

Interactive comment on “Long-term atmospheric nutrient inputs to the Eastern Mediterranean: sources, solubility and comparison with riverine inputs” by M. Koçak et al.

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Response to Reviewers

We would like to thank the editor and the reviewers for their comments that have helped us to prepare this final version. All suggestions have been taken into account and all raised issues are answered one by one. References have been included as proposed. The section related to sea-water solubility has been exempted from the manuscript as suggested. Minor comments have been also taken into account. Below is a point by point answer to the reviewer's comments (by Italics).

Reviewer2 In this paper, plenty of data was used to study the nutrient composition
C3935

in aerosol and rainwater and their temporal variation, solubilities of nutrients in pure and sea water, and the comparison between atmospheric and riverine nutrient inputs for Northeastern Levantine Basin of the Eastern Mediterranean. Most of the results are reasonable and instructive, but there still some descriptions are confused, and there are so many clerical errors in the context. The manuscript may need moderate revision before final acceptance for publication. Some general comments and specific questions/remarks are given below:

General comments: Q: 1. Based on my knowledge, there are lots of researches on the input of atmospheric deposition and related topics over Mediterranean Sea, including the studies of the authors. I recommend the author to elaborate on the scientific reasoning and rationale for the paper in introduction to inform the reader what questions are being asked, why this paper is necessary to answer these questions.

A: We agree with reviewer. The scientific reasoning has been added to the introduction part.

Q:2. The estimation procedure of wet deposition is not clearly documented. Like the calculation of riverine discharge fluxes of nutrients, the estimations of wet deposition fluxes should be based on individual concentration of nutrients and precipitation in rainwater not directly by Eq.1, because the precipitation and nutrient concentration are quite different for individual event if you can find all the precipitation records. If you have not recorded all the precipitation events, you can use annual amount of precipitation as shown in your paper, but the C_w should be described as volume weighted ANNUAL mean concentration. A: The estimation procedure of wet deposition has been clarified by adding formula about volume weighted mean nutrient concentrations.

Q: 3. The authors may reduce some of the contents to make this paper simple and understand easily. The section of nutrient solubility might not be necessarily included.

A: Indeed, exclusion of the part concerning nutrient solubility in sea-water would make the manuscript simple and understand clearly. Consequently, this part has been omit-

ted from the paper.

Q: 4. Table 2 is not clear. Samples were collected from January 1999 to December 2007 for this study, but in this table the aerosol sampling period was Jan 1999–Dec 2009. In the first part of this table, the nutrients are NO₃ and NH₄, the author may miss the name of nutrients.

A: Related discrepancies have been corrected.

Q: 5. In the description of sampling site, it is said the sampling site is not under direct influence of any industrial activities. What is the distance from large pollution sources? On page 5089 line 22-24, “whereas lowest values were observed at Finokalia (Markaki et al., 2003) since this site is categorized by natural background (distance from large pollution sources >50 km)” is there any conflict with the sampling site description for this study? and in Table 2, there is no rainwater sample in Finokalia. Please check.

A: Indeed, the rural sampling site (Erdemli) is not under direct influence of any industrial activities. However, its immediate vicinity is surrounded by lemon trees, cultivated land and greenhouses. The city of Mersin (population ~ 800,000) is located 45 km to the east of the sampling site. More information has added into sampling site description. Unfortunately, Markaki et al., (2003) has reported rainwater samples from Heraklion, Crete but not Finokalia. On the other hand, Finokalia site is located (35° 20'N, 25° 40'E) on the northern coast of Crete. The nearest largest urban centre is Heraklion with 150,000 inhabitants located 70 km west of Finokalia.

Q: 6. It is interesting to compare the nutrient concentrations in aerosol by different sampling filters. The results show considerable difference that NO₃ and NH₄ values by Whatman 41 were 42% and 50% higher than those by polycarbonate filters. The question is which results are reasonable?

A: If one want to measure only aerosols then polycarbonate. Whatman will measure

C3937

both aerosol and gaseous phase, which for our purpose which is estimation of nutrients deposition (in both gaseous and particulate forms) is not wrong. In addition to dry depositions of nitrate and ammonium, alternative dry depositions will also be presented in parenthesis after multiplying by 0.58 and 0.50 (please see Table 5).

