Cryogenic Frostpoint Hygrometer (CFH) Launch Activities at the ARM Southern Great Plains (SGP) Site: 2018 Updates, Data Evaluation, and Opportunities

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Measurement Uncertainty
Most of the uncertainty of CFH mirror temperature measurements is related to the stability of the feedback controller, which activates the cooling or heating of the CFH mirror. Systematic CFH errors were quantified to be less than 0.1 K, while total uncertainties are described to be better than 0.2 K under good conditions.

CFH Specifications and Accuracies

- Measured Parameters: Ambient frost point, Relative humidity, mixing ratio
- Technique: Temperature-controlled chilled mirror
- Uncertainty Measurement: < 4% in tropical lower troposphere
- Altitude range: 0 - 35 km
- Weight: < 400 g (without coolant)
- Dimensions: ~6.5"Wx12"Dx5"H

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Deployment History
Currently we launch one CFH package at ARM SGP per month, twenty-eight successful CFH launches have been performed since September 2014.

Background
The ARM Cryogenic Frost Point Hygrometer (CFH) has been established as a baseline instrument at the ARM Southern Great Planes (SGP) Climate Research Facility. CFH balloon launches are conducted once a month to measure tropospheric and stratospheric water vapor with increased accuracy and sensitivity. The CFH, which uses a temperature-controlled chilled mirror to directly measure the ambient frostpoint, is particularly useful for studying the dry conditions of the lower stratosphere due to the instrument’s sensitivity within a few parts-per-million mixing ratios. CFH data are used for validating observations from radiosondes and from space based remote sensors. ARM CFH measurements are conducted in coordination with the Global Climate Observing System (GCOS) Reference Upper-Air Network (GRUAN).

CFH support for RIVAL
CFH launches have been coordinated with overpasses of the MetOp polar orbiting meteorological satellites to validate Infrared Atmospheric Sounding Interferometer (IASI) data. Future CFH packages will include Vaisala RS-41 sondes for Radiosonde Intercomparison & Validation (RIVAL).

IASI derived water vapor mixing ratio compared with CFH observational data from 01/30/2017 and 02/17/2017.