HIWC 2022 Diode Laser Hygrometer (DLH) Data Descriptor

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1. Data Set Description
    a. Variables
        i. Water vapor mixing ratio
        ii. Relative humidity with respect to supersaturated water (derived)
        iii. Relative humidity with respect to ice (derived)
    b. Data version number and date
    c. Data Status: Final
    d. Time period covered by the data: July 8-30, 2022
    e. Physical location: NASA AFRC DC-8
    f. Data Frequency: 1 second
    g. Data source: N/A
    h. Web address references: N/A
    i. Data set restrictions: Data available without restriction, contact PI for more information if desired
2. Instrument description: The Diode Laser Hygrometer (DLH) uses open-path near infrared absorption spectroscopy to quantify in situ water vapor mixing ratios ($H_2O(v)$) from aircraft platforms (Diskin et al., 2002). On the DC-8, a ~1.4 um laser is directed from a window-mounted transceiver to a commercial retroreflective film attached to the inboard side of the left outboard engine cowling. The retroreflected light is collected onto a detector.

Instrument Precision	< 1%
Instrument Accuracy	5% ($H_2O(v)$), 15% (RH_i, RH_w)
Data Rate	As high as 100 Hz

3. Data collection and processing: Raw signal is converted to water vapor mixing ratio using a combination of a model derived from the HITRAN spectral database and a series of laser-dependent frequency calibrations. Interpolated static air temperature and static pressure (HIWC 2022 Air Data Use) are used as model inputs on a point-by-point basis. Relative humidities are derived using the same static temperature/pressure and parameterizations from Murphy & Koop (2005).

4. Data file structure: The data is presented in the NASA ICARTT data format v1.1 (https://www-air.larc.nasa.gov/missions/etc/IcarttDataFormat.htm).

5. Data remarks: Missing segments near top of boundary layer are due to data loss from dense warm clouds.

6. References:

Diskin, G. S., Podolske, J. R., Sachse, G. W., & Slate, T. A. (2002). Open-path airborne tunable diode laser hygrometer. *Diode Lasers and Applications in Atmospheric Sensing*, *4817*, 196–204. https://doi.org/10.1117/12.453736

Murphy, D. M., & Koop, T. (2005). Review of the vapour pressures of ice and supercooled water for atmospheric applications. *Quarterly Journal of the Royal Meteorological Society*, *131*(608), 608. https://doi.org/10.1256/qj.04.94