remote sensing

MDPI

Supplementary Materials:

Use of WorldView-2 along-track stereo imagery to probe a Baltic Sea algal spiral

George Marmorino *and Wei Chen

Remote Sensing Division, Naval Research Laboratory, Washington, D.C. 20375, USA; wei.chen@nrl.navy.mil

* Correspondence: marmorino@nrl.navy.mil

Shown on the next five pages are plots of wind speed and direction, vertical stratification, before and after examples of de-striping the band 3 data, and the de-striping code.

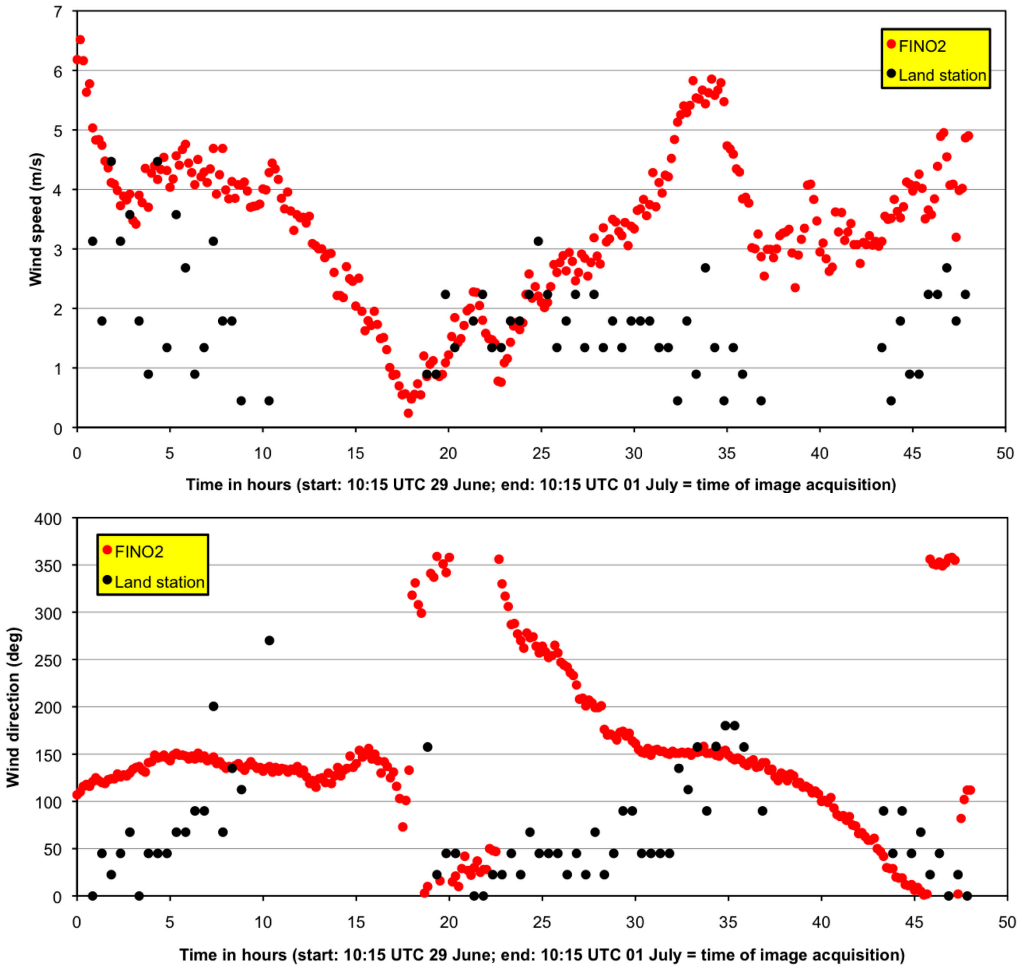

Figure S1. Winds during the 48-h period before acquisition of WorldView imagery, as measured at FINO-2 (31-m mast height) and at a land station. FINO-2 wind speed has been adjusted here to standard 10-height by using a power law, assuming neutral stability. Data from the land station are shown only when wind speed exceeds 0.4 m/s. Location of the FINO-2 platform and the land station are shown in Fig. 1a. Data from FINO-2 were provided courtesy of the BMWi (Bundesministerium fuer Wirtschaft und Energie, Federal Ministry for Economic Affairs and Energy) and the PTJ (Projekttraeger Juelich, project executing organization).

