Ship-based lidar measurements for validating ASCAT-derived and ERA5 offshore wind profiles

General remarks:

- The paper has improved a lot! I like your figures.
- There are however still revisions necessary I think.
- I have also corrected some of the English

Abstract. Text still gives the impression that this work contributes to "accurate characterization of offshore wind resources". Maybe this is true for the Baltic for now, but certainly not for places with wind farm (effects). I suggest this alternative text:

Because offshore in-situ wind measurements at turbine operating heights are scarce, ECMWF Reanalysis 5th generation (ERA5) data are often used for offshore wind resource assessments. There are however a few disadvantages of using ERA5: it has a rather course grid spacing which makes it less useful for coastal areas and it does not include wind farm effects, so it can only be used for wind resource assessments in areas without wind farms. This study presents a comprehensive comparison between wind profiles derived from the satellite-based Advanced Scatterometer (ASCAT) ~~satellite observations~~ and ~~the~~ ERA5 ~~reanalysis dataset~~ against ship-based lidar measurements in the Northern Baltic Sea for a period without wind farms. The aim is to investigate the applicability of ship-based lidar measurements for validating these datasets and to better understand the reliability, accuracy and limitations of ASCAT- and ERA5-derived wind statistics for offshore wind characterization at wind turbines operating heights when there are no wind farms. To extrapolate ASCAT observations at sea level to turbine rotating heights, a mean correction of atmospheric stability effects based on ERA5 and a probabilistic adaptation of the Monin-Obukhov similarity theory (MOST) ~~was~~ were implemented. The comparison between the two gridded.. etc

Met opmerkingen [WI(1]: If you use "wind resource assessment" (or "characterization of offshore wind resources" which effectively means the same) as a reason why your work is relevant, then you should add this.

Line 44-45: Each NWP model comes with inherent limitations due to factors like grid resolution, physical modelling, and parameterization choices (e.g. wind farm parametrisations or the lack thereof).

Line 46-47: However, conducting such validation is particularly challenging in deep-water offshore regions, where in situ measurements are sparse.

Met opmerkingen [IW2]: There are fewer measurements at sea than on land, but I am not convinced there are fewer measurements in deep than in shallow water… what did you base this on?

Line 77-79 (typo): To the authors' knowledge, this study represents the first comprehensive comparison of vertically extrapolated ASCAT winds ~~profiles~~ (hereafter referred to as ASCAT wind profiles) from 10 m height up to wind turbine operational heights against non-stationary in situ measurements, covering locations near the coast and further offshore. ~~a wide horizontal extent from nearshore to offshore locations.~~

Line 80-82: Therefore, this work aims to contribute significantly to a better understanding of the reliability, limitations, and accuracy of satellite measurements derived wind statistics and ERA5 wind data for offshore wind characterization at wind energy-relevant heights in areas without wind farms.

Met opmerkingen [IW3]: For me the most interesting part of your work is the comparison of ship-based lidar to ASCAT-profiles. If in areas without wind farm disturbances, the ASCAT-profiles validate well against the ship-based lidars, there is reason to believe that we can do wind resource assessments with higher resolution ASCAT (KNMI now working on 5.7 km) or SAR for European waters (Copernicus Marine Service) in areas where there are wind farm(effects). And then we are talking…

Line 87: The discussion of these findings and the main ~~extracted~~ conclusions are included in Sections 4 and 5, respectively.

2 Data and Methods

Line 89-91: This section describes the three datasets used in this work. In addition, the methodology used for processing the different 90 datasets is explained in detail~~detailed~~, as well as the methodology to extrapolate ASCAT winds and the collocation approach used for their comparison against the ship-based lidar measurements.

Line 104: The campaign took place from 28 June 2022 ~~to~~ until 21 February 2023

Line 105: … ship-based lidar system was used with ~~This is composed by~~ a vertical profiling Doppler lidar WindCube WLS7v2, …

2.1 Ship based lidar measurements: I still miss info on the accuracy of the measurements from the WindCube WLS7v2 in this section. Also what you added in lines 567-573 (answer to my question 16) is not really info on accuracy. So you assume (or know? reference?) that the accuracy of a ship-based lidar with motion recorder is comparable to the accuracy of a floating lidar? Add in section 2.1: the accuracy of a ship-based lidar with motion recorder is (assumed to be) similar to the accuracy of a floating lidar. According to Dhirendra et al (2016) this is 3.1%-4.2% for heights of 92m in the wind speed range 4m/s-16m/s (pg 15 TNO report - DOWA validation against offshore mast and LiDAR measurements | Report | Dutch Offshore Wind Atlas).

