

# Listen or Try Hands-on Data Analysis

- **Aircraft (\*.iph) and HRRR Profile Comparison**
  - Modify/combine the python code to compare aircraft ascent profile to HRRR profile.
    - Use NasaFile.py, iphex\_plot.py, fetch\_data.py
    - Open netCDF file in IDV and combine with HRRR
- **Microphysical Algorithm Development**
  - Modify/combine python code to overlay radar reflectivity composite image and aircraft flight track.
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# Management of Data from Instrument Observations to Scientific Analysis

- Objective is to manage the production of data (observations) to enable meaningful scientific analysis.
  - Platform deployed (planned flight path) to obtain useful measurements for scientific analysis.
  - Instrument performance validated to be free of systematic errors (quality control).
  - Data sets reviewed by instrument experts (quality assurance)
  - Software used to collect, process and ***analyze*** measurements needs to be free from mistakes that affect scientific conclusions (open source and reproducible).
  - Data submitted to archive in structure (file and directory formats) that allow for easy visualization and analysis.

# NASA Data Set Archive

[ftp://gpm.nsstc.nasa.gov/gpm\\_validation/iphex/cloud\\_microphysics\\_Citation/UND\\_cloud\\_microphysics/data/QC\\_Processed/20140525\\_185917/2014\\_05\\_25\\_18\\_59\\_17.iphex](ftp://gpm.nsstc.nasa.gov/gpm_validation/iphex/cloud_microphysics_Citation/UND_cloud_microphysics/data/QC_Processed/20140525_185917/2014_05_25_18_59_17.iphex)

Delene, David J. and M. Poellot, 2015: GPM Ground Validation UND Citation Cloud Microphysics IPHEX. Dataset available online [<http://ghrc.nsstc.nasa.gov>] from the NASA EOSDIS Global Hydrology Resource Center Distributed Active Archive Center Huntsville, Alabama, U.S.A. (39 Citation Research Aircraft (N555DS) Flights, 1 May - 15 June 2014)







# Airborne Data Processing and Analysis (ADPAA) Software Package

(<http://sourceforge.net/projects/adpaa/>)

- Independent, Open, and Freely Available
- GNU/GPL v3 Licensed (Only non-commercial use)
- Started in 2007, Version 2314 - June 2014
- Approximately 227,981 Lines of Code (IDL, Perl, Bash, csh, FORTRAN, C, Python, etc.)
- Subversion (SVN) Source Code Management System
- Feature Requests, Bug Tracker, Forum and **Wiki**

Delene, D. J., et al. (2015), Airborne Data Processing and Analysis (Revision Version 2000), Source Forge, URL: <http://sourceforge.net/projects/adpaa/>, Retrieved January 18, 2015, DOI: 10.5281/zenodo.14053.

Delene, D. J., Airborne Data Processing and Analysis Software Package, Earth Science Informatics, 4(1), 29-44, 2011, URL: <http://dx.doi.org/10.1007/s12145-010-0061-4>, DOI: 10.1007/s12145-010-0061-4.

