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Chapter 20

Assessment, Validation, and Refinement of the Atmospheric Correction Algorithm for the Ocean Color Sensors

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20.1 INTRODUCTION

The primary focus of this proposed research is for the *atmospheric correction algorithms evaluation and development* and *satellite sensor calibration and characterization*. It is well known that the atmospheric correction, which removes more than 90% of sensor-measured signals contributed from atmosphere in the visible, is the key procedure in the ocean color remote sensing (Gordon and Wang, 1994). The accuracy and effectiveness of the atmospheric correction directly affect the remotely retrieved ocean bio-optical products. On the other hand, for ocean color remote sensing, in order to obtain the required accuracy in the derived water-leaving signals from satellite measurements, an on-orbit vicarious calibration of the whole system, i.e., sensor and algorithms, is necessary. In addition, it is important to address issues of (i) cross-calibration of two or more sensors and (ii) in-orbit vicarious calibration of the sensor-atmosphere system. The goal of these researches is to develop methods for meaningful comparison and possible merging of data products from multiple ocean color missions. With support and collaboration from the SIMBIOS project office, much efforts have been on studying and comparing the ocean color data derived from the Japanese Ocean Color and Temperature Scanner (OCTS) and the French Polarization and Directionality of the Earth's Reflectances (POLDER). OCTS and POLDER were both on board Japan's Sun-synchronous Advanced Earth Observing Satellite (ADEOS) from August 1996 to June 1997, collecting about 10 months of global ocean color data.

This provides a unique opportunity for developing methods and strategies for the merging of ocean color data from multiple ocean color sensors. In this report, I will very briefly discuss other research activities, but mainly focus on describe collective efforts (with SIMBIOS project office) in the OCTS and POLDER comparison study.

20.2 RESEARCH ACTIVITIES

(a) Studies have been carried out to understand various effects on the performance of the SeaWiFS atmospheric correction algorithm for the ocean color and atmospheric aerosols: (i) the solar and viewing geometry effects, in particular, for cases of the large solar and viewing zenith angles; (ii) the Earth curvature effects, i.e., the spherical-shell atmosphere (SSA) vs. the plane-parallel atmosphere (PPA) (Ding and Gordon, 1994); (iii) effects of the sun glint contaminations on the derived SeaWiFS ocean and atmospheric products (Wang and Bailey, 2001); (iv) the effects of ocean surface wind speed on the SeaWiFS derived aerosol optical thickness; and (v) the effects of polarization in the aerosol lookup tables on the SeaWiFS derived ocean color and atmosphere products. These research works (except item (iii)) are still on going. Some preliminary results, however, show importance and necessary to account for some of these effects.

(b) I have been working on activities for the International Ocean-Color Coordinating Group (IOCCG) atmospheric correction working group. The main objective of the working group is to quantify the performance of the various exiting atmospheric correction algorithms used for the various ocean color missions. Therefore, the derived ocean color products from various ocean color missions can be meaningfully compared and possibly merged. As the atmospheric correction is a key procedure in the ocean color remote sensing, we want to answer question such as how can derived ocean color products from one sensor be best compared with those from others. We want to quantify the differences among the performance of the atmospheric correction algorithms. The core working group members are from OCTS/GLI (Japan), SeaWiFS (US), MODIS (US), POLDER (France), and MERIS (Europe). I am currently serving as the working group leader.

(c) In collaboration with A. Isaacman, B. Franz, and C. McClain and the SIMBIOS project office, we have studied and compared the ocean color data derived the OCTS and POLDER.