Authors' response to the 'Interactive comment to “Variability of air-sea gas transfer velocity on the Baltic Sea”' by Anonymous Referee #2

We would like to express our gratitude to the Anonymous Referee #2 for their thorough and helpful review. Our answers are given in the table below.

Reviewer's comment	Authors' response
1. The purposes of the manuscript is not clearly formulated. The title suggests that the purpose was to demonstrate how the air-sea gas transfer varies in the Baltic Sea, but inside the text suggests other objectives. Is the objective to compare active thermography method with dual trace method? Or is the purpose to prove that fetch and surface active material have a significant effect on the gas transfer velocity. Or is the purpose of proving that in the transfer velocity study should we use the Schmidt exponent dependently on water conditions?	The purpose is indeed manifold. First, to present the gas transfer velocities we measured in the baltic sea. Second, to stress that under (even suspected) surfactant influence, the correct Schmidt number exponent should be used. And third but not least to interpret the measured gas transfer velocities with respect to fetch/wave age and surfactants. The dual tracer parameterization by Ho et al. 2011 was chosen to compare our results against, since this study is based on the most thorough compilation of dual tracer data, and it is one of very few studies providing a confidence interval for their parametrization. Since generally dual tracer studies agree quite well with eddy covariance measurements, we could also have chosen a parametrization developed with eddy covariance data, without changing our conclusions. To better represent the purpose of the manuscript, we changed the title to a more general 'Measurements of air-sea gas transfer velocities in the Baltic Sea'
2. The article in its current form - short, specific information on a given topic, without any extensive descriptions of the transfer velocity - is attractive for scientists who are interested in this topic. But for scientists who are not familiar with this topic, this article may be embarrassing, ...	The audience, that this article was intended for was indeed researchers, who personally work in the field of air-sea gas exchange or in very closely related fields. It was specifically not intended to be an overview of air-sea gas exchange research or measuring techniques for a general audience.
2. cont. ..... because they will learn specific results from the use of a given measurement technique, but will not know anything about why this is happening. This article is of a purely technical nature rather than a scientific article.....	Schmidt number scaling is done to provide gas transfer velocities, which are explicitly not depending on the measuring technique, and also not depending on the tracer used (different gases, or, in our case. heat). Therefore, the results we presented are not 'results from the use of a given measurement technique', but results any technique would have yielded given the same boundary conditions (ie. the same wind speed, fetch, surfactant coverage..). We added a sentence ('Schmidt number scaling is used to provide a value for the gas transfer velocity, which is independent of the specific measurement technique or tracer.') to paragraph 3.2 to stress that.
2. cont. .... It is important to add more information about the different methods that are used for study transfer velocity or more information about the gas transfer velocity itself and in the Baltic Sea.	Different methods commonly used (dual tracer and eddy covariance techniques) are already mentioned in the introduction. We added a reference in the introduction to an overview paper where measurement methods are described in detail. (' \citet{wanninkhof 2009} gives an overview of the most commonly used techniques to measure the gas transfer velocity.')

a. The Introduction should be extended about information described above. A few sentences about various technique to study gas transfer. What is the ACTF method characterized. Some more information about correlation k with u*. Perhaps more information about variability of air-sea gas transfer velocity in the Baltic Sea, as the title suggested.	Describing the ACFT in the introduction is not necessary, since a brief description of the ACFT is given in section 3.2. We added a reference to section 3.2 to the introduction. also see answers to point 2.
b. More information why mainly wind speed is taken into consideration in air-sea study and why we should add more factors. Not only write the other factors.	added statement 'since wind speed is the most readily available parameter.' to sentence 2 in the introduction. Some factors influencing the air sea gas transfer velocity other than wind speed are mentioned in the introductory paragraph of section 2. Two selected factors (Surfactants and fetch/wave age) are discussed in detail in sections 2.1 and 2.2. There, experimental evidence is given in the form of references that both factors are indeed modifying the gas transfer velocity and need to be taken into account.
c. P2L6 . . .the active controlled flux (CFT). . .	abbreviation added & sentences slightly rearranged
d. P2L 9 add references after: A wealth of studies (references) have shown. . ..	We decided to group the 'wealth of studies' using the respective factor each of them addressed, respectively. So all references that follow later in the sentence are selected studies from the aforementioned 'wealth of studies'.
e. P3L27..the active controlled flux (CFT)	abbreviation added
f. Please exchange para 4.1 with 4.2 for better organization, as you mention in presence para 4.1 cruises which are introduce in presence para 4.2	we swapped paragraphs 4.1 and 4.2
g. P7L29 - . . .from 25 April 2009 until 7 May 2009 on the German. . ..	replaced 'March' with 'May'
h. P9L11 During most of the FS Alkor campaign in 2010 ... .. this should be after Fig. 5 where you introduce this cruise	Figure placement will be taken care of in the production stage of the finalized manuscript. We added a clarifying statement that this paragraph is about the Alkor 2010 campaign in the previous sentence, where the fig 5 is referenced for the first time.
i. The results and conclusion are very short when they are the most important part of the article. Maybe comparison with other data from the Baltic Sea.	Unfortunately, not many measurements of gas transfer in the baltic sea exist. We have added a sentence mentioning both previous measurements of gas transfer in the Baltic, and compare our results with one of them (Fig.6). We have significantly extended the discussion of our results, to more thoroughly argue that surfactants are the most likely reason why the Aranda2010 results from the Archipelago are lower than expected. We have also added a discussion of why we think bubble mediated gas transfer is no valid explanation for this to comply with the requests of the other two reviewers. To do this, we have added one eddy covariance based parametrization of CO_2 gas transfer and two eddy covariance based data sets of DMS transfer to Fig. 6.

j. We know that at higher and lower wind speed gas transfer are limited so maybe more about that.	The ACFT method cannot be used to measure gas transfer at very low wind speeds. Therefore, discussing limits in the low wind speed case is outside of the scope of the presented manuscript. For high wind speeds, the gas transfer velocity was found to be not limited, see: McNeil & D'Asaro 2006: Parameterization of air–sea gas fluxes at extreme wind speeds https://doi.org/10.1016/j.jmarsys.2006.05.013 Iwano et al. 2013: Mass transfer velocity across the breaking air–water interface at extremely high wind speeds https://doi.org/10.3402/tellusb.v65i0.21341 Krall & Jähne 2013: First laboratory study of air–sea gas exchange at hurricane wind speeds https://doi.org/10.5194/os-10-257-2014