Overview

This document provides a brief description of the PACE OCI NO_2 product. These products were produced by Zachary Fasnacht (SSAI, NASA GSFC). The PACE Ocean Color Instrument was launched in 2024 as the first polar orbiting hyperspectral instrument to monitor ocean health. This product is based on a machine learning approach (described in Algorithm Description) that utilizes the UV to Visible wavelengths from OCI to retrieve total vertical column NO_2.

Algorithm Description:

This product was developed using a machine learning approach originally described in Joiner et al. 2023. In short, this approach uses decomposed principal components from measured spectra to train a machine learning model to learn physical parameters. For this product, the PACE 5km reflectances were decomposed into principal components and trained to learn total vertical column NO_2 that was co-located from the TROPOMI instrument. This model derived for the 5km PACE OCI reflectances was then applied to the PACE OCI 1km reflectances to estimate NO_2 at 1km spatial resolution. The product provided here has been gridded to 1.5m spatial resolution for easy use by the science users.

Due to the volume of the PACE data, this initial release includes two regional datasets covering North America (130W to 70W, 20N to 60N) and the Middle East (20E to 80E, 10N to 50N) for the months of April-June 2024. The filename denotes the location that the file covers:

PACE_NO2_Gridded_NAmerica_YYYYmMMDD.nc covers North America
PACE_NO2_Gridded_MiddleEast_YYYYmMMDD.nc covers the Middle East

In addition to the NO_2, the product also includes 10m surface winds co-located from the NASA GMAO Forward Processing for Instrument Teams (FP-IT). The wind information can be used in combination with the retrieved NO_2 to calculate emission estimates.

Data Quality Assessment:

Users should be aware that these data have undergone limited validation and are to be used with caution.

Known Product Features:

- This preliminary product was only developed for the Northern Hemisphere. The PACE OCI instrument has two distinct viewing conditions in the Southern and Northern Hemisphere to point away from sun glint over the tropics. As a result, we

trained a model specifically for the Northern Hemisphere and plan to do the same for the Southern Hemisphere at a later date.

- These data were developed only for cloud free conditions, but the initial PACE cloud products have only undergone limited validation, so caution should be used if a scene is potentially cloud covered. We have used the PACE cloud products to remove potentially cloudy scenes, but it is possible the PACE cloud products could miss thin cloud conditions.

Contact:

Please send all questions about the product to Zachary Fasnacht (Zachary.fasnacht@ssaihq.com).

References:

Joiner, J., Marchenko, S., Fasnacht, Z., Lamsal, L., Li, C., Vasilkov, A., and Krotkov, N.: Use of machine learning and principal component analysis to retrieve nitrogen dioxide (NO_2) with hyperspectral imagers and reduce noise in spectral fitting, Atmos. Meas. Tech., 16, 481–500, https://doi.org/10.5194/amt-16-481-2023, 2023.

Goddard Space Flight Center Distributed Active Archive Center (GSFC DAAC). (2024). tavg1 2d slv Nx: MERRA2 3D Single-Level Diagnostics 1hourly ver- sion 5.12.4. (Accessed: 2024-10-01) doi: 10.5067/VJAFPLI1CSIV