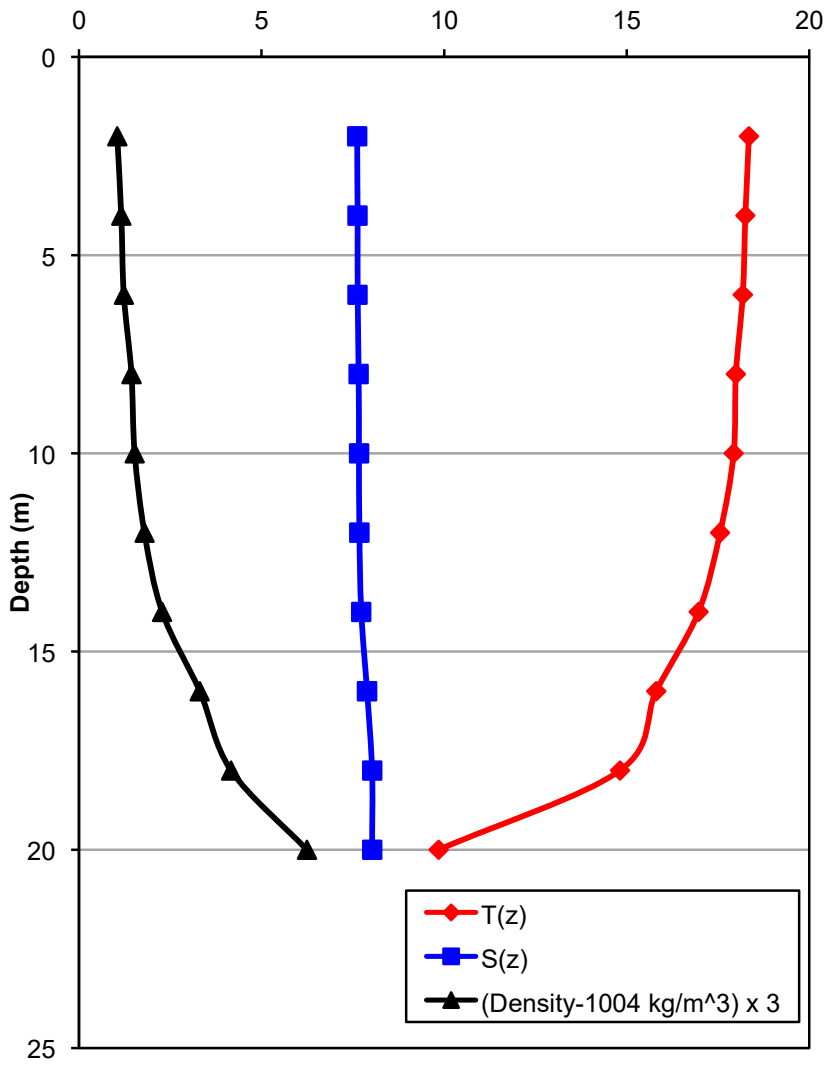

Figure S2. Water-column stratification at FINO-2 at the time of the WorldView-2 data collection (10:15 UTC 1 July 2018). Temperature and salinity were measured at 2-m increments over depths of 2 to 20 m; bottom depth is 25 m. (Temperature and salinity values are raw data.) A linear fit to the density profile (excluding the bottom-most data point) yields a density change of about 1 kg m^{-3} over a 20-m depth range. The values $\Delta\rho/\rho = 1\text{x}10^{-4}$, $H = 20$ m, and $f = 1.19\text{x}10^{-4}$ are to estimate a value of 3.7 km for R_d, the baroclinic deformation radius.

