
A. Chekalyuk¹, A. Barnard², M. Hafez¹, C. Koch², W. Strubhar², A. Derr², and J. Pearson²

¹Lamont-Doherty Earth Observatory of Columbia University  
²Western Environmental Laboratories, Inc.

E-mail: chekalyuk@ideo.columbia.edu, Tel: 908-240-2555

**Abstract**

The Advanced Laser Fluorometry (ALF) has been recently developed for characterization of natural aquatic environments. It provides assessments of phytoplankton pigments, biomass, photophysiology, community composition, and chromophoric organic matter (COM). The environmental applications include oil/PAL detection and spectral discrimination from COM fluorescence. The ALF has been tested in the Pacific, Atlantic, and Arctic Oceans; Mediterranean, Arabian, and Bering Seas; Gulf of Mexico; Chesapeake, Delaware, and Monterey Bays; and Amazon and Congo River plumes. Its modular design allows flexible instrument configuration to optimize measurements in various water types. Several instrument modifications can be used for flow-through, fiber-probe, and in situ measurements. The commercial ALF instrument, the WET Labs Aquatic Laser Fluorometer Analyzer (ALFA) can be used for fully automated long-term underway measurements from various platforms. The recently developed ALF In Situ (ALFIS) prototype incorporates fiber-probe sampling. The probe will facilitate ALF technology in surface and subsurface AUVs and gliders, vertical profilers, towed and stationary platforms (buoys, moorings, platforms, bridges, etc.). The fiber-probe sensor will allow sampling from remote locations and various depths. It is feasible to implement the ALF analytical capabilities in compact airborne LIDAR-fluorosensors.

**Advanced Laser Fluorometry**

The ALF provides spectrally and temporally resolved measurements of the laser-stimulated seawater emission [1,2]. Various excitation wavelengths (e.g., 375, 405, 510 or 532 nm) can be used for the measurements [3]. Real-time spectral deconvolution (SSC) is used for assessment of Chl a, phytoflagellates and chromophoric organic matter (COM). The SSCB provides detection and quantification of three spectral types of phycoerythrin (PE) for characterization of blue- and green-water types of autotrophic cyanobacteria and eukaryotic cryptophytes (Fp, Fp, and Fp with spectral maxima at 565, 578 and 590 nm, respectively) [1,3,5,7,8].

**Modular Design for Various Benchtop and In Situ ALF Configurations**


**ALF: Studying Biogeochemical Variability Across the Oceanic Fronts**

**ALF Spectral Measurements Help to Improve Temporal Assessments of F/Fv**

**ALF Temporal F/Fv Measurements Help to Improve Spectral Assessments of Chl-a**

**ALFA Global Survey in the Arctic Seas**

An example of the global-scale underway ALF measurements (Dr. E. Ross, U. of Maine) to survey the impact of climate change on the biophysical environment in the Arctic Seas (May–Dec 2013, R/V Tara).

**ALFA Bio-Environmental monitoring in the Chesapeake Bay**

The ALF underway measurements in the Chesapeake Bay (Aug 2013; Dr. Olinson, CUNY) provided rich information for biophysical characterization of the area (including changes in phytoplankton biomass, composition, and photochemical efficiency) using the new 514 nm laser for fluorescence excitation.

**References**