[Line 567-573: "Consequently, the mean values derived from lidar measurements may exhibit biases that vary depending on the time slots during which measurements were acquired at particular locations. Additionally, it is acknowledged that lidar measurements, like any other observational data, are subject to inherent uncertainties that may impact the results (Duncanet al., 2019b; Rubio and Gottschall, 2022). Nevertheless, the observed deviations between the lidar measurements and both extrapolated ASCAT and ERA5 significantly exceed the magnitude of potential discrepancies attributable to floating lidar uncertainties (at turbine rotor heights roughly 3-4% see section 2.1), which can be up to approximately 2 % with mast-mounted anemometers as lower limit reference (Wolken-Mohlmann et al., 2022)".]

2.2 ASCAT

Line 150: What is a nadir gap?

Line 170-172: Despite the application of these quality filters, ASCAT seems to overestimate wind speeds ~~excessively high mean wind speed values were observed in ASCAT grid cells~~ near the coast (as shown later in this report in fig 12), likely due to coastal contamination effects (Stoffelen et al., 2008; Lindsley et al., 2016).

2.3 ERA5

Line 179-180: provides hourly estimates of a wide range of atmospheric, land surface and oceanic variables with a 0.25° x 0.25° latitude-longitude grid resolution (31x31 km), covering the period from 1950 to present.

2.4 Satellite vertical extrapolation

Line 211-212: So there are two methods for stability correction: mean stability correction and instantaneous stability correction. Compared to the instantaneous stability correction approach, applying the mean stability correction avoids the need to calculate wind speeds under stability …

Line 218-221: Another advantage of the ~~Additionally, employing the~~ mean stability correction ~~offers other potential benefits. N~~is that the numerical models used for this method can accurately capture

Met opmerkingen [IW4]: Bit unclear: do you mean that floating lidar measurements can give up to 2% lower values than mast mounted anemometers? This is interesting, but does not really tell me anything about the uncertainty of the measurement. The mast-mounted anemometer can have an uncertainty of 2% and then floating lidar is not significantly different from the mast-mounted measurement.

Met opmerkingen [IW5]: This would mean that (1) 'ASCAT quality checks' and (2) 'the fact that only ASCAT measurements are available further than 12.5 km from the coast' are insufficient to guarantee the quality of ASCAT. I have heard about contamination of ASCAT by ships 'parking lots', but never about this. Please check this with Ad Stoffelen.

Met opmerkingen [IW6]: KNMI Technical report - The Dutch Offshore Wind Atlas (DOWA): description of the dataset | Report | Dutch Offshore Wind Atlas average meteorological conditions over extended periods (Peña and Hahmann, 2012). The stability information of data used for instantaneous stability correction is (generally?) less accurate because the measurements are for a single location or a limited time span. This introduces ~~, whereas the accuracy of instantaneous stability information from these datasets is questionable, introducing~~ additional uncertainty to extrapolated profiles using this instantaneous data (Badger et al., 2012)

Line 224-225: ~~Otherwise~~However, a relevant drawback of the mean stability correction is that everything gets averaged out and site- or time-specific information ~~the~~ information ~~provided by~~from in-situ measurements is not included~~the individual wind speed samples is neglected,masking the potential influence of particular mesoscale effects that modify the average wind profile~~.

Line 237: You use ERA5 to derive L and you select values of C that give NPD of 1/L closest to ERA5. Does that mean that all differences between ASCAT and ERA5 at higher levels are mainly due to differences at sea level (or 10m) because the (stability dependent) extrapolation to higher levels is equal?

Line 250: In this study, the values for the C± constants have been set to 6 and 4 for the stable and unstable portions, respectively. These values are the same for all ASCAT grid points (both near coast and further offshore) and for the whole period (regardless of e.g. time of day and season).