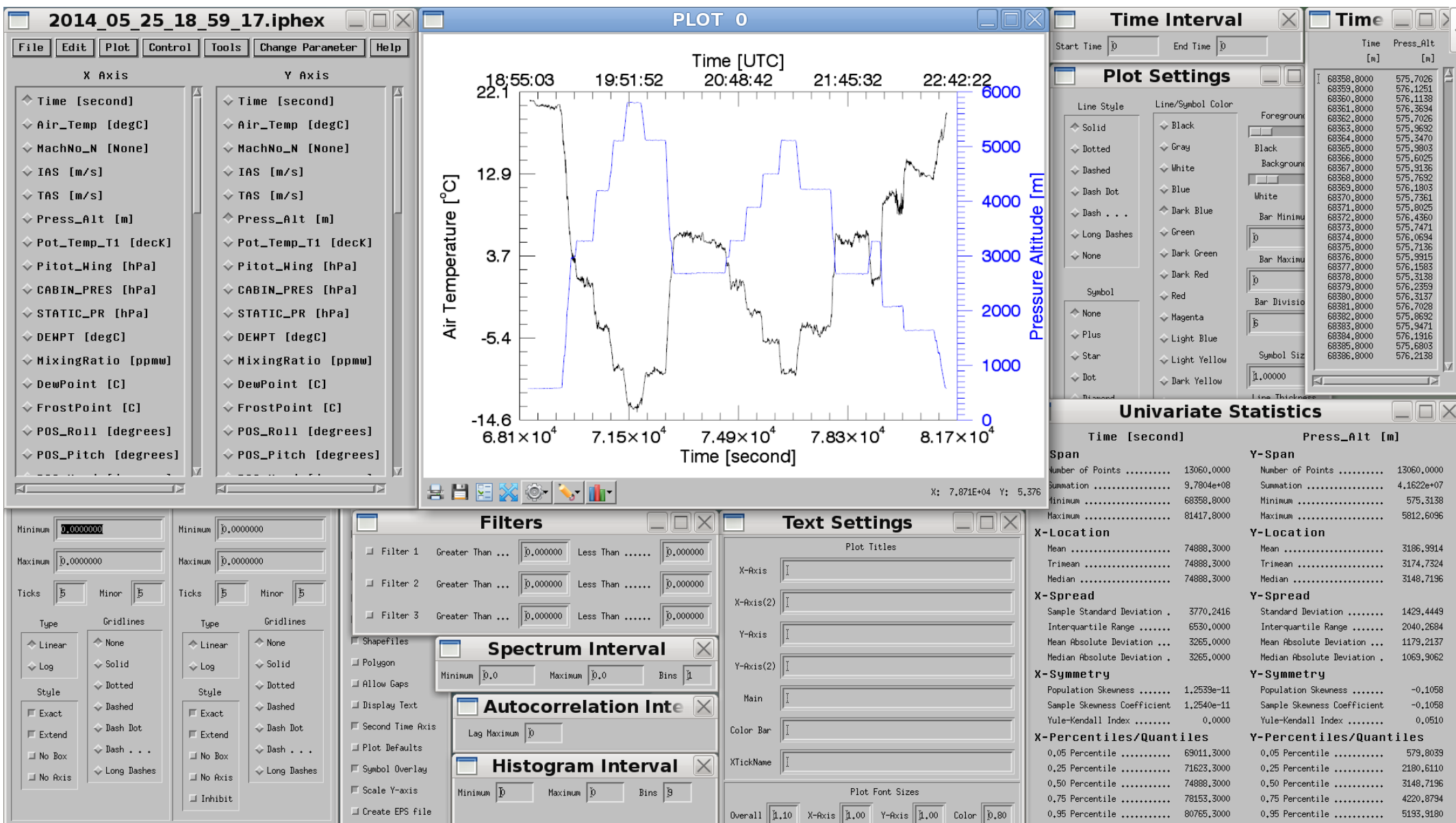
# Data Processing

- Missing Values Codes
- Levels of Data Processing
  - Raw Recorded Data
  - Convert to Physical Units
  - Single Instrument Files
  - Combined Instrument Files
- Automatic Post-processing
- ASCII Meta-data Header
- Handles Synonymous and Asynchronous Data of any Frequency
- Creates Project Science Analysis File (i.e. 2014\_05\_25\_18\_59\_17.iphex)

```
$ process_all_iphex
Processing the 14_05_25_18_59_17.sea file ..... Done
Creating 14_05_25_18_59_17.applanix.1Hz ..... Done
Creating 14_05_25_18_59_17.analog.1Hz ..... Done
Creating 14_05_25_18_59_17.cdp.1Hz ..... Done
Processing the 14_05_25_18_59_17.analog.raw file ..... Done
Processing the 14_05_25_18_59_17.serial.GPS.raw file ..... Done
Creating the 14_05_25_18_59_17.physical.10Hz file ..... Done
Creating the 14_05_25_18_59_17.physical.1Hz file ..... Done
Processing the 14_05_25_18_59_17.physical.? file ..... Done
Creating 14_05_25_18_59_17.basicP1T1.1Hz ..... Done
Creating 14_05_25_18_59_17.basicP1T2.1Hz ..... Done
Creating 14_05_25_18_59_17.basicP2T1.1Hz ..... Done
Creating 14_05_25_18_59_17.basicP2T2.1Hz ..... Done
Creating 14_05_25_18_59_17.basic.10Hz ..... Done
Creating 14_05_25_18_59_17.basic.1Hz ..... Done
Processing the 14_05_25_18_59_17.cdp.pcaspc.raw file ..... Done
Creating 14_05_25_18_59_17.basic.8Hz ..... Done
Processing the 14_05_25_18_59_17.cdp.cdp.raw file ..... Done
Creating 14_05_25_18_59_17.king.raw ..... Done
Processing the 14_05_25_18_59_17.applanix.raw file ..... Done
Processing the 14_05_25_18_59_17.serial.cpc.raw file ..... Done
Creating 14_05_25_18_59_17.angles.applanix.1Hz ..... Done
Creating 14_05_25_18_59_17.king.1Hz ..... Done
Creating 14_05_25_18_59_17.conc.cdp.1Hz ..... Done
Creating 14_05_25_18_59_17.hum.raw ..... Done
Creating 14_05_25_18_59_17.egg.raw ..... Done
Creating 14_05_25_18_59_17.wind.raw ..... Done
Creating 14_05_25_18_59_17.nevwc.raw file ..... Done
Creating 14_05_25_18_59_17.nevwc.1Hz ..... Done
Creating 14_05_25_18_59_17.cwc.csi.raw file ..... Done
Creating 14_05_25_18_59_17.serial.GPS.10sec ..... Done
Creating 14_05_25_18_59_17.REAL.winds.1Hz ..... Done
Creating 14_05_25_18_59_17.550nm.scatsc.raw ..... Done
Creating 14_05_25_18_59_17.conc_stp.pcaspc.raw ..... Done
Creating 14_05_25_18_59_17.iphex file ..... Done
```

