

Comments on Theron Miller AD memo

Utah Lake Water Quality Science Panel:

This morning I read Dr. Theron Miller's memo ("*Comments on the white paper*") on Dr. Janice Brahney's white paper draft on atmospheric nutrient deposition to Utah Lake. I will not attempt to go over every detail in Dr. Miller's memo, instead I will focus on a few key points.

1. Dr. Miller disagrees with the use of the Lake Tahoe study by Dolislager et al. (2014) as an analog system for Utah Lake. Dr. Miller points out that Lake Tahoe and Utah Lake are very different in many regards. This point is obviously true, but I don't think it directly pertains to Dr. Brahney's use of this example. Dr. Brahney was using the Tahoe study to get at the very specific question of how rapidly nutrient containing atmospherically transported particles attenuate. Specifically, how rapidly will nutrient AD decrease with increasing distances from the lake shore and AD sources? This is obviously a complicated topic but given that this has been studied extensively in the Lake Tahoe basin insights on AD attenuation across a large lake surface are highly relevant to attempts to understand similar phenomena in the Utah Lake basin. Perhaps the particles discharged to the atmosphere near the shoreline of Lake Tahoe have different characteristics (e.g., size distribution) compared to analogous particles near the shoreline of Utah Lake that would in turn affect the distance these particles would be transported across the lake surface? I strongly agree with the recommendation from the draft Dr. Brahney white paper to specifically and directly determine how quickly AD drops off as particles are transported across the lake using field observations at Utah Lake.

2. Dr. Miller's memo has an extended discussion of the Olsen master thesis atmospheric loading estimates. In this case, I feel Dr. Miller is trying to have it both ways. Dr. Brahney correctly pointed out that the contaminated Olsen estimates are approximately 2-orders of magnitude higher than other analogous estimates. The ULWQS Science Panel has discussed the contaminated estimates from the Olsen thesis several times, and in my personal opinion the contaminated estimates should not be believed because they very likely include a substantial contribution from emerging chironomids which are in fact a sink of nutrients from Utah Lake and not a source of nutrients to this system. (alternatively, the emerging chironomids are an example of nutrient recycling as Dr. Miller argues in which case they would play a neutral role in the overall Utah Lake nutrient mass balance).

It is true that the uncontaminated Olsen atmospheric loading estimates are only somewhat higher than other estimates provided in Dr. Brahney's draft white paper. In my opinion, the uncontaminated values are plausible and should be taken into consideration when attempting to estimate the potential atmospheric nutrient loading to Utah Lake. But Dr. Miller is also attempting to argue that because the uncontaminated Olsen estimate is similar to Dr. Brahney's higher estimates, the contaminated Olsen estimates should also be included in the mix of information considered when estimating potential atmospheric nutrient inputs to Utah Lake. For example, Dr. Miller's memo states "*These data suggest that P loading is somewhere between Olsen's high estimate, including contaminated samples (373 metric tons total P per*

year) and Olsen's low estimates, discarding contaminated data (including excluding samples with any single piece of debris; 17 metric tons per year)." I strongly disagree with this point. The contaminated Olsen estimates are unreliable because they include nutrients that are actually being exported from Utah Lake! Therefore, only the uncontaminated Olsen estimates should be considered. I could say more, but I feel this particular topic has already been given considerable attention in various ULWQS meetings.

3. Dr. Miller also makes the point that quantifying atmospheric nutrient transport to lakes is very complicated. While I am no expert on this topic, I have listened carefully to the various conversations on this topic and I certainly agree that obtaining plausible AD estimates for nutrients is non-trivial. I also agree that the ULWQS Science Panel should strive to reach a consensus on appropriate methodologies for these estimates, and hopefully contracting with an external AD expert will help us reach a resolution on this topic.

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