Line 309-310: This situation may lead to coastal contamination and excessively high wind speed retrievals within these grid boxes.

3 Results

Section 3.1

Line 329: Figure 8 illustrates the differences in wind speed at 100 m height between the collocated and the full campaign approache~~s~~.

Line 336-338: Consequently, the collocated approach in these areas may have insufficient stability information available, potentially introducing a biased representation of the theoretical stability distribution during the campaign period.

Line 344-347: As can be observed, the more unstable conditions just before midday at Nynäshamn harbour due to land-contamination (red line) "weigh" more in the mean stability assessment if you just consider the collocated periods (orange shadows) instead of the full period. ~~collocated approach yields a more variable and unstable mean distribution of the stability conditions near the Nynäshamn harbour (red line),~~ This leads ~~leading~~ to a larger stability correction factor in absolute terms (despite its negative sign at this location), and consequently, to lower wind speeds compared to the full campaign approach, as derived using the equations described in Section 2.4.

Line 347-350: This ~~instability~~ unstability at location A is attributed to the coarse resolution of ERA5, resulting in land contamination of the grid box at the harbour location, where ~~the~~ land ~~mask~~ covers 56% of the grid box surface. Therefore, the daily stability cycle ~~profile~~ is more ~~akin~~ similar to that of an onshore site.

Line 352: The period of ~~lowest~~ highest unstability then occurs around midday when the surface heating is most intense.

Line 354: ~~As this trend persists, s~~Untability reaches its ~~maximum~~ minimum (the negative value of 1/L closest to 0) in the late evening and stays relatively constant until the following morning.

Met opmerkingen [WI(7]: Sentence not clear: from which datasets? You do not mean datasets from numerical models, but that is how this sentence reads. I have tried to re-write what I think you mean, but this is not my expertise.

Met opmerkingen [WI(8]: Sentence not clear: maybe this is what you mean?

Met opmerkingen [WI(9]: My question 27: so basically mean stability correction is based on an average (time and space) stability distribution?

Met opmerkingen [WI(10]: Counter-intuitive: land contamination gives an overestimation of the surface roughness and an underestimation of the surface wind. So please explain.

Met opmerkingen [IW11]: My old question 28 has not been answered. Too few ASCAT measurements increases uncertainty, but does not necessary lead to bias. Maybe the reason is that a higher percentage of land-contaminated ERA5 data are used in the collocated stability correction than the full approach?

Met opmerkingen [WI(12]: My old question 29 is answered: 10 UTC is around midday and if this gridpoint is very land-contimated, this explains why it is zo unstable.

Met opmerkingen [WI(13]: My old question 30 is not sufficiently answered. I can not see in the formulas in 2.4 how a higher negative value of 1/L leads to a larger stability correction (so please explain). And how does a larger stability correction lead to lower wind speeds (and at what level)? Less unstable (more weight to surface friction effect) tends to result in a lower wind speeds at the surface: is that what you mean?

Met opmerkingen [WI(14]: In meteorology we call it unstablity, not instability.

Met opmerkingen [WI(15]: What you have written is wrong

Met opmerkingen [WI(16]: Again: what you have written is wrong

Line 355: In contrast, locations B to E are purely offshore (with a land fractionmask of 0%) and therefore exhibit almost no diurnal cycle because the atmospheric stability is mainly determined by the sea water temperature. There is however a seasonal cycle that was not taken into account. a more stable diurnal cycle of stability and lower variations throughout the day, due to the presence of a relatively uniform water surface.This leads to

Line 357-359: Finally, location F at Hanko harbour (location F) there is more of a daily stability cycle than offshore, but a lot less than at Nynäshamn harbour (location A). There are two reasons for the difference between Nynäshamn (A) and Hanko (F): (1) The gridbox at Hanko (F) contains a significantly lower land-fraction: 6% compared to 56% at Nynäshamn (A) and (2) with predominantly W-SW winds, the wind at Hanko (F) is mostly from sea to land and at (Nynäshamn (A) is from land to sea. , with a land mask of 6%, presents slightly higher variations in stability during the day compared to the offshore sites but is still relatively steady compared to location A.

