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Water Quality Assessments

A guide to the use of biota, sediments and
water in environmental monitoring

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AN INTRODUCTION TO WATER QUALITY

1.1 Characterisation of water bodies

Water bodies can be fully characterised by the three major components: hydrology, physico-chemistry, and biology. A complete assessment of water quality is based on appropriate monitoring of these components.

1.1.1 Hydrodynamic features

All freshwater bodies are inter-connected, from the atmosphere to the sea, via the hydrological cycle. Thus water constitutes a continuum, with different stages ranging from rainwater to marine salt waters. The parts of the hydrological cycle which are considered in this book are the inland freshwaters which appear in the form of rivers, lakes or groundwaters. These are closely inter-connected and may influence each other directly, or through intermediate stages, as shown in Figure 1.1 and Table 1.1. Each of the three principal types of water body has distinctly different hydrodynamic properties as described below.

Rivers are characterised by uni-directional current with a relatively high, average flow velocity ranging from 0.1 to 1 m s⁻¹. The river flow is highly variable in time, depending on the climatic situation and the drainage pattern. In general, thorough and continuous vertical mixing is achieved in rivers due to the prevailing currents and turbulence. Lateral mixing may take place only over considerable distances downstream of major confluences.

Lakes are characterised by a low, average current velocity of 0.001 to 0.01 m s⁻¹ (surface values). Therefore, water or element residence times, ranging from one month to several hundreds of years, are often used to quantify mass movements of material. Currents within lakes are multi-directional. Many lakes have alternating periods of stratification and vertical mixing; the periodicity of which is regulated by climatic conditions and lake depth.

Groundwaters are characterised by a rather steady flow pattern in terms of direction and velocity. The average flow velocities commonly found in aquifers range from 10⁻¹⁰ to 10⁻³ m s⁻¹ and are largely governed by the porosity and permeability of the geological material. As a consequence mixing is rather poor and, depending on local hydrogeological features, the groundwater dynamics can be highly diverse.

*This chapter was prepared by M. Meybeck and R. Helmer