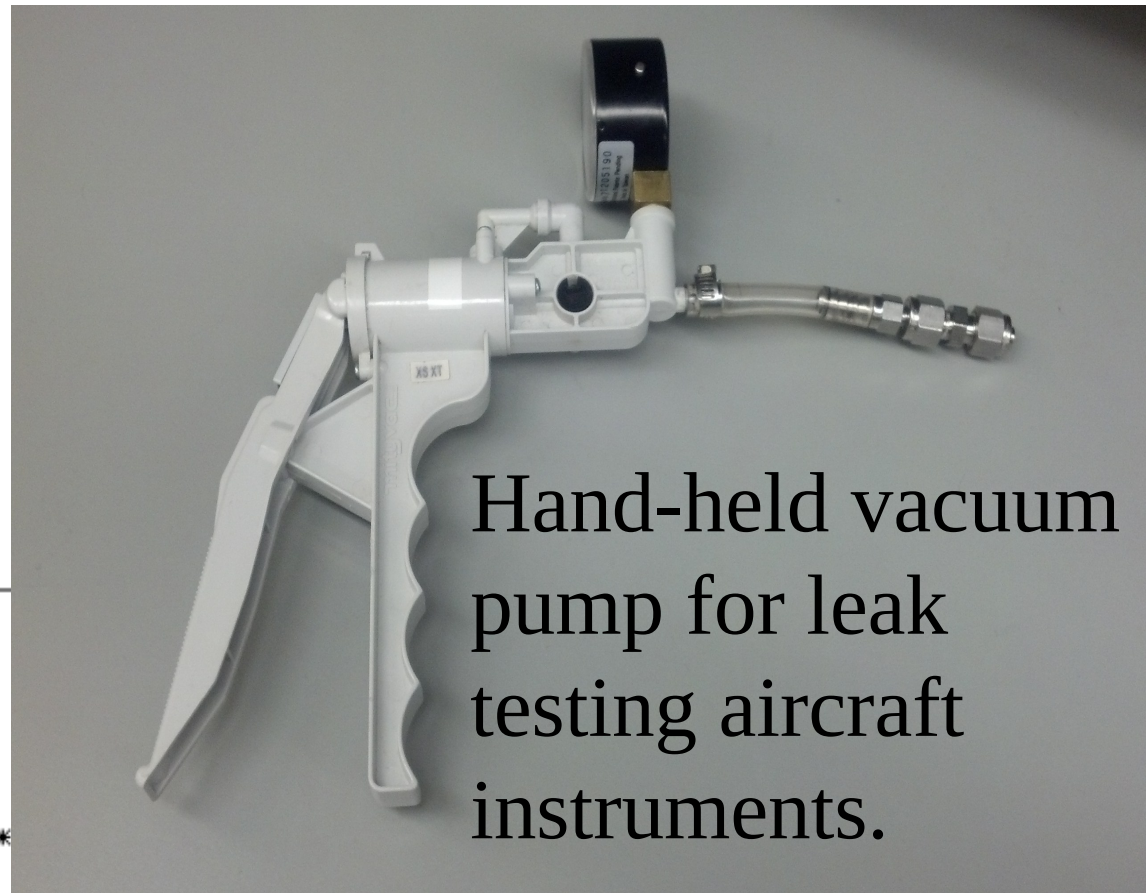
# Data Set Quality Assurance

- Rapid Data Review by Instrument Scientist Expert(s)
- Total for Unrealistic Values Discovery