Line 364-367: Given the minimal differences in the wind speeds at 100 m depicted in Fig. 8, and thus the similar wind profiles obtained using both approaches, subsequent sections of this paper will only consider the full campaign approach for the sake of clarity and conciseness. Tbecause this approach is expected to provide more representative wind profiles along the complete ship route.

Fig 9: Daily cycle of the stability parameter (1/L) at the six evaluated locations A-F from Fig. 7. All values of 1/L are below zero indicating an unstable atmosphere. Long(itude) 18° corresponds to the harbour of Nynäshamn (Sweden) and long(itude) 23° to the harbour of Hanko (Finland). The orange shadows indicate the time periods when ASCAT overpasses are available and are therefore the only time periods included , considered for the stability characterization in the collocation approach.

Section 3.2

Line 372-378: As can be observed when comparing the spatial variation shown by the two datasets at 10 m, ERA5 exhibits higher mean wind speeds in the areas farthest from the shore at 10 m, but the wind speed near the coast is lower. with a progressive decrease as the coast is approached. However, although ASCAT also shows higher wind speeds in the middle of the basin, the areas closest to shore still present considerably higher values of wind speed compared to ERA5. This is because ERA5 has a grid-box size of 31x31km, so part of the selected grid boxes (only grid boxes with ASCAT data so at 12.5 km from the coast) are still land-contaminated in ERA5 (and assume a surface roughness that is too high and therefore a 10m wind that is too low). Again, the effect of the prevailing W-SW winds can be seen: the land affects particularly the areas where the wind predominantly blows from land to sea (Swedish coast). Similar effects can be seen at 100m height. This discrepancy occurs because, despite the filtering process for the ASCAT dataset, the coastal contamination still affects ASCAT measurements, leading to excessively high mean values in nearshore areas. The effect of coastal contamination in the ASCAT map is particularly visible in the 100 m height map, where the highest mean wind speeds are located along the perimeter of the region with available data.

Line 397: As to be expected, bBoth datasets consistently show higher wind speeds at 100 m than at 10 m height.

Line 380-383: For 10 m height, tThe overall mean wind speed averaged over all included gridpoints is s at 10 m are 7.61 m s^{-1} (ASCAT) and 7.15 m s^{-1} for ASCAT and (ERA5), respectively.which means that However, a notable reduction in the mean deviationdifference (U_{ASCAT} − U_{ERA5}) is 0.46 m s^{-1}. When only locations is observed when considering only locations distanced more than 20 km from the shore are included, this difference reduces where the overall mean deviation decreasesto

Met opmerkingen [WI(17]: Land mask and land fraction are two different things.

Met opmerkingen [WI(18]: My old question 24 has not been answered: offshore stability should have a seasonal cycle (because sea water temperature has a seasonal cycle) and you miss 3 months of the year where the sea is particularly cold (but that is the case for both the collocated and whole dataset). So that probably explains the overestimation of unstable. But why do we only see that for collocated, not for the whole campaign?

Met opmerkingen [WI(19]: My old suggestion 31 was not implemented and I think it should. I have made an attempt to do this here.

Met opmerkingen [IW20]: Why? You just showed there is no difference..

Met opmerkingen [IW21]: This tekst is unclear. Again: few ACAT measurements means higher uncertainty, but why overestimation?

Met opmerkingen [IW22]: An additional difference plot would help.

Met opmerkingen [IW23]: You write: mean high values nearshore areas? I see lower wind speeds near the coast...

approximately 0.16 m s^{-1}. However~~Conversely~~, only including locations within 20 km from the shore increases the ~~account for a total mean deviation~~difference ~~of~~ to 0.98 m s^{-1}.

