Advances on Chrorophyll concentration reconstruction from multiespectral radiances

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An inverse hydrologic optics problem is solved in order to reconstruct gaussian vertical profiles of Chlorophyll concentration from synthetic water-leaving radiance experimental measurements in the ocean water. The inverse problem is formulated as an optimization problem and iteratively solved by the meta-heuristics Ant Colony Optimization, using the radiative transfer equation as direct model. An objective function is given by the square difference between computed and experimental radiances at every iteration. In a typical inversion, hundreds of iterations may be required and therefore the choice of an algorithm that is suitable for parallelization is an important issue. It was included a new intrinsic regularization scheme that pre-selects candidate solutions at every iteration based on their smoothness, quantified by the 2nd order Tikhonov norm. Besides the smoothness, an additional information is also used to compute the inverse solution: the concavity of the Chlorophyll profile that is verified by means of its second derivative. Since only curves with negative concavity are expected, a penalty is assigned to profiles with positive concavity. Tipically, good estimations were obtained only for the upper part of the curve with poor agreement below the depth that corresponds to the peak. Therefore, a new two-step strategy is proposed for this kind of profiles: in step-1, estimation is performed for the whole profile and then, in step-2, the reconstruction is performed only for the deeper part of the curve, and the values obtained in the first step for the upper part are frozen. In other words, step-2 is a new inverse problem, but simpler and with a lower dimension than the original problem.