

This chapter lays the physical and conceptual foundations of *optical oceanography*, or more generally of *hydrologic optics*, the quantitative study of the interactions of light with the earth's oceans, lakes, rivers and other water bodies. The Level 1 material starts with an overview of light and the basics of light detectors. We then show how to specify directions and other geometrical concepts such as solid angle in a manner suited to the mathematics of radiative transfer theory. We finally define various quantities such as radiance and irradiance, which provide the building blocks for discussions of the absorbing and scattering properties of water and for the mathematical structure of radiative transfer theory, which are the topics of later chapters.

After defining the basic terms, there are Level 2 discussions of the nature of light , blackbody radiation, light from the sun, and comments on various details of the Level 1 material.

Much (but not all) of the work done in optical oceanography can be done without consideration of the state of polarization of the light. However, polarization carries important information and is increasingly being used to extract environmental information via remote sensing and to enhance underwater visibility. The last page of the level one material begins the discussion of polarization.

Photometry is the study of how radiant energy is perceived by the human eye and brain. Strictly speaking, photometry is extraneous to optical oceanography and radiative transfer theory. Yet it is photometry, not the physical science of radiometry, that enables us to understand the connections between radiant energy and subjective concepts such as brightness and visibility. These topics are discussed in a separate chapter Photometry and Visibility.

Level 3 contains links to commercial instrument manufacturers.

Most of this Chapter 2 material is reformatted and revised from the 1994 text *Light and Water* (1994), which you can download in its entirety from the references page.