

Report on the workshop titled "Harnessing Remote Sensing to Address Critical Science Questions in the Ocean-Atmosphere Interface", that was held at ESA-ESRIN, Frascati Italy, 13-15 June 2016.

The challenges in surface ocean-lower atmosphere exchange research are highly interdisciplinary, blending ocean and atmosphere chemistry and physics, with the cryosphere and clouds thrown into the mix. Moreover, the spatial and temporal scales of SOLAS challenges cover many orders of magnitude, and remote sensing is the only practical means to monitor large-scale properties and trends. On the other hand, classical radiation transfer sciences focus on the interactions of electromagnetic radiation with matter, how to measure it and how to invert the measured electromagnetic signals into information on the underlying matter. Climate problems are challenging, and future progress is now dependent on extending radiation transfer and remote sensing science beyond the relatively well-defined domains of the oceanic ecosystem and atmospheric aerosols.

Toward dismantling boundaries between SOLAS science and remote sensing, we held a meeting dedicated to highlighting the key challenges in the Surface Ocean-Lower Atmosphere Study sciences, and how remote sensing measurements and approaches can help address them. We brought remote sensing, SOLAS, and related sciences experts together to brainstorm on the issue, and to produce few examples of key SOLAS problems that could be approached by new or improved remote sensing methodologies.

To set the stage, the first part of the workshop was dedicated to perspective talks on both SOLAS subjects and remote sensing. We then moved to group discussions on key topics. Veronique Garcon opened with an overview of the SOLAS project, its importance, and key scientific challenges. Lisa Miller talked about SOLAS at high latitudes and how interactions with ice and land affect the dynamics of near interface processes, and Paulo Artaxo described how multidiscipline and multiscale climate questions are studied over the Amazon. The next cluster of talks was dedicated to the state of the art in ocean and atmosphere remote sensing. Chris Hostetler talked about current and future developments in active remote sensing of ocean and atmosphere. Jacek Chowdhary described recent developments in polarimeter data inversion to study the atmosphere and oceans, and Oleg Dubovik described the GRASP (Generalized Retrieval of Aerosol and Surface Properties) as a unified framework for characterizing atmospheric (and potentially oceanic) properties.

The subsequent discussions were organized around three groups tasked with identifying SOLAS themes with particular potential to benefit from new approaches to remote sensing measurements and data. Those discussions generated three questions for further development:

1. How can turbulence be quantified in the global ocean? (led by Griet Neukermans);
2. To what extent does the ocean ecosystem affect the composition and radiative properties of the lower atmosphere? (led by Brian Ward); and
3. How do the characteristics of surface ocean organic matter impact properties of primary aerosols? (led by Yoav Lehahn).

A commentary manuscript is now being prepared for the journal *Elementa: Science of the Anthropocene* and will present to the Earth system science community the new ideas generated at this workshop, including how existing and possibly future remote sensing tools could be used to answer these questions.