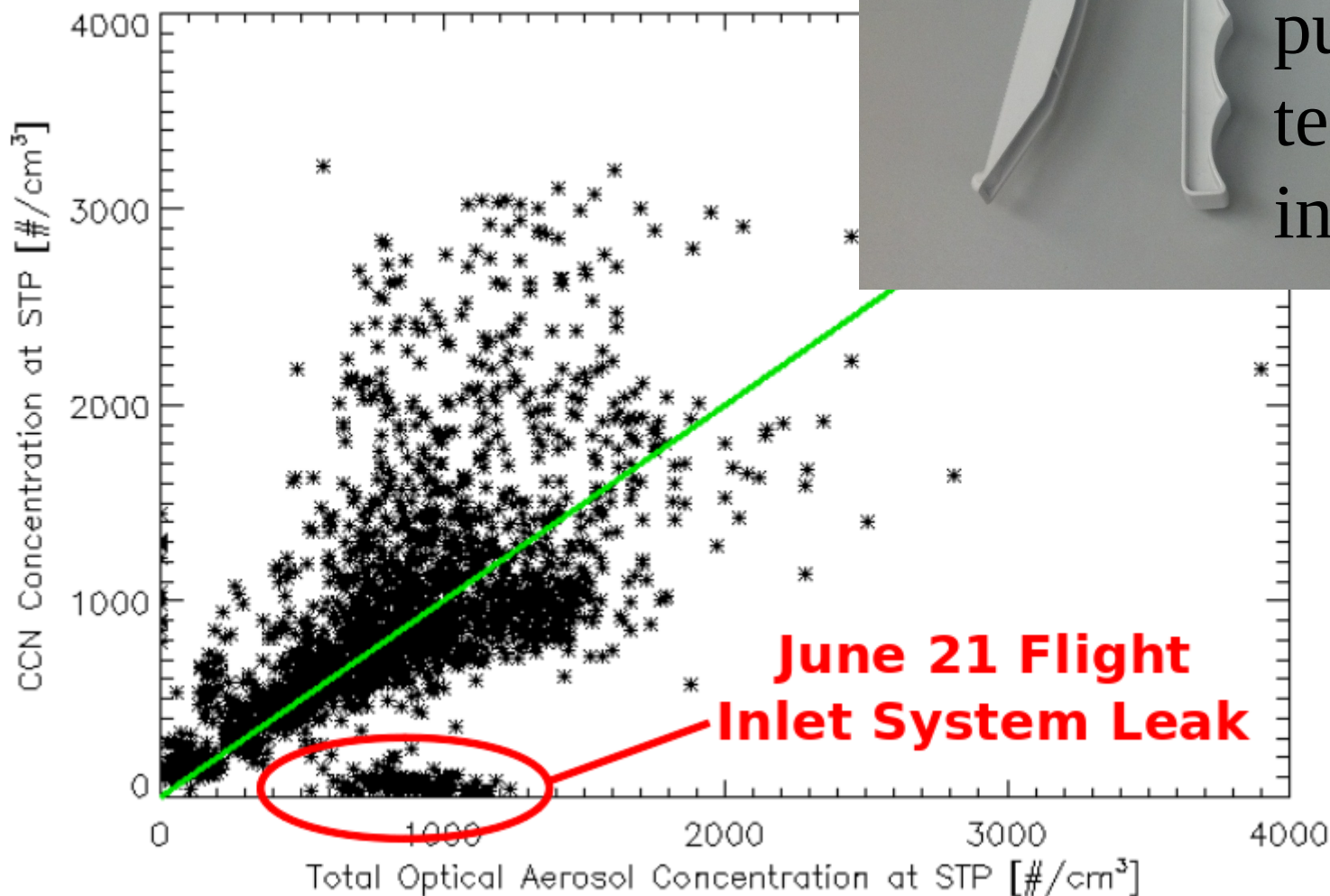


# Quality Control

Process of conducting tests to ensure measurements are being made correctly and accurately.



