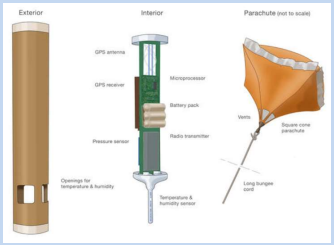
3D3v: An Interactive App for 3D Visualization of Dropsonde Data

Background

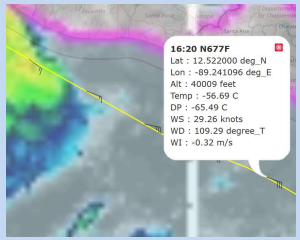
The main objective of the research project is to design and implement an app that allows both display and interaction of dropsonde data in 3d-space.

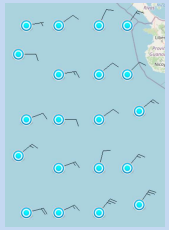
Data was gathered from both a chassis outfitted in the plane and dropsondes: a cylindrical instrument injected from the plane. Data which is of interest to scientists includes pressure, humidity, temperature and wind speeds and direction



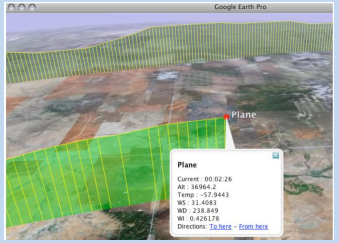
The archival format of the data is stored as netCDF4 files.
Original Postgres data is near identical to netCDF4 data however netCDF4 is structured in a columnar manner (which required some preprocessing to format as ..json)

Existing Software





- Confine to 2-d space, meaning no perception of all winds at all altitudes at once. Maybe wind icons are less intuitive for those unfamiliar.
- Cannot select any datapoint, snaps to wind barbs at set intervals
- Limitation of 2-d plots is that label popup has to obscure parts of the maps



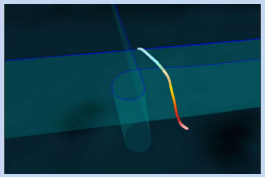
- Labels are arguably ambiguous;
- Cannot plot sonde data entirely
- Can see plane trajectory (including altitude changes and has curtain projection to understand position over surface)
- Can only plot for kml files

Has no visual sense of the wind directions and how fast winds are blowing relative to other winds in a dataset

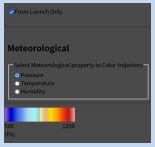
3D3v

- In 3d space the angle and distance of perception could be easily adjusted
- The lack of a surrounding white-box minimizes the blocking of visuals.
- As exposed as showing the final location of the dropsondes, it is possible to see entire trajectory
- Vectors directly drawn in wind directions, with their length adjusted relative to other edges in the dataset.

- Plane trajectory feature is retained but now viewable alongside sonde drops.



- The sondes encode some semblance of change in a selected variable over time with a color gradient.



- Current UI allow filtering abilities that the Flight Tracker does not have.
- Data before the true drop could be trimmed to display meaningful info only.

Results

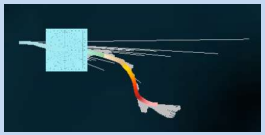
One of the first software to work with data from the next-generation ACS which has seem limited testing outside of field work in April.

Revealed issues in the recording of data; particularly the occurrences of early launch-detect by ACS (currently thought to be caused by operating ACS concurrently with legacy AVAPS)

Verified an issue with data checksums which incorrectly labels some valid data as invalid and vice versa.

Will display segments of the sonde trajectory where telemetry temporarily experience outages.

Fully implement Hodograph which allows for visual understanding of wind angles and absolute speeds at a glance.



Animate plane and sonde trajectories to more easily display how sondes travel through time and interpret the direction of plotted objects.

Enhance performance by reducing the amount of Renderables with minimal loss of information. Or modify the underlying API to allow for direct path-plots of dropsonde with gradient.

