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Atmospheric Measurement Techniques Discussions

Interactive comment on "A Generalized Simulation Capability for Rotating Beam Scatterometers" *by* Zhen Li et al.

Zhen Li et al.

li@knmi.nl

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Page 3, Line 3: Question: Have either SCAT or WindRad been launched? Are there any references to their design and on-orbit performance?

SCAT has been launched on 29th Oct 2018, but WindRad has not been launched yet and the plan is this year. The references can be added.

Page 5, Tables 1, 2, and 3 Correction: What is currently listed as "antenna bandwidth" in the table is perhaps more appropriately termed "center frequency."

Yes, it has been corrected.

Recommendation: In Tables 1-3 include the actual TRANSMIT BANDWIDTH in the

table. This would be extremely valuable for the readers to understand how many independent range looks are available for each slice measurement. (For instance, from the literature SeaWinds has a transmit bandwidth of 375 kHz.).

The transmit bandwidth can be added.

Recommendation: Specifically state the number of independent looks (not views) for each slice.

It can be added.

Recommendation: In Tables 1-3 add what the Noise Equivalent sigma-0 is for each system. Perhaps it is actually a range of values depending on the specific slice position within the antenna footprint on the ground.

Yes, it is added.

Recommendation: Add a new diagram/figure showing how each antenna footprint is "sliced" using range processing. What are the dimensions of the individual slices on the ground? What is the overall spatial resolution of each system?

In the simulation, the slicing is simplified by cutting the pulse into the equal length slices. It is two dimensions of the individual slices on the ground. The overall spatial resolutions are CFOSAT 10km, WindRad (C-band 20km, Ku-band 10km), SeaWinds 25km.

Page 7, Lines 1-5: Comment: The authors are correct in indicating that the coefficients A, B, and C are a function of the precise detection scheme. The approximations for A, B, and C given in the paper are identical to those derived for SeaWinds, which uses a deramp detection of the chirped bandwidth and then frequency filtering to obtain each slice. It is unclear whether they are applicable to the SCAT or WindRad cases because the detection scheme is not specified. Question: I don't understand what the statement "The distribution of Bs on each slice in one pulse is assigned according to the antenna gain pattern of the pulse" means.

We do not have the access to the detection scheme of CFOSAT and WindRad, so the approximation is applied here. The approximation is to give the slice bandwidth by the pulse bandwidth with antenna gain pattern. The antenna gain pattern has the feature that peak at the center and gradually decreasing to the sides as a function of the distance to the center. So, the slice_bandwidth = pulse_bandwith * antenna_pattern.

Page 9, Figure 6: Question: What are you defining as being a "view." Specifically, for SeaWinds, my understanding is that for the outer WVC's, there are measurements that occur from multiple azimuth angles for multiple antenna rotation, although it is a very small range of azimuth angle variation). For instance, in the paper "Point-Wise Wind Retrieval and Ambiguity Removal Improvements for the QuikSCAT Climatological Data Set," A.G. Fore et. al., IEEE Trans. on Geosci. and Remote Sensing, VOL 52, No. 1, January 2014, it shows a distinct "saddle shaped" distribution of "composites" as a function of WVC, not a flat distribution as shown in the author's Figure 6. What is the difference between "composites" in the above paper and "views" in this paper?

For SeaWinds, the classic way of defining the views is that the slices in one WVC are classified by fore/after beam first and then within the inner swath, the slices are classified by their polarization into two views (VV and HH), so there are four views at the inner swath. The outer swath only has one polarization, so it only has two views (fore/after beams). The definition of the composites in the paper (2014) is not very clear, they used a new method to aggregate the slices into one WVC, but the next step of grouping into views is not clearly described, so I would think the definition of composites is different from the views in my paper.

Page 10, Lines 4,5: Comment: The line that reads ". . . the Kpc on the WVC level is derived by averaging the Kpc for all the views in the corresponding WVC." Wouldn't the Kpc instead be actually reduced when all the views of included together? As multiple s0's from different views are averaged, wouldn't the aggregate Kpc go down?

Yes, the Kpc will go down with the averaging all views or slices together and this is the

purpose to reduce the Kpc.

Pages 14 and 15: Question: Figures 10 and 11 appear to be a model simulation output whereas Figure 12 is an actual SeaWinds measured wind field (?).

They are all simulated output.

Page 20, Line 20: Comment: The statement "Overall the wind retrieval performance of the rotating fan-beam instruments is better than the pencil-beam instrument." Clearly more "views" are better than fewer views, but the number of looks is also important. This conclusion may be the case for this specific pencil-beam scatterometer (SeaWinds) with its relatively small bandwidth and low number of looks per slice, but a pencil beam scatterometer with a higher gain and/or higher transmit bandwidth could potentially compensate for the lack of views. There may be a trade-off here.

This trade-off is possible. In general, the number of views and the geometry diversity of the views play a major part in the wind retrieval quality, and the number of views of rotating fan beam is significantly larger than pencil beam, so this trade-off might play a less important role here.

Page 25, Conclusions: Comment: One aspect that I find seriously missing in this paper is the acknowledgement that SeaWinds (as well as SCAT and WindRad maybe?) have already been operating in orbit. In the case of SeaWinds, there is an approximately 10 year data record that has been extensively evaluated. Yet the actual performance of the scatterometers on actual wind fields is not compared to the model simulation results. It seems that this would be a good means of establishing the validity of the model, particularly with regards to evaluating the "geophysical noise." The chances are good, I would guess, that the model performance is actually better than that observed in the real world in all cases. Thus the model/simulation evaluation might best be said to be an evaluation of "relative performance potential" amongst various scatterometer designs as opposed to actual real world performance.

Thank you for your comment. The SCAT is in the orbit now, but WindRad is not launched yet. The validation between simulated SeaWinds and actual SeaWinds data is a good evaluation for the simulation system and it can be done.

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