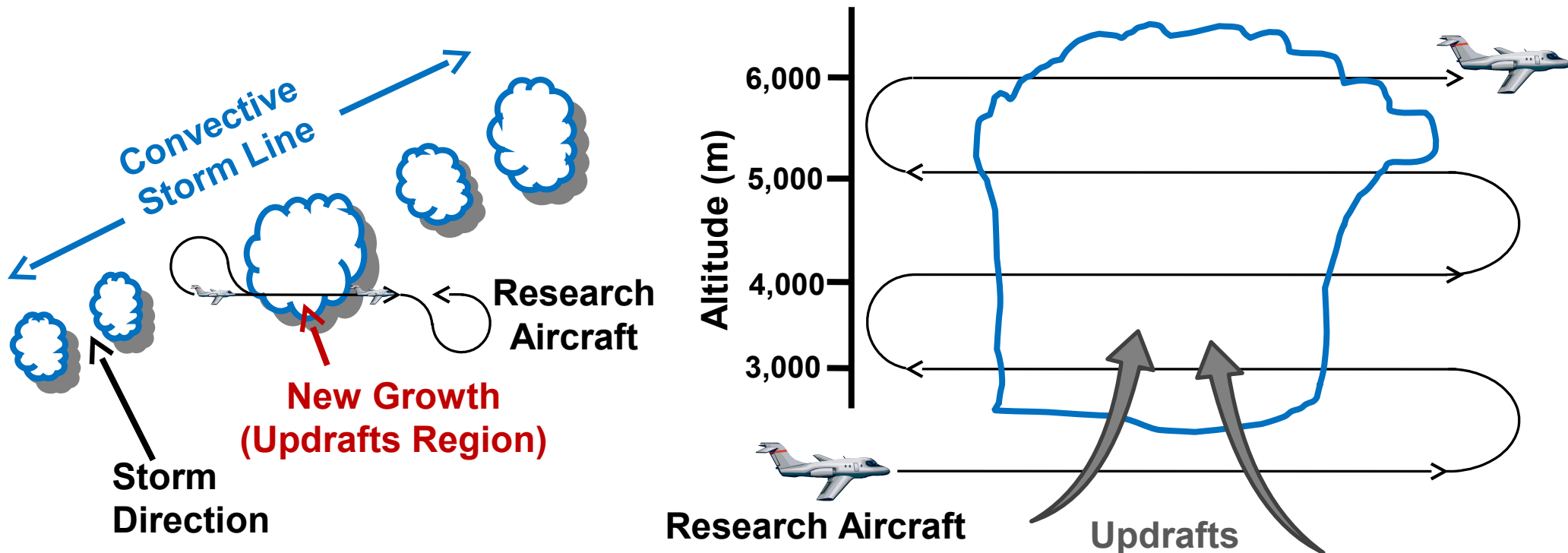
Hand-held vacuum pump for leak testing aircraft instruments.





# Operations Plan: Convective Clouds

- Sampling conducted at fixed speed of 160 knots IAS.
- Ascent and turns (90-270 degrees) conducted outside of cloud, and a constant altitude pass through cloud.
- Vertical climb rate is 500 ft/min.
- Penetration legs vary (1-20 min) depending on cloud.