Line 386-390: For ~~At~~ 100 m height, the wind speed averaged over all included gridpoints is ~~, the mean wind speed values increase to~~ 9.31 m s^{-1} (~~for~~ ASCAT) and 8.67 m s^{-1} (~~for~~ ERA5) and the difference 0.64 m s^{-1}. If only more than 20 km from shore locations are included, the difference is only slightly ~~if the whole area is considered, though the deviation is~~ reduced to 0.43 m s^{-1}. ~~when only far-from-shore sites are considered~~ So land-contamination in ERA5 is less relevant at 100 m height than at 10 m height, which is what we expect (surface roughness affects wind at lower levels more than at higher levels). The differences between ASCAT and ERA5 at 10 and 100m ~~differing biases between these two datasets at the two heights levels (10 m and 100 m)~~ can be attributed to ~~three~~ two (or one?) key factors: first, the inherent difference between the datasets at 10m (e.g. the gridbox sizes: ERA5 still land-contaminated near the coast, ASCAT not), second, the mean stability correction approach used to extrapolate ASCAT; ~~and finally, as illustrated in Figure 8, the impact of the collocation strategy applied for the theoretical stability characterization.~~

Met opmerkingen [IW24]: My old question 34 was not answered: Because you use ERA5 stability info to calculate ASCAT-derived wind speeds at 100m height, the difference you see at 100m should mainly be because of differences at 10m, right?

Line 396-398: This ~~discrepancy~~ difference between in nearshore areas can be explained by the combination of excessively high wind speeds retrieved by ASCAT due to coastal contamination and ERA5's inability to properly resolve the coastal atmospheric phenomena and small-scale wind flow variations due to its coarse horizontal resolution.

Met opmerkingen [IW25]: No: you only used the full dataset for figure 10 (assuming this is still about figure 10).

Met opmerkingen [IW26]: Again: ?

Met opmerkingen [IW27]: See my old remark 36: I do not think "coastal atmospheric phenomena" (sea breezes?) and small scale wind variations (low level jets?) affect your mean values. This is all because of ERA5 land-contamination (which indirectly affects ASCAT winds extrapolated to 100m). Please rethink your conclusions.

Line 398-401: The differences become smaller ~~When~~ moving further offshore and almost negligible at distances further than 40 km from the shore: ~~(more than around 40 km), this discrepancy stabilizes, converging to more consistent estimates away from the influence of land and coastal effects and reaching mean difference values of~~ around 0.2 m s^{-1} at 10 m height and 0.4 m s^{-1} ~~400 at 10 m and~~ at 100 m height~~, respectively.~~

Question 37: Figure 10 shows you that you should not use your method within about 40 km from the coast (you should expect 31 km because of the grid size of ERA5 and what I explained earlier) Results presented in Figure 11 (Figure 10 in first submitted version of the manuscript) show higher discrepancies between ERA5 and ASCAT at both 10m and 100m (within these 40km distance to shore). However, since the extrapolation methodology used in this study does not affect the data at 10m, we cannot conclude that the method itself should not be used within 40 km from the coast. Rather, we believe a more accurate conclusion is that, within this region, higher uncertainty is expected in both ERA5 and ASCAT values, as evidenced by the larger differences observed due to the limitations of these datasets (e.g. ERA5 grid size as mentioned by referee). Therefore, we want to highlight that this is not due to a limitation of the method, but a limitation of these datasets. This has been discussed in the manuscript. While the extrapolation may contribute to some additional uncertainty, as seen by the consistently larger bias at 100m compared to 10m (also explicitly mentioned in the manuscript), the key limitations regarding the applicability closer or further away from the shore lie in the datasets themselves, not in the methodology employed in this study.

Met opmerkingen [IW28]: Part of the method is that you use ERA5 data for the extrapolation of ASCAT to 100m, so I do not agree with your answer.

Section 3.3

Line 417: mean profile bias is consistently positive (indicating ASCAT overestimation compared to the ~~regarding~~ lidar measurements), with the magnitude depending

Line 426: significantly outperforms ASCAT profiles, which overestimates the wind speed ~~exhibit~~ even at 10 m height, highlighting the

Line 427-429: Additionally, it is striking to observe the substantial deviation of the ASCAT stability corrected profiles from the logarithmic profiles, particularly at heights above 50-100 m, as a consequence of a stability distribution that is not representative enough of these specific sites.

Line 431: A statistical analysis of the wind speed deviation between ASCAT and ERA5 ~~with regard~~compared to the lidar observations

Line 432-435: Each box plot is calculated considering the wind speed difference of all the grid boxes with lidar data along the whole route of the ship, but grid boxes closer than 20 km away from the shore have been excluded to minimize the effect of ASCAT coastal contamination in the derived statistics.

