Inferring missing data in satellite chlorophyll maps using turbulent cascading

C. POTTIER (1), A. TURIEL (2), and V. GARCON (3)

(1) CNES, Toulouse, France (claire.pottier@cnes.fr), (2) ICM - CSIC, Barcelona, Spain (turiel@icm.csic.es), (3) LEGOS / CNRS, Toulouse, France (veronique.garcon@legos.obs-mip.fr)

Oceanic turbulent flows develop complicated patterns, with eddies, filaments and shear currents. Although usually referred as chaotic, their inner organization is strongly hierarchical: turbulent flows develop cascades, which transfer properties such as energy or scalar density from larger to smaller scales. We present a novel algorithm based on the cascade and able to fill data gaps in satellite images (particularly, chlorophyll concentration maps). The first step is to show that cascade processes for chlorophyll-a concentration images take a simple, explicit form when an appropriate wavelet (here Battle-Lemarié of order 3) representation is used. A reconstruction algorithm exploiting the cascade structure is then given with a detailed description. We discuss the validity and quality of this algorithm when applied to SeaWiFS and MODIS-Aqua ocean color images. An application to merging data from multiple satellite missions is presented together with a demonstration of the benefit of this algorithm over two other merging methods.