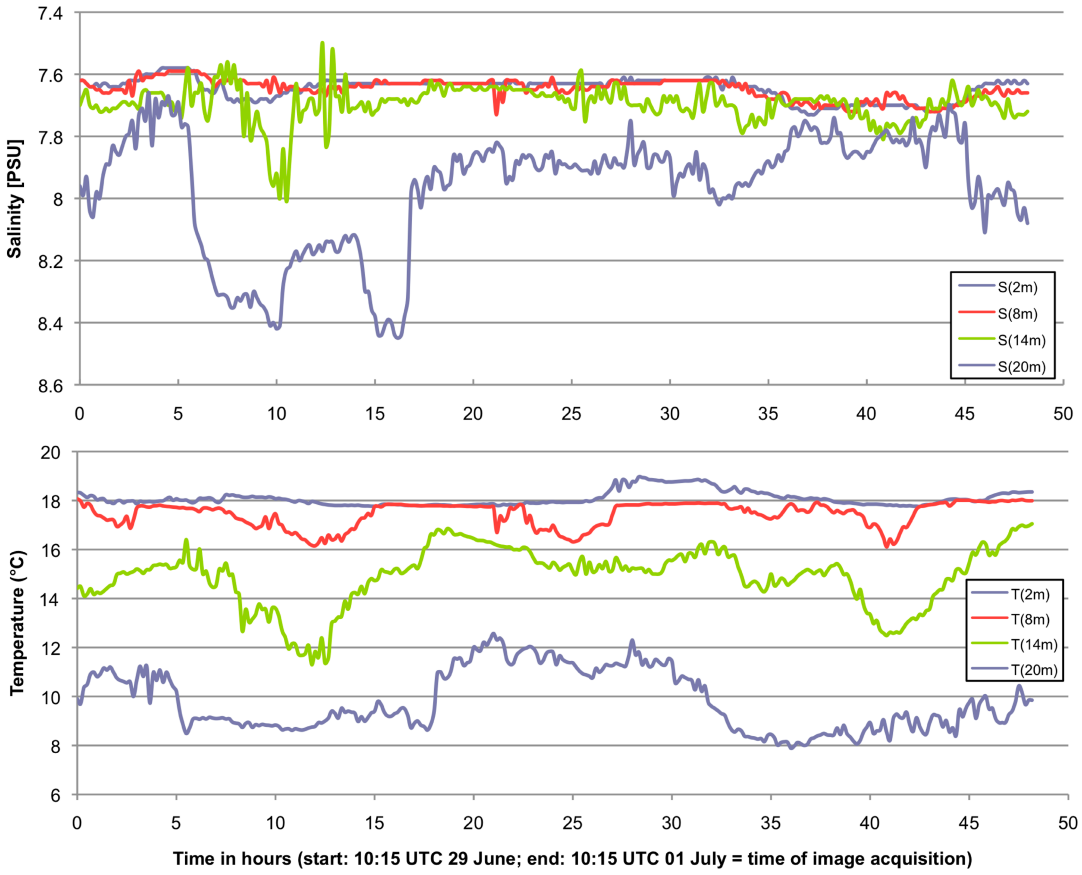

Figure S3. Water-column stratification at FINO-2 over the 48-h period before acquisition of WorldView imagery. Temperature and salinity time series are shown at depths of 2, 8, 14, and 20 m. Stratification is weak where curves are grouped closely, stronger where farther apart. The dominant temperature stratification changes little over time.

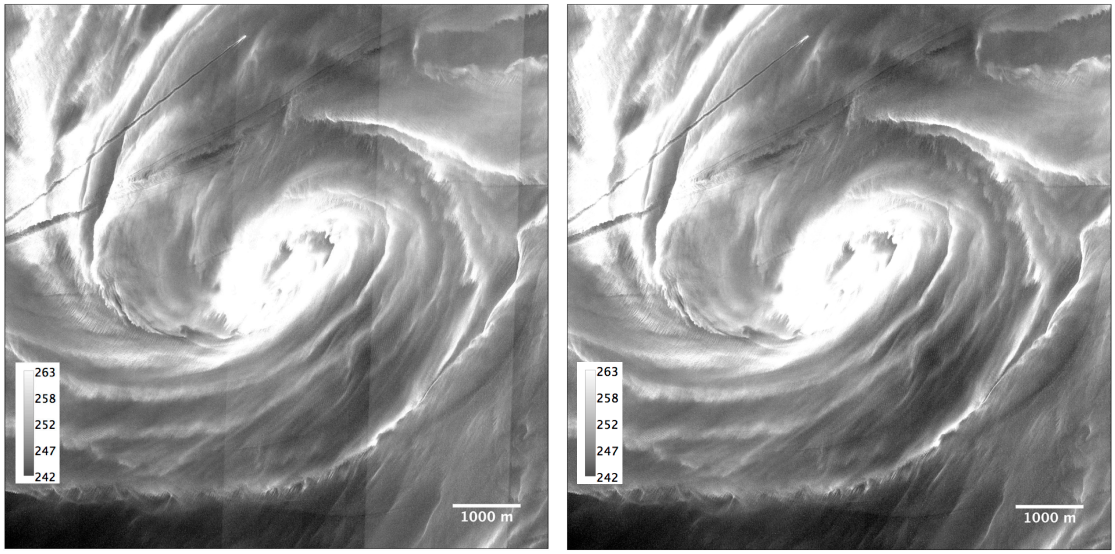

Figure S4. Band 3 data before (left) and after (right) de-striping.

Listing of de-striping code

```
%
%  Script for creating offset values for use in removing vertical stripes in WorldView imagery
%
close all;
graphics_toolkit gnuplot;

%  Input parameters

N_jumps = 5;  % number of jumps

width = 7; % width of each jump as an odd number of pixels; here we use a constant width of 7 pixels

x_end = 9216; % dimension of output array; x_end will usually be the width of the image

y = linspace (0,0, x_end); % row vector of x_end elements: each element of y is a zero.

%  Center position of each jump
x = [885,1764,2646,3526,4407];

%  Height of each jump; positive if image intensity increases across the jump in the direction of increasing x
h = [-130, +125, +190, -170, -220];


% Create the offsets y(x) from the end of one jump to the beginning of the next
% Note: y(x) = 0.0 for x=1 through beginning of jump 1

h_sum = 0.0;

for n = 1: N_jumps -1
        h_sum = h_sum + h(n);
        for i = x(n) + ((width+1)/2) : x(n+1) - ((width+1)/2)
                y(i) = h_sum;
        endfor
endfor


%  Treat separately the x range from end of final jump to x_end

for i = x(N_jumps) + ((width+1)/2) : x_end
        y(i) = h_sum + h(N_jumps);
endfor


%
% Create the offsets y(x) within each jump, using a simple linear interpolation

for n = 1: N_jumps
        for i = x(n) - ((width-1)/2) : x(n) + ((width-1)/2)
                y(i) = y(x(n)-((width+1)/2)) + (i -(x(n)-((width-1)/2)) + 1) * h(n)/(width+1);
        endfor
endfor


%
% Write file of offsets y(x)
%
fid=fopen('offsets.out','w')
fwrite(fid,y, 'single');  % 'single' means 32-bit floating-point numbers; import into ImageJ using "32-bit real"
fclose(fid)
```