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Scan for interactive demo

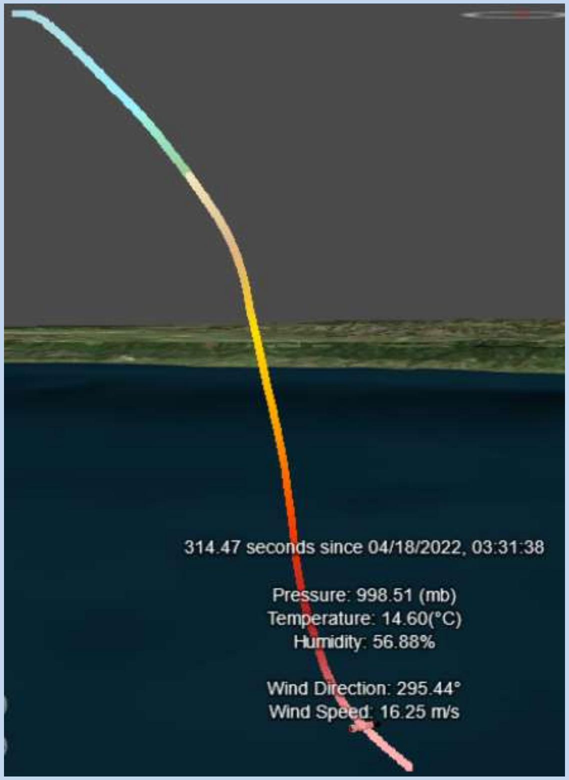
Scan for slides deck

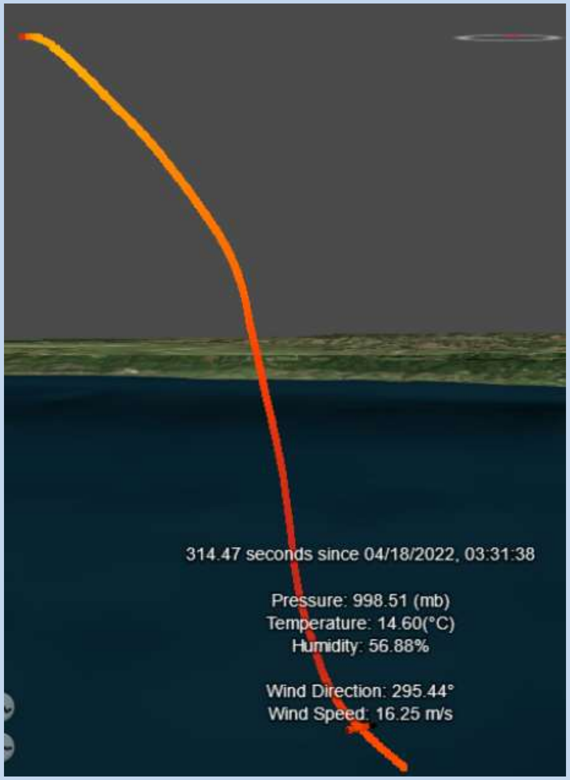
SWEX Mission 7: All data

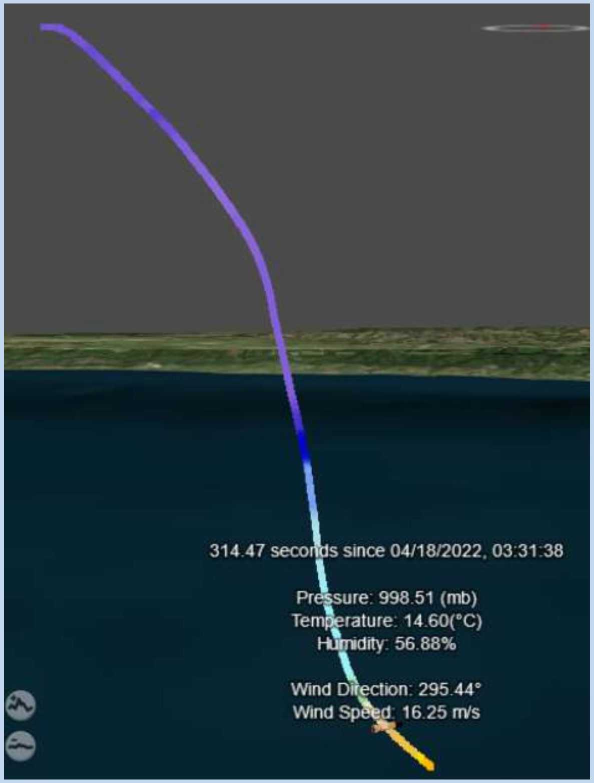
Sonde 8: Pre Launch-Detected data removed

Sonde 3: Pre Launch-Detected data removed

Sonde 8: Shaded according to Pressure, Temperature, Humidity







Prototype of Hodograph implementation