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1 INTRODUCTION

This report compares the composite slice winds from SeaWinds on QuikSCAT to the standard egg L2B product for a set of test revs (8070 - 9030). The quality assurance algorithm developed by Draper and Long [3] evaluates the self-consistency of the selected wind for both egg and composite slice data. Both noise level and ambiguity selection are evaluated and reported as a function of cross track and rms wind speed. In addition, the number of ambiguities generated in both sets of data and the ambiguities selected are given. It is found that the composite slice winds are generally noisier and have a slightly higher incidence of ambiguity selection error. The largest differences between the egg and slice data occur in the nadir and far-swath regions where the slice winds tend to be much noisier. This report gives a brief description the quality assurance algorithm followed by a statistical analysis of the egg versus slice winds.

2 SEAWINDS QUALITY ASSURANCE

Among the problems evident in scatterometer retrieved winds are noise and ambiguity selection errors. The noise level in a wind vector estimate is influenced by environmental factors, instrument geometry and the estimation process [4]. Ambiguity selection errors are a function of the ambiguity selection process and can be influenced by the presence of noise, rain, or other factors. Both noisy areas and ambiguity selection errors can be identified by evaluating the self-consistency of selected wind fields [1].

The quality assurance (QA) algorithm developed for SeaWinds on QuikSCAT evaluates the self-consistency of ambiguity-selected wind flow by comparing the observed wind to a low-order wind field model fit [2]. The wind model is data-derived using a Karhunen-Loève approach [1]. The 8×8 wvc wind field model is applied on a region-by-region basis with regions overlapping by 50% in both along track and cross track directions. A wind vector cell (wvcs) exhibiting a large directional or vector deviation from the model fit is flagged as

- Noisy, if the wvc exceeds directional or vector thresholds that are constant with cross-track.
- A possible ambiguity selection error (ASE) cell, if the wvc exceeds directional or vector thresholds that are variable with cross-track and rms wind speed, optimized to flag wvcs with constant performance [2].

Each 8×8 region is next rated according to the number of "noisy" cells flagged. This general classification identifies clusters of noisy wvcs. Regions are classified as "good," "fair" or "poor" according to the number of noisy cells flagged per region. A good rating (less than 5% cells flagged) represents a low overall noise level and consistent wind flow. A fair rating (between 5% and 20% cells flagged) indicates moderate noise level or high-frequency content, and a poor rating (more than 20% cells flagged) indicates significant noise or ambiguity selection errors evidenced by inconsistent wind flow [3].

An additional ASE region flag is given which identifies the region as a possible ambiguity selection error if all of the following criteria are met:

- Over 14% of wvcs are flagged as ASE cells.
- The region rms error is greater than 1.8 m/s.
- A histogram of wvc directions in the region is multi-modal, indicating more than one major flow.
- The rms wind speed of the region is above 3.5 m/s. Most low wind speed regions are too noisy to accurately assess the ambiguity selection.

These criteria have been determined by an analysis of false alarms versus missed detections on a subjectively reviewed training data set using egg winds [3]. We do not believe that the results would be significantly different if slice winds were used.

3 QA RESULTS

The SeaWinds quality assurance algorithm is performed on both egg and composite slice data sets. Overall, the percentage of regions rated as good, fair and poor, and identified as ambiguity selection errors is given in Table 1.

Table 1: *Overall Results of the QA algorithm on SeaWinds Egg and Composite Slice data.*

Region Flag	Egg	Slice
Good	65%	60%
Fair	20%	23%
Poor	15%	17%
Ambiguity Selection Error	4.7%	5.5%

The QA algorithm performed on the slice data results in less "good" regions and more "fair" and "poor" regions. This indicates that the overall noise level is higher in the slice data. In addition, the percent of regions flagged as ambiguity selection errors are higher.

3.1 Cross Track

Because of instrument geometry, the ambiguity selection performance and noise level varies with cross track. By comparing the composite slice winds to the egg winds, we find that the noise level (shown by the percent of "poor" regions in Figure 1b) is somewhat higher at nadir and on swath edges for the slice data. The ambiguity selection errors are equally higher for each cross track position (Figure 1a). The percentage of individual cells flagged follows a similar trend as the regions with a larger difference at nadir and on the swath edges for "Noisy" Cells (See figure 2).