# Hands-on Data Analysis

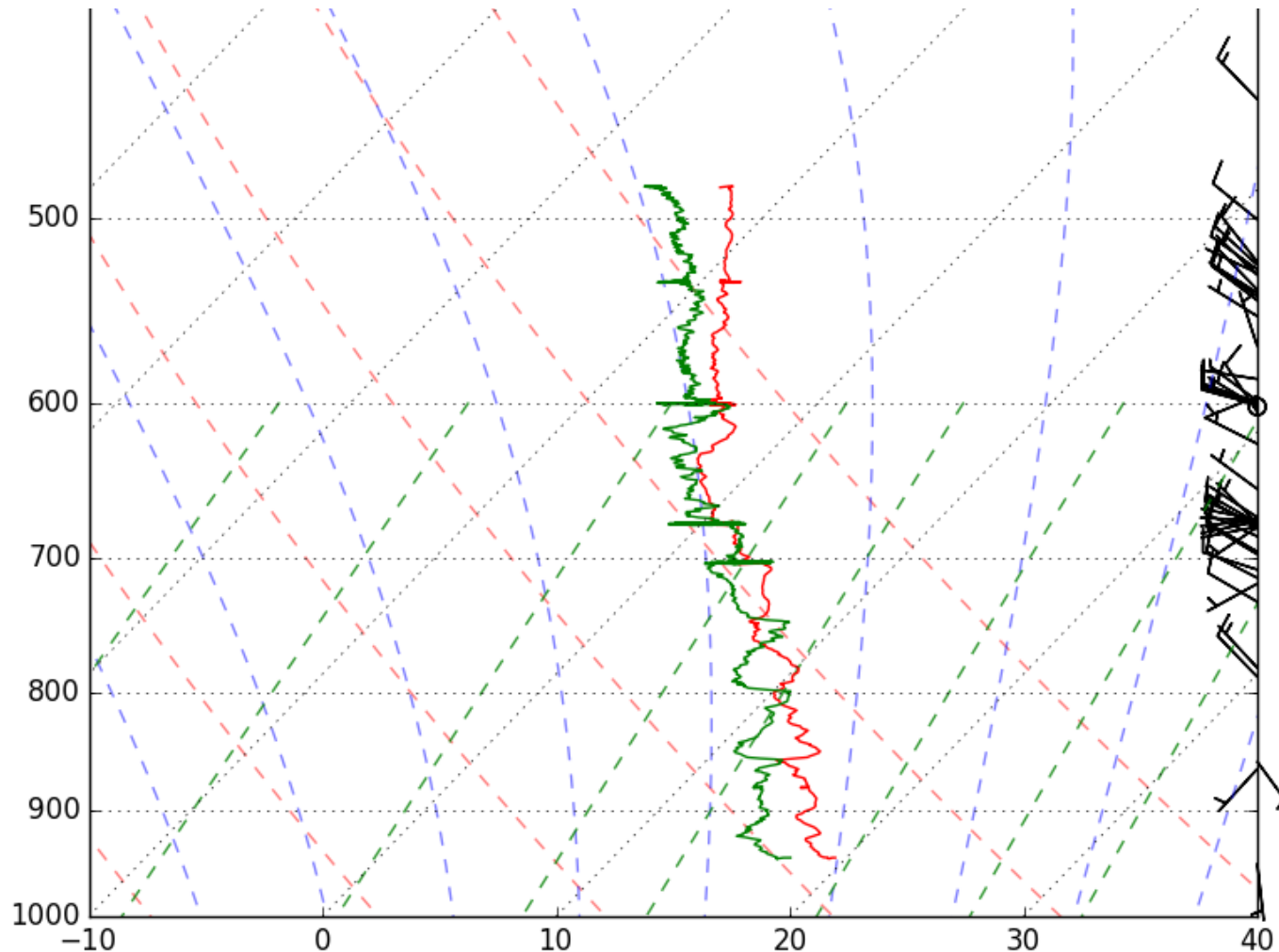
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# Comments on Scientific Data Management

- Mission planning and execution.
  - Operational plans, Web, NASA Mission Tool, **IDV**
- Quick processing, visualization, and quality control.
  - ADPAA, Wiki, Cplot, Cplot2, cloud, SVN, **docker**
- Quality assurance of data sets by scientists is required.
  - Cplot, Cplot2
- Archive data sets containing raw, edit, and clean data files and quality control documentation.
  - standard directories, NASA DAAC, **Ramadda**
- Conduct analysis using documented file formats that include missing value codes and meta data.
  - ADPAA, Python, **MetPY**, **siphon**, **IDV**, **Ramadda**