Q: 7. It is said that the lower values of aerosol nutrients in winter can be attributed to efficient removal via frequent rain events (70% of the annual amount) on page 5091. Why the discharges of rivers show highest values during spring not winter on page 5097? What's the seasonal variation of precipitation in the research area?

A: There is no snow on the coastal sites, as expected. However, the ridge of the Mountain Toros lies parallel to the coast from Syria to Rodos Island and receives important amount of snow during winter. The discharges of rivers denotes highest values in spring due to melting of snow.

Q: 8. It is suggested that the author should made a comparison between some published results of dry and wet nutrients fluxes and those in this study.

A: Comparison with literature values has been added.

Specific questions/remarks Q: Page 5078 the units of Fw, Cw, P, Fr, Cdw, Qannual should be given just after the Eq.1 and Eq.3.

A: Equations have been rearranged.

Q: Page 5084 line 1 “The Mediterranean has one of the highest fluxes: : : : :” is not clear.

A: Sentence has been rephrased.

Q: Page 5084 line 19 “atmospheric (dry and wet)” should be atmospheric deposition Page 5085 line 8 “form” should be from.

A: Mistakes have been corrected.

C3938

Q: Page 5085 line 14-15 “Samples and blanks (n=110) were kept cool at 4 °C until analysis”. How long is the period from sampling to analysis?

A: Never exceeds a year. Tests showed no significant change under the storage conditions.

Q: Page 5085 line 21 what is “sampling coverage” A: Please see Table 1 and introduced definitions.

Q: Page 5086 line 21 “Air masses back trajectories” should be Air mass back trajectories. There are still several similar clerical errors in the context.

A: Errors have been corrected through the manuscript.

Q: Page 5086 line 24-26 “Daily back trajectories between January 1999 and December 2007 were evaluated for 3 days for three different heights above the starting point at ground level (1, 2 and 3km a.g.l.)” is not clear.

A: This sentence has been clarified.

Q: Page 5087 line 18 “The latest provided from General Directorate of State Hydraulic Works, Turkey.” is not clear.

A: Sentence has been corrected.

Q: Page 5089 line 18 “equivalent to be” should be equivalent to.

A: Equivalent to be has been corrected as ‘equivalent to’

Q: Page 5090 line 8-9 “Although particles are efficiently scavenged by wet deposition (26% of the annual amount, 39% of the total events, one rain event per 5 day)” What are “26% of the annual amount, 39% of the total events, one rain event per 5 day”? The meanings of these percentages are not clear. How can you get them? In this sentence, “wet deposition” was not used correctly.

A: The numbers were used in the manuscript have been explained.

C3939

Q: Page 5090 line 18 “was observed” should be deleted.

A: Correction has been done as suggested.

Q: Page 5091 line 9-10 “from the atmosphere via frequent rain events (70% of the annual amount, 55% of the total events, one rain event per 3 day)”. The meanings of these percentage numbers in bracket are not clear. How can you get them?

A: The numbers were used in the manuscript have been explained.

Q: Page 5091 line 9-10 “For instance, rain samples associated with air masses from North Africa and which had a red “mineral dust” had pH values as high as 7 as a result of the dissolution of calcium carbonate originated from dust” is not clearly expressed.

A: This sentence has been clarified.

Q: Page 5092 line 5-8 “Rain events on 2 and 3 December showed drastic decreases in pH (3.4) and Sidiss since crust originated particles removed from atmosphere efficiently and resulted in a deficiency of neutralizing agents such as calcium carbonate” is not well written.

A: Sentence has been corrected

Q: Page 5095 line 12 “36 (0.56, 0.70 and 3.48 nmolm⁻³) h” should be 36h (0.56, 0.70 and 3.48 nmolm⁻³).

Q: Page 5096 line 13,16 “Vd’s” should be “Vd ”

A: Vd’s have been replaced with Vd.

Q: Page 5109 Table 4 “DW” should be “SW”

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C3940