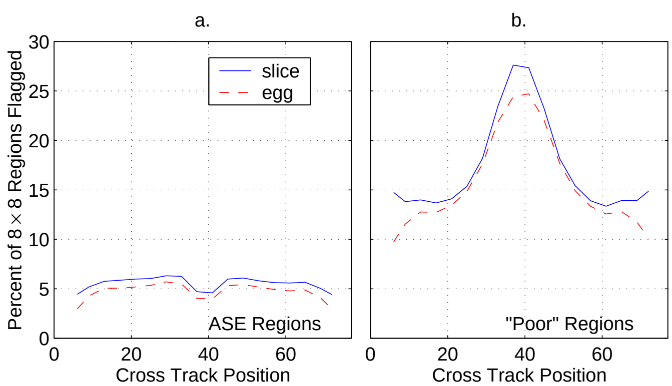

Figure 1: *(a) Percentage of ambiguity selection error regions and (b) percentage of "poor" regions for slice and egg data sets per cross track position.*

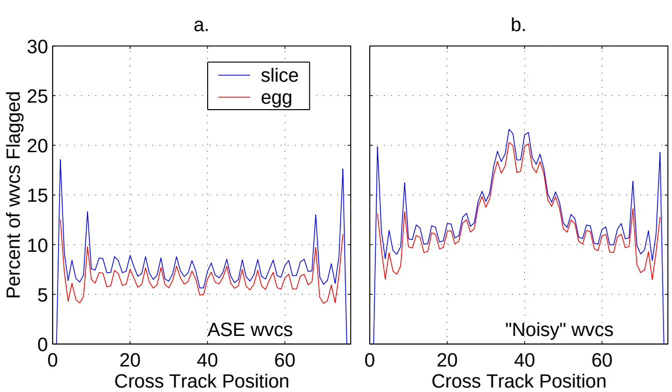

Figure 2: *(a) Percentage of cells flagged as ambiguity selection errors and (b) percentage of "noisy" cells for slice and egg data sets per cross track position. The "spikes" along the cross track are artifacts of the QA algorithm.*

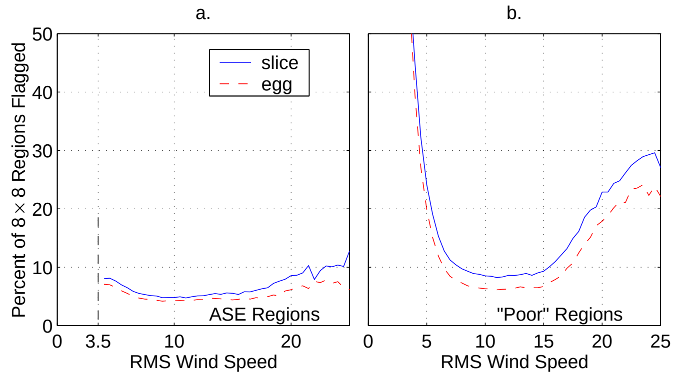

Figure 3: *(a) Percentage of ambiguity selection error regions and (b) percentage of "poor" regions for slice and egg data sets per region rms wind speed.*

3.2 RMS Wind Speed

The performance of the QuikSCAT winds also varies with wind speed. Figure 3 demonstrates that for low to moderate wind speeds, the ambiguity selection errors are only slightly higher for the slice data. However, higher wind speed regions generally contain more ambiguity selection errors. The percentage of "poor" or noisy regions also increases with RMS wind speed.

