

# ***Interactive comment on “Evaluation of atmospheric nitrogen inputs into marine ecosystems of the North Sea and Baltic Sea – part B: contribution by shipping and agricultural emissions” by Daniel Neumann et al.***

**Daniel Neumann et al.**

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## **Response to review comment #2 by referee #3**

We thank the reviewer for the positive feedback to our manuscript and for suggested improvements.

Below, the reviewers comments are written in bold letters and our answers in non-bold letters.

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**Reactivity of ammonia with sea salt:** It is stated several times that condensation of ammonia on sea salt particles enhances the removal of ammonium from the atmosphere in the coastal zone. Please could some specific citations of observational reports be added that support this statement? (Some literature is cited at the first occurrence (line 24, page 2), while subsequent statements do not include citations. Of the sources cited on page 2, the observational data presented in Kelly et al. 2010 (Figure 5 of the paper) directly contradict the statement). What mechanism drives this process?

> Ammonia has a low residence time in the gas phase but tends to condense on surfaces (= ground or existing particles) or tends to form new particles. If there are relatively many large (“coarse”) particles in the ambient atmosphere, relatively more ammonia condenses on these large particles. If there are relatively many small (“fine”) particles in the ambient atmosphere, relatively more ammonia condenses on these small particles. Coarse particles have a lower atmospheric residence time than fine particles because they have a higher dry deposition velocity (higher gravitational settling). Hence, if the major share of atmospheric particles is of coarse size, the dry deposition of ammonium is enhanced compared to a situation with predominantly fine particles. In coastal regions, sea salt is a dominant source for atmospheric coarse particles. Hence, a large fraction of ammonia condenses on the surface of sea salt particles, which desist fast to the sea.

> The reviewer is right, Kelly et al. (2010) does not state it directly. We mixed it with another publication. Please excuse us. Kelly just states: “*Due to the different deposition velocities of gases and particles, condensation of HNO<sub>3</sub> and NH<sub>3</sub> on coarse sea salt can alter nitrogen deposition to sensitive ecosystems (Pryor and Sorensen, 2000; Evans et al., 2004).*”. We will add further correct references if the paper is not rejected.

**Length of manuscript and repetition:** There are many examples where sections

**of text are repeated in this manuscript. I can see no advantage to this I list some examples, but there are more. [...]**

> We will shorten the manuscript and consider the suggested improvements in a revised version of the manuscript.

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