Biogeosciences Discuss.,
doi:10.5194/bg-2016-226-RC1, 2016

Biogeosciences
Discussions
Open Access

Interactive comment on "Abiotic versus biotic controls on soil nitrogen cycling in drylands along a 3200 km transect" *by* Dongwei Liu et al.

Anonymous Referee #1

Received and published: 15 June 2016

General comments:

Overall, this manuscript provides an insightful data set that I believe will be of interest to anyone interested in aridland biogeochemistry. The large geographic scale and compound-specific isotopic analysis are especially valuable and the conclusions reached seem valid. Generally, the discussion of the mechanisms driving the observed patterns is thorough. There are some issues that need addressing, primarily in the discussion where several important processes have not been raised (mainly NO production), and there are several mechanisms that do not make sense (perhaps partly as a result of unclear English). This section would benefit from revision.

Generally, the figures are clear and informative. Editing for English language is necessary prior to publication.

Specific comments:

Methods: Is it just a coincidence that there is a gap in sampling sites around 100 mm MAP?

Discussion: What about loss of NO during nitrification? NO can be the dominant trace gas emitted from arid soils, and would explain loss of ammonium without subsequent appearance of nitrate. For process see Firestone & Davidson (1989) For arid land NO production see Homyak et al (2016, PNAS) and Soper et al (2016, Global Biogeochemical Cycles). This process belongs on Figure 8! A discussion of the isotopic consequences of this process should also be included.

Re foliar 15N reflecting 15N of NH4+ in the soil- this could also reflect shifting plant physiology across the significant precipitation gradient, rather than just plant source preference for ammonium. Many aspects of plant internal N cycling likely shift as a function of water availability and would influence foliar 15N. This should at least be acknowledged as an alternative explanation. Also, ammonium shows a larger range of isotopic values along the transect than nitrate, making it less likely that plant 15N would correlate with nitrate 15N anyway.

Deposition- I think you need to be clear about the difference between wet versus dry deposition (with different isotopic signatures) and how you might expect them to change along the transect. Are there any measures of deposition anywhere on the transect you could mention?

Line 225- nitrate could also be removed from the soil by biological uptake. This also has potential to be a fractionating process (although evidence for fractionation by directly by plants under field conditions is limited, mycorrhizal fractionation is likely). You posit later that plant uptake of nitrate is low, but this may not necessarily be the case.

Line 235- increasing compared to what? This is important.

Line 244- There are several potential mechanisms for chemodenitrification (see again

Homyak 2016)

Line 255- Soper et al (2016, Global Biogeochemical Cycles) did find increased NH_3 flux with wetting in an arid system.

Line 256- “First, plant uptake will be enhanced when it is coupled with the microbe-regulating N cycling”- I’m not sure what this means

Line 268- This doesn’t make sense. I don’t know of any evidence showing preference for enriched substrates- I would expect it to be exactly the reverse in fact.

Line 324- This paragraph should be rewritten for clarity- right now it’s just listing off a bunch of processes and it’s confusing. What are the processes that would explain more NH_4^+, with higher enrichment, at low precipitation? Increasing volatilization with precip explains the concentration gradient, but would induce the opposite isotopic pattern (though it depends really on how much volatilization occurs as a fraction of the standing pool). A greater proportion of atmospheric deposition versus mineralization at low precip might explain the higher 15N. If you invoke fixation by BSCs at low precip, this would also tend to decrease, rather than increase, the 15N at those sites. This also this needs to be clarified- are there BSCs on the transect? However it looks from the gene abundance data like Nfix genes increase along the transect. Rethink this paragraph.

Line 336- Does fractionation during mineralization actually increase with mineralization rate though? I don’t recall any evidence for this. Also I think invoking heterotrophic nitrification, when as far as I know there isn’t a lot of evidence this is an important process in the field, is a stretch. Maybe remove.

Line 359- “Increasing ammonification with increasing MAP both reduced NH_3 volatilization” Why would more mineralization reduce volatilization? Unless you mean that volatilization decreases with precip? Again, I’m not sure that this is necessarily true. pH probably the main driver.

Line 360- why does more mineralization mean more plant uptake? Plant uptake is likely

more a function of water availability. These things likely co-occur, but it’s not causal. Perhaps misinterpretation of wording- re-write

Figure 8- I think it needs to be clear that the size of arrows indicates qualitative interpretation of these fluxes rather than actual measurement- the presence of pool sizes on the boxes makes this especially necessary. And again, NO loss is likely much more important than ammamox and should appear here.

Technical corrections:

The manuscript contains many examples of awkward or technically incorrect English that can obscure meaning and requires editing by a native English speaker before publication. E.g. in the abstract –‘our understanding of’ might replace ‘understanding about’ and ‘nitrogen cycling in drylands’ rather than ‘nitrogen cycling of drylands’. Also ‘the patterns and mechanisms of water availability on soil N cycling’ doesn’t make technical sense. ‘Driving’ rather than ‘driven’. ‘Above and below’ rather than ‘on the two sides of’. ‘Preference for’ rather than ‘preference of’, etc.

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-226, 2016.