Line 441-443: This indicates that both ERA5 and ASCAT are probably within measurement uncertainty of the lidar measurements for these heights. ~~yield similar performance in this segment of the profile, suggesting that they are both reasonably aligned with the lidar observations in the lower to mid-altitude ranges.~~

Line 443-445: ERA5 consistently underestimates the wind speed across the entire profile, with this negative bias becoming increasingly pronounced with altitude and reaching the largest negative mean bias of around 0.2 m s^{-1} at 270 m, which is (probably) still an insignificant difference with the lidar measurements if you take into account the accuracy of the lidar measurement itself ~~.~~

Line 445-446: As opposed to ERA5~~Contrarily~~, ASCAT profiles exhibit a persistent overestimation of wind speed relative to the lidar across all heights. This overestimation increases significantly above 170 m.

Line 447-450: For ERA5, the IQR is almost the same for ~~remains fairly constant across~~ all heights, with values around 0.5 m s^{-1}, suggesting the quality of ERA5 wind speeds does not depend on height~~a stable performance across different elevations~~. In the case of ASCAT, IQR displays a slight decrease with height, highlighting the larger and more consistent overestimation at higher altitudes.

Line 451-455: The whiskers analysis provides further insights into the discrepancies between the two datasets. For ERA5, the lower whiskers extend further into negative values as altitude increases, with the larger underestimations reaching approximately -~~1.3~~0.8 m s^{-1} at 270 m. ~~Differently,~~ ASCAT's whiskers reveal a different pattern:~~,~~ particularly noteworthy are the upper (positive) whiskers that extend significantly beyond the lower whiskers at ~~altitudes above 170~~270 m, illustrating once again the ~~. This observation strikes emphasises again the pronounced~~ tendency for ASCAT to specifically overestimate wind speeds at ~~higher elevations~~greater heights.

Line 464-469: Notably, the western area of the ship route (longitude below 18.5 degrees) exhibits the largest errors for both ASCAT-extrapolated and ERA5 winds, with maximum differences up to about 5 ~~exceeding 1~~ m s^{-1} at all elevation levels. In the eastern area of the ship route, there are maximum differences up to about 4 m s^{-1}. This indicates that wind speed estimation cannot be done accurately enough in ~~these~~ coastal areas using these datasets, first, because of the poor quality of ASCAT in areas closer to the coast, and secondly, due to the ~~insufficient~~ ERA5 grid box size of 31 km, which means that for distances closer than 31 km to the coast the surface roughness in ERA5 gridboxes is overestimated because of land-contamination. This effect will be larger near the harbour of Nynäshamn in Sweden (longitude 18°) than near the harbour of Hanko in Finland (longitude 23°) because with a prevailing W-SW'ly winds, the wind at Nynäshamn blows mostly from land to sea, advecting 'land surface roughness contamination' to sea grid points (at Hanko where the wind mostly blows from sea to land, 'water surface roughness contamination' is advected to land grid points).

Met opmerkingen [IW29]: I do not understand want you want to say here. The logaritmic profile represents a wind profile for neutral atmospheric stability. Do you mean that at the harbour sites the ASCAT-profile seems to follow a logaritmic profile up to 50-150m (so no stability correction occurs). What does that mean?

Met opmerkingen [IW30]: Why not 30 km to eliminate the land contamination in ERA5 (that you have used for stability correction)? Line 438-439 can go: you already mentioned that you did not use grid points closer than 20k from the coast.

Met opmerkingen [IW31]: This is what you have to assess. No measurement is without uncertainty.

Met opmerkingen [IW32]: But at what level does the difference become significant (bigger than lidar measurement uncertainty)?

Met opmerkingen [IW33]: Correct?

Met opmerkingen [IW34]: Nowhere in fig 13b so the whiskers reach -1.3 m/s?

Met opmerkingen [IW35]: Fig 13a: only at 270m height.

Met opmerkingen [IW36]: This is what I see in fig 14.

Met opmerkingen [IW37]: This is what I see in fig 14.

