**Motivation**

Aviation pilots get their weather information from complex, text-based reports called METARs and TAFs. These are coded messages that provide weather observations (METAR) or forecasts (TAF) for specific airport locations.

**SIMPLE METAR AND TAF DATA PICTURES**

**Challenges**

* Hard to Read and Time Consuming
* Data Gaps
* Limited Altitude Information
* Sparse Data
* High Dimensional Inputs

**Solutions**

* Continuous Time Weather Prediction
* Gap-less Interpolation
* Altitude-Aware
* Learns Dynamics
* Visual & Interactive

**Approach**

**A Continuous -Time Model**

To provide a continuous forecast, we need to build a model that learns the dynamics of the weather. It processes a 4 dimensional query (latitude, longitude, altitude, time) and predicts key weather variables.

**Data Collection**

We combined 2 primary data sources

1. Surface Data – Hourly METAR reports providing ground level observations.
2. Altitude Data – HRDPS model which forecast at different pressure levels.

**Model Architecture**

1. Feature Encoder – A network that first reads the 4D input and encode it into a hidden state.
2. Neural ODE Solver – This is the core of our model. It uses a neural network to ;learn the hidden state evolving continuously over time and then calculate the state for the future time.
3. Decoder – A final network from ODE solver that translates the state back into the weather predictions.

**Baselines**

* 1. Barycentric Interpolation – A simple, non learning method that just calculate the weighted average of the nearest weather stations.
  2. Gaussian Process Regression – A common statistical method that can make predictions with uncertainty but struggles with large, high dimensional datasets.