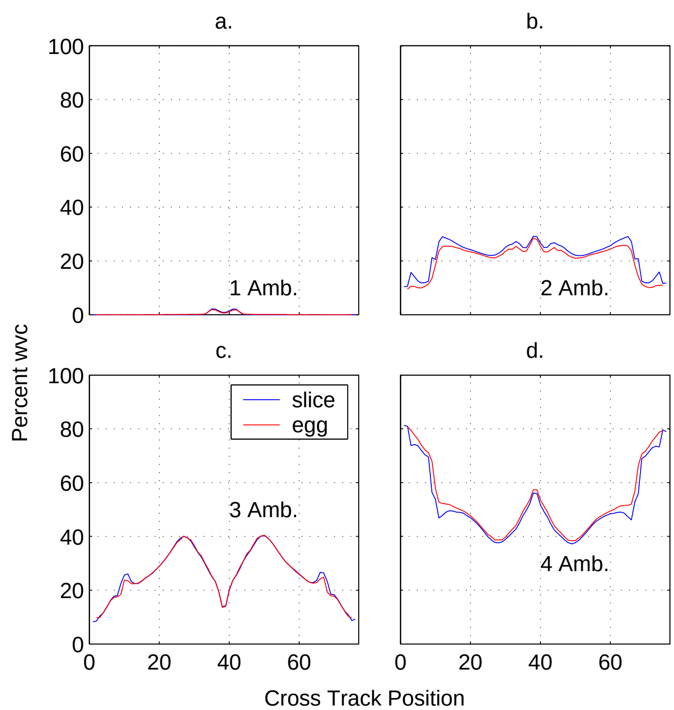

Figure 4: *Percentage of wvcs with (a) 1 , (b) 2 , (c) 3 , or (d) 4 ambiguities generated plotted per cross track position.*

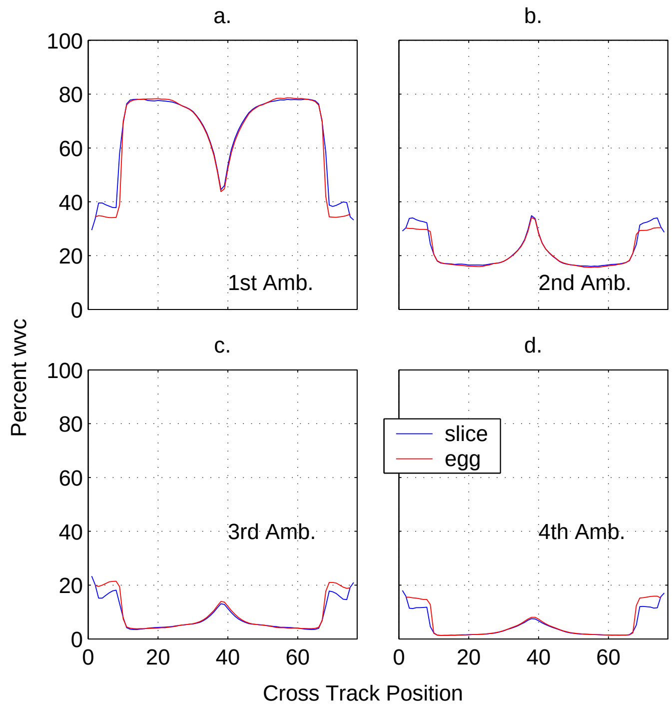

Figure 5: *Percentage of wvcs with the (a) first, (b) second, (c) third , or (d) fourth ambiguities selected plotted per cross track position.*

3.3 Ambiguities Generated and Selected

The self-consistency of the wind can be affected by the number of ambiguities generated and the ambiguities selected per wind vector cell (see Figure 4). The egg data has more 4 ambiguity cases and less 2 ambiguity cases on the edges of the swath than the slice data (compare Figure 4b to 4d). Having less ambiguities to choose from may result in more inconsistencies on the swath edges.

Additionally, we explore the ambiguities selected per cross track position (see Figure 5). It is evident that on the swath edges, more first and second ambiguities are chosen in the slice data set than in the egg data set. Whereas the instrument skill is poor on the swath edges, more first and second "incorrect" ambiguities selected can generate greater inconsistent wind flow.

4 SUMMARY

Overall, the composite slice data set is noisier than the standard egg data set. Generally, the slice nadir and far-swath regions are more noisy than the corresponding regions in the egg data. Inconsistent flow in the far-swath region may be explained by the fact that more "incorrect" first and second ambiguities are selected in the far-swath for the slice data than the egg data. Higher wind speed slice data also tends to contain more noise and ambiguity selection errors than moderate wind speed data.

References

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