Microprocessor measuring instruments have recently found applications in hydrological research. They allow measuring water level changes extremely accurately. Thanks to the devices it was possible to notice daily regular several-centimeter water fluctuations in spring areas, small streams and even big rivers. In the afternoon the water level was several centimeters lower than in the morning. In addition, it was noticed that during 24 hours water levels changed differently in spring than in winter. The phenomenon is generated in the zone in which surface and underground waters meet, or when water flows through bottom sediments. The zone in which surface and underground waters are changed is called hyporheic. The mechanism of processes that take place in hyporheic zones has not yet been recognized sufficiently. It can be assumed that changes in insolation that result in daily fluctuations of evaporation from the water surface, soil or plants play an important role. Numerous other factors can have an influence on the observed daily water level fluctuations. The aim of the studies planned as part of the grant is to recognize processes that influence daily water level fluctuations in spring areas, small streams and big rivers.

First, accurate observations of water level fluctuations in field conditions for a hydrological year are planned. The level, temperature and conductance of water will be registered automatically by means of microprocessor devices called divers. Moreover, two automatic meteorological stations will be installed in order to register insolation, precipitation, air humidity and temperature, barometric pressure, and wind speed and direction. Field observations will be carried out for two objects:
1. The spring area of the Gryżynka river, the Gryżynka stream, the Oder in Ziemia Lubuska.
2. The spring area of the Różany Strumień stream, the Różany Strumień stream, the Warta River in Poznań.

Laboratory studies have also been planned for a specifically designed station which will reconstruct conditions of water exchange in the hyporheic zone. The zone functions differently when underground waters feed a river and differently when a river supplies water to a aquifer.

The results of field observations and laboratory studies will be used to formulate a mathematical model of the way in which the hyporheic zone functions. Using mathematical equations it is possible to describe natural processes that take place where surface and underground waters meet. The mathematical model will have to be verified based on the registered observations. After the model has been verified, it will be possible to forecast processes that take place in the hyporheic zone.

Water level fluctuations are not only characterized by daily changeability, but they also change during a hydrological year. Recognizing the way in which the hyporheic zone functions is quite important for better understanding of surface and underground waters interactions. If a river drains underground waters, then the functioning of the hyporheic zone may affect a flood risk when water levels are high and the depth of low water periods when water levels are low. In the opposite situation, when river waters infiltrate to underground waters, the hyporheic zone may influence the efficiency of infiltration processes, which is particularly important in the regions of underground water intakes. This means that the functioning of the hyporheic zone is also important for water management.