

## ***Interactive comment on “Quantifying importance and scaling effects of atmospheric deposition of inorganic fixed nitrogen for the eutrophic Black Sea” by A. Varenik et al.***

**Anonymous Referee #2**

Received and published: 24 August 2015

General Comment : The manuscript focuses on the dissolved (or water-soluble) inorganic nitrogen (DIN) species (namely, nitrate, nitrite and ammonium) in rainwater samples obtained from rural and urban sites located at the northern Black Sea (Crimean coast). The study reveals that nitrate and ammonium have almost equal contributions to the dissolved inorganic nitrogen whilst contribution of nitrite to DIN is less than 5 %. The highest concentrations of DIN species are found in winter whereas, the intra-annual difference is statistically important for the urban site Sevastopol. The wet deposition of DIN is found to be 39 % of the riverine input. Furthermore, the manuscript relates wet DIN deposition and marine productivity, with 1.5 fold increase in chlorophyll-a. Considering the atmospheric deposition over the Black Sea, the re-

C4655

search is limited. Thus, I suggest the acceptance of the manuscript for publication. However, the manuscript should be revised before considering it for publication (see comments below).

Specific Comments Title: It would be useful to use dissolved inorganic nitrogen (DIN) instead of inorganic fixed nitrogen, since the measured species are not fixed. These species simply presented in the water-soluble fraction.

Abstract As stated, DIN deposition is reported for rainwater samples. Therefore, it would be suitable to apply wet deposition instead of atmospheric deposition throughout the whole document (for example, see line 1: wet deposition and line 16: atmospheric deposition)

Lines 13-15: Please specify riverine input as t N yr<sup>-1</sup>. On the other hand, Ludwig et al. (2009) have assessed the riverine input of 1.12 t N yr<sup>-1</sup> for the Black Sea. Regarding reported riverine input, the DIN from wet deposition is only 28 % of the riverine input. Ludwig et al. (2009): *Progress in Oceanography* 80(2009) 199–217.

Keywords: It seems that the keywords are missing.

Introduction The words ‘yet’ and ‘but’ are applied quite often. Please use another word from time to time (see page 3, lines: 4, 5, 6, 15).

It seems that the usage of the ‘recent’ is awkward. For example, (page 3, line 11-13) ‘it has been recently found that. . . (Donaghay et al., 1991; Duce et al., 2008). The cited studies are not recent; on the other hand, the former one is published 24 years ago. The same mistake can be throughout whole text. Please correct these mistakes.

Page 4, Line 18: Kubilay et al. (2013) should be Kubilay et al. (1995). Please check cited studies.

Page 5, Lines 4-6: Medinets and Medinets (2012) have discussed the temporal variability of the atmospheric deposition of DIN between 2004 and 2010. For example, they found the highest wet DIN deposition in 2009. Please consider aforementioned

C4656

publication and rephrase lines from 4 to 6.

Medinets and Medinets (2012): Turkish Journal of Fisheries and Aquatic Sciences 12: 497-505 (2012)

2. Data and Methods Page 6: Please use official pages while addressing sampling sites Katsiveli and Sevastopol. Remove Wikipedia links.

Page 6, third paragraph: A total of 228 and 217 rainwater samples are obtained from Sevastopol and Katsiveli, respectively, between 2003 and 2008. Please give information about sampling coverage so that the reader may assess the rigorousness of the sampling campaign.

Page 7, lines 5-16: The manuscript gives information about observed levels of nitrogen species in rainwater samples. However, there is no information how the authors calculate nitrate, nitrite and ammonium in rainwater samples. As it is well known, concentrations in rain must be calculated considering volume weighted means (VWM). Without applying VWM, concentrations will be misleading. Moreover, there is information about calculation of wet deposition (see Herut et al., 1999, 2002). Please give details about these issues.

Herut, B., Krom, M.D., Pan, G., and Mortimer, R.: Atmospheric input of nitrogen and phosphorus to the Southeast Mediterranean: sources, fluxes and possible impact, *Limnol. Oceanogr.*, 44, 1683–1692, 1999. Herut, B., Collier, R., and Krom, M.D.: The role of dust in supplying nitrogen and phosphorus to the Southeast Mediterranean, *Limnol. Oceanogr.*, 47, 870–878, 2002.

Results and Discussion 3.1. IFN speciation, average concentrations and temporal variations As the title implies (see comment above), it seems that manuscript use arithmetic mean values instead of VWM. If VWM are applied, clarify it? If not, then use VWM to present your data.

Page 10, lines 24-28: It is suggested that the observed values of DIN might be affected

C4657

by long range transport (LRT) and local sources (LS). Indeed, values might be affected by LRT and LS. However, there is no attempt to clarify or support aforementioned suggestion. Thus, it would be useful to categorize air masses back trajectories and assess the influence of air flow on the DIN composition. In addition to fuel combustion, are there any possible sources for DIN, such as residential heating, wood burning, and vehicle emissions?

Page 12, lines 21-23: The emission from ship should be considered since the urban site is near to port.

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Interactive comment on Biogeosciences Discuss., 12, 11159, 2015.

C4658