# Aircraft Sounding Plot

**`./iphex_plot.py 2014_05_25_18_59_17.iphex`**



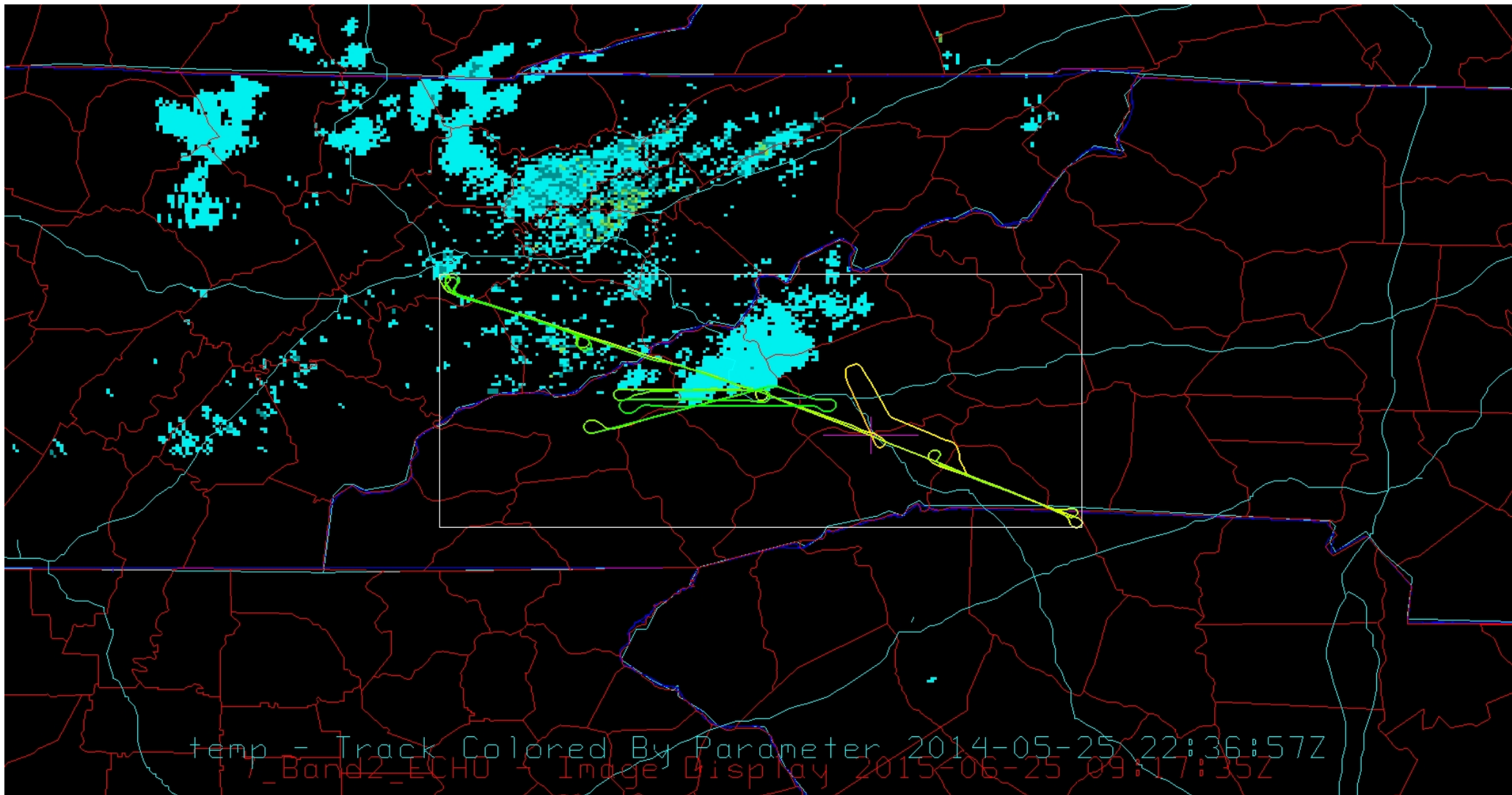
**Use python and metpy to create profile plot.**

**Use siphon (fetch\_data.py) to combine with recent HRRR data?**



# Radar and Aircraft Track Results

## `./create_CFnetCDFTrajectory.py`



**Use IDV combine flight track and recent radar composite image.**