NASA/TM-2002-210005

SIMBIOS Project 2001 Annual Report

Giulietta S. Fargion, Science Applications International Corporation, Maryland
Charles R. McClain, Goddard Space Flight Center, Greenbelt, Maryland

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

March 2002

Chapter 22

Measurements and modeling of apparent optical properties of ocean waters in support to ocean color data calibration, validation, and merging

David Antoine, André Morel, Marcel Babin and Hervé Claustre
Laboratoire d'Océanographie de Villefranche, CNRS-INSU, Villefranche sur Mer, France

Stanford B. Hooker
NASA/GSFC, Greenbelt, Maryland

22.1 INTRODUCTION

This progress report does not show any results in terms of *in situ* data because the buoy' deployment is only planned for late January 2002. The advancement of the buoy development and testing, of the instrument integration and testing, and of all other preparatory activities (in particular monthly cruises to the deployment site) are succinctly described here. The objectives and the analyses that are planned thanks to the data to be collected are also reminded. This project is supported by the European Space Agency (ESA/ESTEC contract N° 14393/00/NL/DC), the French Space Agency "Centre National d'Etudes Spatiales (CNES)", the "Centre National de la Recherche Scientifique (CNRS-INSU)" and the "Observatoire Océanologique de Villefranche sur mer". A prerequisite to building long-term (over decades) archives of ocean color, in response to the need for assessing the response of the oceanic biota to climate changes, is to accurately calibrate the top-of-atmosphere satellite observations, then to validate the surface geophysical parameters derived from these observations. Ensuring coherence between these geophysical products, as derived from different sensors, is also an important aspect to consider. When ocean color observations from different sensors are considered in view of data merging, their cross-calibration and validation might be facilitated if it could be "anchored" on continuous long-term *in situ* stations (IOCCG, 1999). Deploying and maintaining moorings that operate in a continuous way is, however, a difficult task.

In response to these concerns, we propose to carry out match-up analyses and vicarious calibration experiments, based on a data set to be built from a permanent marine optical buoy. This new type of marine optical buoy has been specifically designed for the acquisition of radiometric quantities, and has been already deployed in the Mediterranean sea in July 2000 (a deployment of 3 months for validating the mooring concept), between France and Corsica.

The vicarious calibration experiments should allow the top-of-atmosphere total radiance to be simulated and compared to the satellite measurements, in particular for the European MERIS sensor. By this way, the need for a change of the pre-flight calibration coefficients for a given sensor might be evaluated, and its amount quantified. From this data set, match-up analyses shall be also possible for chlorophyll concentration and water-leaving radiances, as well as algorithm evaluation (atmospheric correction and pigment retrieval). Because of a certain commonality in the band sets of the new-generation ocean color sensors, the data acquired with the buoy might be used for several of these sensors, and then contribute to the international effort of cross-calibrating them and of cross-validating their products, which are amongst the basic goals of SIMBIOS. In addition, some protocol issues (measurements) are specifically linked to the use of buoys, while others, of general concern to marine optics measurements, may find specific answers in the case buoys are used. We propose to examine these aspects, which, to our knowledge, have not been thoroughly investigated up to now.

Description of the planned analyses

Two main "vicarious" calibration paths exist to produce ocean color products of the desired accuracy, *i.e.*, water-leaving radiances within an error of about 5% in the blue for an oligotrophic ocean (Gordon, 1997, Antoine and Morel, 1999). The first one is usually referred to as "vicarious calibration", and consists in forcing the satellite-derived water-leaving radiances to agree with a set of *in situ* water-leaving radiances ("match-up analyses"). A set of "vicarious calibration coefficients" is therefore obtained, which is applied to the Top-of-atmosphere (TOA) total radiances measured by the sensor. The second procedure, which is also an indirect ("vicarious") calibration is sometimes referred to as a "radiometric calibration", and consists in simulating the TOA signal that the sensor should measure under certain conditions, and to compare it to the measured signal.