NEON Atmospheric Stable Isotope Technical Working Group

2020 Annual Report

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National Ecological Observatory Network (NEON) is a project sponsored by the National Science Foundation and proudly operated by Battelle.

Introduction

Since its inception, NEON has relied on expertise within the science, education, and engineering communities to advise on key areas impacting the design, construction, and maintenance of the observatory with the goal to optimize its operation. Currently, two types of external advisory bodies support staff and leadership in making key decisions that guide all of NEON's activities: the Science, Technology & Education Advisory Committee (STEAC) and Technical Working Groups (TWGs). Both bodies are comprised of experts nominated to serve in these roles who are selected by NEON staff following a rigorous selection process.

NEON currently relies upon input from 22 TWGs. These groups play an important role by providing input to NEON's data collection and processing methods and ensuring that NEON infrastructure, data, and programs are a valuable community resource. Working groups are participatory and advisory; they are often tasked with providing input on issues that have scientific, educational, engineering, or operational implications.

This document includes a summary of activities, recommendations, and NEON's response to those recommendations for the Atmospheric Stable Isotope TWG during the 2020 funding year (November 2019-October 2020).

The Atmospheric Stable Isotope Technical Working Group provides guidance regarding sensor designs and assemblies, data products, and field and lab procedures and protocols to measure atmospheric stable isotopes of ^{13}C in CO_2 and ^{18}O and 2H in water vapor and precipitation water.

Q1 – November 2019-January 2020

Summary of Activities

~~This~~ The TWG focused on general status updates and group introductions for new members, as well as discussion of a few TWG member~~-~~identified data quality issues. We also discussed plans to identify ~~what~~ NEON priorities ~~should be~~ for the isotope data products during the remainder of 2020.

TWG Recommendations

The TWG members recommended that we check our reported reference gas uncertainties, as they look higher than expected. They also requested that we ~~look into~~investigate the root cause of some unusual measurement values that occurred for a period of time ~~time period~~ at two sites. High priority items identified by the TWG were monitoring data quality and continuing with the low humidity dependence (LHD) tests that are currently in progress.

NEON Response

We investigated all issues brought up by the TWG. For the reference gas uncertainties, we suspect a mapping issue of values sent from the Calibration, Validation and Audit Lab (CVAL), through the processing pipeline, to the output HDF5 files. This is now in troubleshooting with our cyberinfrastructure team. For the unusual measurement values, we confirmed sensor problems. For the affected time

periods at each site, we raised the science review quality flag to mark these data as invalid. We plan to implement the LHD tests along our current plan as suggested.

Q2 – February 2020-April 2020

Summary of Activities

The TWG held email discussions to fully prioritize future work related to the stable isotope data products. This prioritization was achieved by each TWG member ranking our proposed items, then the list was sorted to identify what items were most important to the science community. The TWG chair then summarized the information. Later in the quarter, we provided the TWG with a progress update on previously discussed topics, incorporated TWG recommendations into team quarterly planning, and distributed this plan to the group.

TWG Recommendations

The top items identified in TWG prioritization were to 1) improve data quality, 2) make LHD test data and plots available to community, and 3) implement strategies to increase data availability. The group suggested elevating priority of things that can only be done by NEON staff, such as working to improve data quality, compared with what can also be done through community code development (such as data calibration, which is already under active development at the University of Utah).

NEON Response

We investigated data quality issues and resolved the TWG-identified problem with reported reference gas uncertainty values. This required calibration files to be reprocessed from CVAL, however values won't be updated in the bundled EC HDF5 files until data product reprocessing. Additionally, our future work prioritization plan was adjusted based on feedback from the TWG.

Q3 – May 2020-July 2020

Summary of Activities

The TWG ~~D~~discussed whether to continue archiving Picarro raw data files. These files contain the raw spectrum data before it is processed by the instrument software.

TWG Recommendations

The TWG recommended that we continue to archive the files, although there was discussion regarding storage cost vs benefit to the science community. TWG members advised that that the technology for laser absorption spectroscopy is evolving and preserving raw data files will ensure that we retain the ability to assess whether long term trends are real or the product of changing algorithms. It was suggested that these files would not often be needed, so it is not necessary to stream the files back to NEON HQ, and that storage of files could be re-assessed every 5 years as algorithms stabilize.

NEON Response

NEON will continue to archive the Picarro files but will examine cost-saving data transfer strategies. Data storage costs will accumulate over time, we will revisit this discussion and potentially examine other storage options according to the suggestion that these files will not be frequently accessed.

Q4 – August 2020-October 2020

Summary of Activities

No activity for Q4.

TWG Recommendations

N/A

NEON Response

Work is ongoing to address previously raised data quality concerns and recommendations.