



Determination of inherent optical properties in the field Citclops Quality Control and Assessment

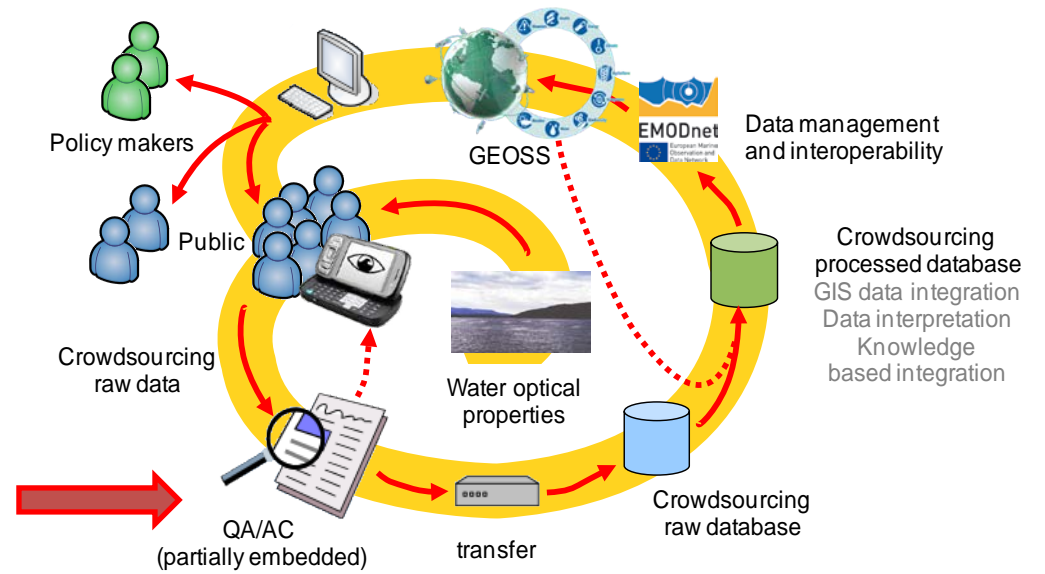
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Introduction

The FP7 Citclops project aims to develop systems to retrieve and use data on seawater colour, transparency and fluorescence, using low-cost sensors combined with people acting as data carriers, contextual information (e.g. georeferencing) and a community-based Internet platform, taking into account existing experiences (e.g. Secchi Dip-In, Coastwatch Europe, Oil Reporter).

Methods are being developed to rapidly capture the optical properties of seawater, e.g.: colour through Forel-Ule observations, and transparency through a variant of the Secchi disc. People will be able to acquire data taking photographs of the sea surface on ferries or other vessels, on the open sea or from the beach.

Ultimately, these sensors will collect large volumes of data on water colour, transparency and fluorescence. An important aspect in using crowdsourcing is to apply strict data quality control to collect useful environmental data.



Approach

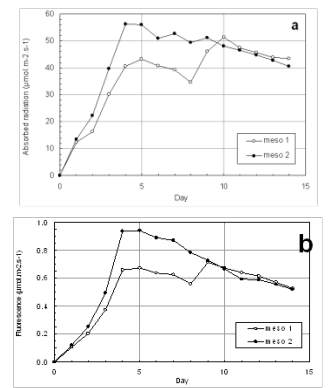
In this presentation an attempt is made, based on HydroLight simulations, to summarize the origin and magnitude of errors in these measurements by geometry of the ambient light field, including the influences of the solar zenith angle, sun glitter at the air-water interface, waves and lens effects, and rapid changes in cloud cover.

The multiple protocols for optical measurements (FU-scale, Secchi Disk, water-leaving radiance, turbidity and fluorescence) have always concentrated on the prescription of the exact deployment of these instruments to **minimize** the impact of the environmental conditions. This work aims to complement these protocols to support the derivation of inherent water properties from all field measurements.

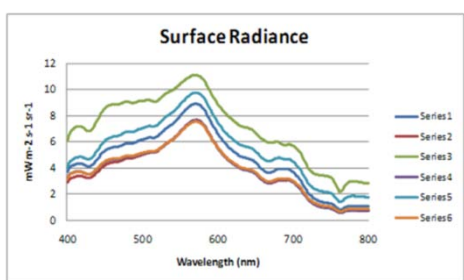
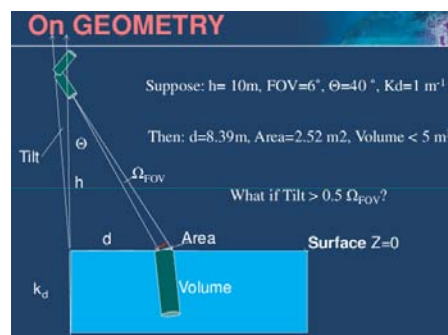
Fluorescence

Natural fluorescence: The Absorbed radiation (a) and emitted fluorescence (b) during the *Phaeocystis* experiment in a Mesocosm (Peperzak et al., 2011). Absorbed radiation was calculated from surface irradiance and ICAM-absorption. Fluorescence was calculated from water-leaving radiance. There is a clear dependence on growth-condition and Nitrogen limitation.

The general time evolution is similar and in a relative sense the fluorescence and Chl-a concentration can be coupled for a limited time and space.



Above Water measurements



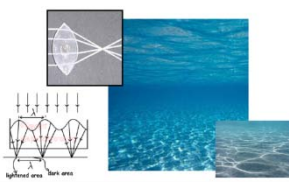
Spectra measured at the North Sea with wind Bft 3

The above water radiance comes from a limited volume and area of the sea. The area is also highly variable due to wind and wave action and acts as a wiggling mirror that shows different parts of the sky.

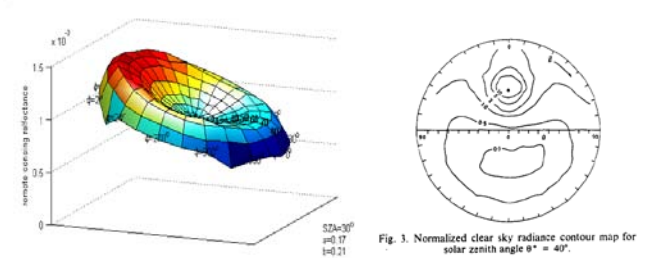
FU measurements by eye are generally able to focus on the Secchi Disk below the water and ignore wave effects. How about your iPhone 5 or Galaxy SIII?

Below water measurements

Refraction & light focusing



Waves



Position of the sun and sky radiance field

The below-water measurements in the field influenced by:

- Geometry of the waves
- Geometry of the incoming light field, especially the position and visibility of the sun and presence of clouds.
- The scattering properties of the water. In case of direct sunlight not only the reflection depends on the viewing angles, but also the light attenuation in the water can vary.

