Pan-sharpening to improve spatial resolution of optical remote sensing with examples from SEVIRI (3km/1km), Landsat-8 (30m/15m) and Pléiades (2m/70cm)

Quinten Vanhellemont and Kevin Ruddick

Landsat-8 data has proved to be very successful in mapping suspended matter in coastal waters, revealing features such as turbid wakes behind offshore structures, sediment in/outflow at harbour mouths, dredger plumes, etc. In addition to the 30m multispectral bands there is a “panchromatic” band giving 15m spatial resolution and hence potentially even finer scale data. In fact, many satellite remote sensing missions designed for land or meteorological applications are designed with a broad “panchromatic” band with higher spatial resolution than the standard multispectral bands. At one extreme the very high resolution Pléiades mission gives 2m multispectral data and 70cm panchromatic data on demand. At the other extreme the geostationary SEVIRI sensor gives data every 5 minutes with a spatial resolution at nadir (0°, 0°) of 3km\*3km for the red (0.6µm) band and a nadir spatial resolution of 1km\*1km for the “HRV” (High Resolution Visible) panchromatic band.

The present study investigates the exploitation of these very broad spectral bands for improving the spatial resolution of maps of suspended particulate matter. A physically-based theoretical framework for pan-sharpening of multispectral imagery is described, based on the work of [Neukermans et al, 2012]. This is applied to remote sensing imagery of SPM from SEVIRI, Landsat-8 and Pléiades. The validity of the pan-sharpened imagery is assessed.

[Neukermans, G, Ruddick KG, Greenwood N. 2012. Diurnal variability of turbidity and light attenuation in the southern North Sea from the SEVIRI geostationary sensor. Remote Sensing of Environment. 124:564-580.]