

Author's reply to referee comments

Kanarik, H., Tuomi, L., Alenius, P., Miettunen, E., Johansson, M., Roine, T., Westerlund, A., and Kahma, K.: Observed currents in the Archipelago Sea, EGU sphere [preprint], <https://doi.org/10.5194/egusphere-2025-1101>, 2025.

We thank the referee for taking the time to read and comment our manuscript thus helping us to improve our work. Below, referee comments are displayed with italic font. Our author replies are with plain blue text.

RC1, Anonymous Referee #1, 30 Apr 2025

This is a manuscript describing current measurements in the Archipelago Sea in the northern Baltic Sea. Observations time series from various times and locations are analyzed and related to forcing from winds, sea levels and air pressure, and it is found that winds are the main forcing component, but that sea levels can weaken or strengthen currents under certain conditions, mainly when the sea level in the Bothnian Bay is low and that in the Gulf of Finland is high due to seiching motions. Generally it is a well written and well performed study that deserves publication.

One issue is that it makes little sense to compare the maximum value between different observation series since it is a function of record length as well as ensemble length. It would be better to present a percentile value, e.g. 99% or 99.9% or something like that, e.g. of hourly mean current speeds, in order to make the numbers more comparable.

Thank you for this suggestion, as well as for the positive overall assessment. We have updated the values in Chapter 3.5 “Seasonal statistics of the current magnitudes” and removed the comparison of maximums from the very beginning. We also updated Figure 10 to include hourly mean magnitudes and 99% instead of maximum values. To enhance the persistency analysis, as suggested by second reviewer, we also added information of completeness of each season as well as seasonal persistence values from each station. In Chapters 3.1 to 3.4 where we discussed the characteristics of measured currents based on the area of the measurement, we think it is appropriate to keep the original measured values, especially as we focus to describe the measurements and the general directionality of the currents, driven by the geometry of the area.

Detailed comments:

We thank the author for noticing these mistakes in the text. In case of a larger correction, we have included the original and revised sentences to this answer.

- *Line 14: basing -> basins, current -> currents*
Corrected

- *Line 15: dirction -> directions, related -> relative*
Corrected
- *Line 66: published -> unpublished ?*
Corrected
- *Line 90-91: move “bottom mounted” to before “Teledyne” since Teledyne do probably not sell bottom mounted instruments 😊*
Corrected
- *Line 103: Unclear what this means. Was the instrument compass calibrated for magnetic variation or how was it taken into account?*

Sentence “Magnetic variation was taken into account during the deployment setup.” was changed to “Magnetic variation was corrected by calibrating compasses prior to deployments and applying up to date magnetic declination correction.”

- *Lines 142- 143: Unclear what is meant here. Winds are weakened between NNE and S but E (which is within this interval) is overestimated??*

We re-checked this information from the weather station, and it was written in unclear way. By “*between NNE and S*” we meant *area from west between S and NNE*. We changed the sentence “*The size and shape of the Isokari island weaken the winds from NNE to S directions; however, winds from E are slightly overestimated due to the height of the measurement device.*” to:

“As wind measurements are made on the eastern edge of the Isokari island, the size and shape of the island weaken the winds from the western sector between the S and NNE directions; however, winds from E are slightly overestimated due to the height of the measurement device.”

- *Lines 157 - 159: Unclear text. Please clarify.*

Sentence “*As in this study, we are interested in the sea level tilt driving the currents, we used hourly sea levels relative to the theoretical mean sea level for statistical analysis over climatological standard normal period of 1991 to 2020 and half-hourly measurements for analysis on simultaneous current and sea level measurements.*” was changed to the following format to avoid repetition with text in an earlier chapter and make it more clear. The first sentence of the chapter “*To evaluate the relation between currents and the sea level differences over the area, we analysed hourly instantaneous sea level data from tide gauges at Rauma ...*” was also corrected :

*“To evaluate the relation between currents and the sea level differences over the area, we analysed **instantaneous sea level data** from tide gauges at Rauma ... **The sea level values used are given relative to the theoretical mean sea level. For statistical analysis of typical sea level difference, we used hourly instantaneous data over climatological standard normal period of 1991 to 2020.**”*

- *Line 190: “Halocline” -> “The halocline”. Please also check similar issues other places in the text.*

Corrected

- *Lines 236-240: This is interesting, since it must mean that water is added along the length of the channel. Any speculations about where this water is taken from?*

This refers to lines: “The narrowness and length of the strait strengthen currents along the flow direction, so that southward travelling currents are strongest at the southern edge of the strait and vice versa, as seen from simultaneous measurements of currents in Norrgrundet and Gloskär (Fig. 8). The distance between the stations is around 28 km (15 nautical miles) and within this distance, the current magnitude increases to around double in the northern end of the channel with northward currents. For southward currents, the increase in magnitude along the channel is slightly less.”

We see that our sentence here was bit misleading here. We wanted to emphasize that in these straits there are two factors that increase the flow strength: first the narrowness of the strait compared to the more open areas, where the waters push into the strait strengthening the flow speed, and second the length of the straight enables growth of flow speed also by winds. We have updated this part as follows:

“The flow speed increases as the water flows into the narrow strait from the more open areas of the north and south. Additionally, wind can further increase the flow speed along the channel. As a result, southward travelling currents tend to be strongest at the southern edge of the strait and vice versa, as seen from simultaneous measurements of currents in Norrgrundet and Gloskär (Fig. 8). ...”

- *Line 267: This -> these*

Corrected