**SPATIAL STRUCTURES IN HUDSON BAY: A FIRST LOOK AT THE AMUNDSEN ALONG-TRACK SYSTEM DATA DURING ARCTICNET 2005 AND IMPLICATIONS FOR REMOTE SENSING APPLICATIONS**

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**ABSTRACT**

An along-track measuring system (ATS) was used during the course of the 2005 Arcticnet expedition to measure salinity, temperature, and chlorophyll in Hudson Bay. After a screening process to eliminate abnormal values, ATS data were compared to independent validation measurements. Results show that both types of measurements agreed very well for salinity while ATS temperatures show an alternating bias towards cold values. Extracted chlorophyll values showed a relatively good fit to ATS chlorophyll fluorescence but the error appears to increase with concentration. Comparison between ATS and satellite measurements of temperatures shows a good agreement not only in the large scale patterns but also in individual values. The comparison for chlorophyll shows however an overestimation of satellite measurements compared to in situ values. This is probably due to the effect of dissolved matter of terrestrial origin which affects the SeaWIFS satellite sensor. A semi-variogram analysis was applied to a section of ATS data in southern Hudson Bay to evaluate the spatial scales of variability. Results show that salinity and temperature have relatively large spatial scales (30-160 km) allowing the use of coarse satellite sampling to study the major oceanographic features. The scales of variability for chlorophyll appear affected by the presence of dissolved matter and only shows one structure at 50 km. More work will be needed to extend the study to other regions and time to study the finer scales of variability that should be present in the dataset.

**OBJECTIVES OF THE PROJECT**

Biological and physical structures exist in the sea at scales varying from millimeters to hundreds of kilometers for oceanic gyres. Normal oceanographic sampling based on the concept of individual stations dispersed throughout an experimental area can lead to serious biases in the interpretation if the scales of spatial variability are unknown. This translates into a question of test asked by scientists: How do we skip points fits into the big picture? As part of the Arcticnet Theme 3 scientific program, we are trying to answer that question for the Hudson Bay ecosystem.

**SYSTEM DESCRIPTION**

Located in the engine room, the Amundsen along-track system (ATS) is measuring salinity, temperature, chlorophyll, and dissolved matter (CDOM) fluorescence using a SBE-43 MicroTurb and a pair of Weilbacher fluorometers (Fig. 1). The water intake is located in a seastead on the ship’s port side at a depth of approximately 5 m which depends on ship’s draft (Fig. 2). Water is continuously flowing through the different sensors at a rate of approximately 1.5 m3/s and data from the sensors are acquired at a rate of 1 Hz. At a typical navigation speed of 8 knots, this should transfer into a sample every 5 m but the seastead flushing time being unknown, it is reasonable to assume the existence of strong autocorrelation at short temporal scales.

**DATA PROCESSING**

The ATS provides a large number of data for each parameter. As a mean to evaluate data quality, we used the following protocol. First, histograms were plotted for each parameter allowing the selection of valid range values. This step allowed the elimination of abnormal values that resulted from system failures such as an ice clogged intake and also allowed the detection of systematic errors in the dataset that were resulting from bad data transmission. The remaining data were then compared to measurements taken to validate the system. For most of the 2005 Arcticnet cruise (Fig. 3), daily samples were drawn from the ATS tap and processed in the following manner. A temperature reading was immediately taken in the sampling thermos using a handheld thermistometer having a precision of 0.1 ºC. The water sample was then brought to the filtration laboratory where subsamples were taken for salinity and CDOM. A final sample was taken for chlorophyll which was processed onboard using a Turner fluorometer. Salinity samples were processed using a Guildline Autosal 8400B while CDOM was measured by its absorption at 440 nm using a Perkin-Elmer Lambda 25 dual-beam spectrophotometer.

**RESULTS**

Figure 5 shows the results of the ATS data validation exercise. From these graphs, it appears evident that some parameters were better measured than others. Salinity shows an almost perfect fit with validation measurements. Even though temperature was measured 1 minute of sampling, some important discrepancies were observed with the ATS and the validation measurements of the ATS being 1.5 deg. While this is consistent with a sample warming after its measurement by the thermosalinograph, the value appears somewhat high for a temporal distance of about 1 min. Post-calibration of the handheld thermometer showed that its precision was within 0,1ºC. Further validation with another independent dataset (mosts CTD) will be needed to determine which measurement truly represent water temperature.

**COMPARISON WITH SATELLITE DATA**

Figure 6 shows the satellite data measured by the ATS for Hudson Bay. Despite a large data gap on the eastern side of the bay, the ATS shows temperature patterns that are consistent with concurrent satellite images (Fig 6b). A comparison of values from both types of measurements (Fig. 6c) also indicates a relatively good agreement considering that the satellite image is a 15-days time composite while ATS data are instantaneous measures. The standard deviation of the difference is 0.1 ºC for the temperature.

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