn bei Freising

A summary of the characteristics of the PROLINE-CE pilot area

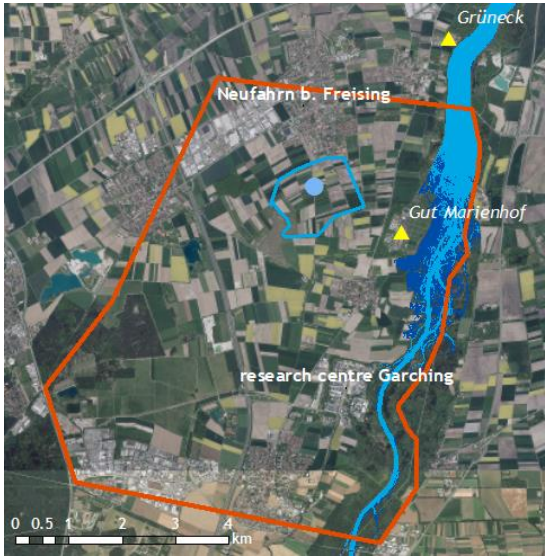
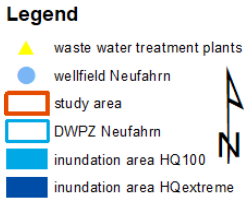


Fig. 1. Pilot area in Neufahrn bei Freising



Pilot area

The pilot area Neufahrn bei Freising is located about 20 km north of Munich in Bavaria and covers an area of about 48.8 km^2 (Fig. 1). The size of the area is characteristic for the Bavarian region, where a large number of small (i.e., smaller than 100 km^2) drinking water supply systems are distributed throughout the state. The drinking water protection zone of the water union Freising Süd in Neufahrn bei Freising was established in 1992 and has the primary goal to protect the well field Neufahrn (Fig. 1) from harmful impacts of anthropogenic activities. The well field comprises 3 shallow wells and 6 deep wells, whereof only the deep wells are used for the local drinking water supply. Those deep wells are screened in the hydro-stratigraphical units of the Upper Freshwater Molasse (*Obere Süßwassermolasse*, screened from 30 m to 80 m depth, lower aquifer). The shallow wells are screened in the Quarternary deposits (upper aquifer) and provide process water to the Garching research centre.

Geology

The pilot area relates to the Alpine foreland of Bavaria and accounts for the sedimentary basin of the Alpine orogeny. The important lithostratigraphical units, in terms of water supply, are related to the Quaternary and the Tertiary ages. Both units are characterized by loose sediments, i.e. mostly gravels, sands and clay (lenses). The sediments from the Quaternary age are mostly related to the Pleistocene age and can be described as glaciofluvial deposits. The Pleistocene deposits are complemented by Holocene deposits, mostly along the Isar river. The Tertiary sediments also consist of accumulated and mostly consolidated sediments from the Alpine orogeny. The considered unit (Upper Freshwater Molasse) relates to the Neogene age, being the youngest geologic system of the Tertiary age. Given a longer time span of sedimentation during the Tertiary unit, the thickness of the Upper Freshwater Molasse (ca. 80m on average) is greater as compared to the Quaternary layer (ca. 10m on average).

Hydrology

The only river in the pilot area is the Isar river and delimits the area at its eastern boundary. Unfortunately, the Isar discharge is not gaged by the water authority in the pilot area and the closest river gages are located in Munich and Freising. However, due to a river bifurcation between those gages (Mittlerer-Isar-Kanal), the hydrographs measured at these stations show completely different patterns (Fig. 2). At the point of bifurcation, a monthly varying minimum flow is discharged into the Isar river. However, during flood events, the flood waves are released into the Isar river, causing a quick and intense increase in river discharge (see hydrograph Freising in Fig. 2).

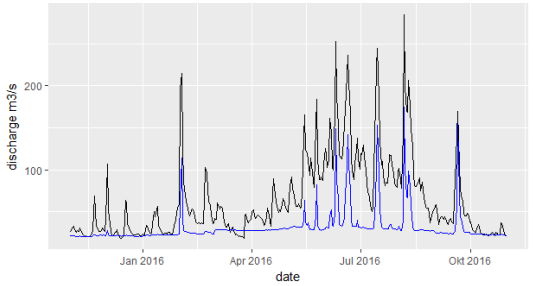


Fig. 2. Isar river discharge measured in Munich (black line) and Freising (blue line)

Fig. 1 shows the potential inundation areas of a HQ100 and a HQextreme event (1.5x the discharge of HQ100) for the considered study area. Thanks to the restored floodplain, (surface) flood issues, in terms of danger for anthropogenic infrastructures, are not present in the study area. A more relevant issue of river floods, however, are the rising groundwater levels resulting from the infiltration of river water during and after flood events. Due to constantly high groundwater levels in the and a high hydraulic conductivity in the Quarternary aquifer (ca. 1 x 10-3 m/s), river floods pose a risk for groundwater quality, engineering structures as well as for arable lands during the main cropping seasons.

Land use

The land use in the pilot area is dominated by arable land (ca. 45 %). In 2010, about 60 % of the arable land was used for grain farming. The most frequent grain types are wheat, winter and spring barley. Further important crops are winter oilseed rape (ca. 15 % of the total arable land), maize (ca. 13 % of the total arable land) and potatoes (ca. 4 % of the total arable land). Two considerable land use changes occurred in the study area: First, the