Met opmerkingen [IW38]: There are no ASCAT-values less than 12.5 km from the coast, so what are those "ASCAT" values in fig 14 for < 12.5 km distance from the coast? See also earlier remark about quality of ASCAT near coast (after quality control and just looking at sites > 12.5 km from the coast).

Also, a fairly course model like ERA5 is ~~ing, which is~~ unable to capture the small-scale wind flow variations in these complex locations and the intricate interactions in the coastal boundary layer influenced by both land and sea.

Line 474-475: It can be noted that, although ERA5 usually underestimates the wind speed, this is more pronounced at higher elevations and in the western part of the ship track.

Line 484-490: When comparing the two datasets, ERA5 shows a smaller nRMSE in the majority of the studied region, except in the 485 eastern area near the harbour in Hanko. This may be attributed to the differing spatial resolutions of the two datasets. In the east of 22 degrees longitude, the finer resolution of ASCAT mitigates the impact of coastal contamination, enabling it to capture local conditions more effectively and consequently leading to a lower average nRMSE in this region. In contrast, the coarser resolution of ERA5 may be insufficient to adequately represent the average wind characteristics in this area. Conversely, in the western part of the studied area, with features more intricate topography and a higher density of small islets within a few tens of kilometres from the mainland shoreline, ASCAT measurements are more susceptible to coastal contaminated.

4. Discussion

Line 510-513: For the mean stability correction methodology, we had to decide whether we would use the collocated or the full dataset. A disadvantage of the collocated dataset is that the stability information may be biased because ASCAT overpasses only twice a day at roughly the same time. ~~One of the primary limitations of the mean extrapolation technique is the requisite for a comprehensive characterization of the atmospheric stability throughout the comparison period. To address this, we examined the impact of the stability information available on ASCAT profile derivation by comparing two distinct strategies: the collocated and the full campaign approach.~~ The collocated and full dataset ~~Both~~ strategies demonstrated remarkable agreement across most of the examined area, resulting in very similar wind speed

5 Conclusion

Met opmerkingen [IW39]: Basically at a coast where there is an abrupt change of the surface roughness an internal boundary layer (IBL) is formed where the flow adjusts to the new surface roughness. This is what affects your results in coastal areas, mainly near the Swedish harbour where the wind mstly blows from land to sea. So why is the underestimation of the wind speed more pronounced at higher levels? I think because the Internal Boundary Layer (IBL) has not reached these heights yet. So basically the wind profile has not adapted to the surface roughness of the sea.
Internal Boundary Layer (IBL): Internal boundary layer growth following a step change in surface roughness | Boundary-Layer Meteorology . The height of the IBL grows the father away you are from the place where the surface roughness changes (coast). So at the Swedish harbour with a W-SW wind, the wind speed adapts to the lower sea surface roughness in the IBL. The further away from the coast, the higher this IBL.

Met opmerkingen [IW40]: See reasoning above.

Met opmerkingen [IW41]: How significant are the differences that you find in figure 15.
Also, I do not think you should put all heights together. At 10m ASCAT is ASCAT, at other heights ASCAT is not ASCAT, but you have used ERA5 data for stability correction. So you can only compare spatial resolutions at 10 m height. Due to land contamination, ERA5 (31 km) will always lose from ASAT (12.5 km) in joined gridpoints closer than 31 km from the coast. At other heights than 10m you include ERA5 data, so affectively make the spatial resolution courser.
The only reason why one location might on average be more land-contaminated than another is prevailing wind direction (if wind blows mostly from sea to land, there is less land-contamination).
Please rewrite this (and the rest of this) section or leave it out. You use the grid box land fraction argument to say that ASCAT is better than ERA5 near the Finnish harbour (I get that) and ERA5 is better than ASCAT near the Swedish harbour (that I think is wrong)???

Met opmerkingen [IW42]: Please look again at the discussion with all the remarks that I made earlier. I have not continued to check this section in detail (too much repetition of what has been said before), but my general remarks are: (1) This is not really a discussion, but more a conclusion (or summary?). Does this paper need a discussion section (discussion is included in the results section)? (2) Do not repeat (literary) what you have written earlier in the report and (3) Write clear sentences, Do not try to impress with long vague sentences.

Met opmerkingen [IW43]: Not checked. Needs to be adapted after revisions.