Artificial Neural Network Applied in AIP Data
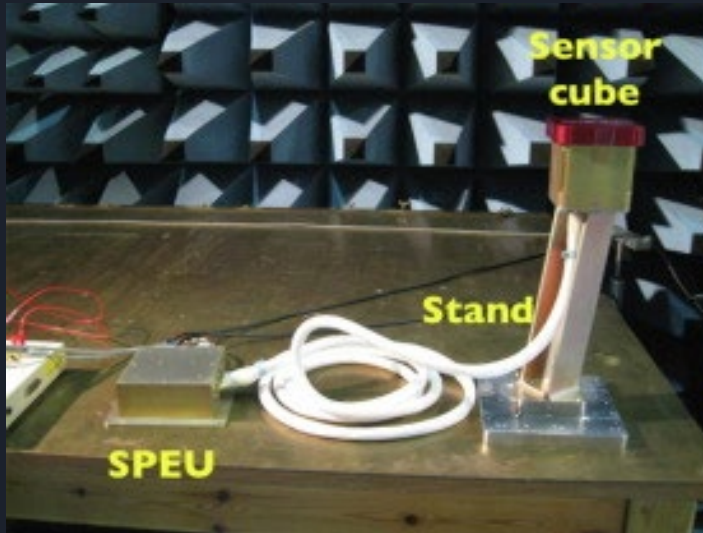
Yueh-Chun Hsieh, Loren Chang,
Cornelius Csar Jude H. Salinas, Chi-Kuang Chao

Department of Space Science & Engineering
National Central University, Taoyuan City, Taiwan
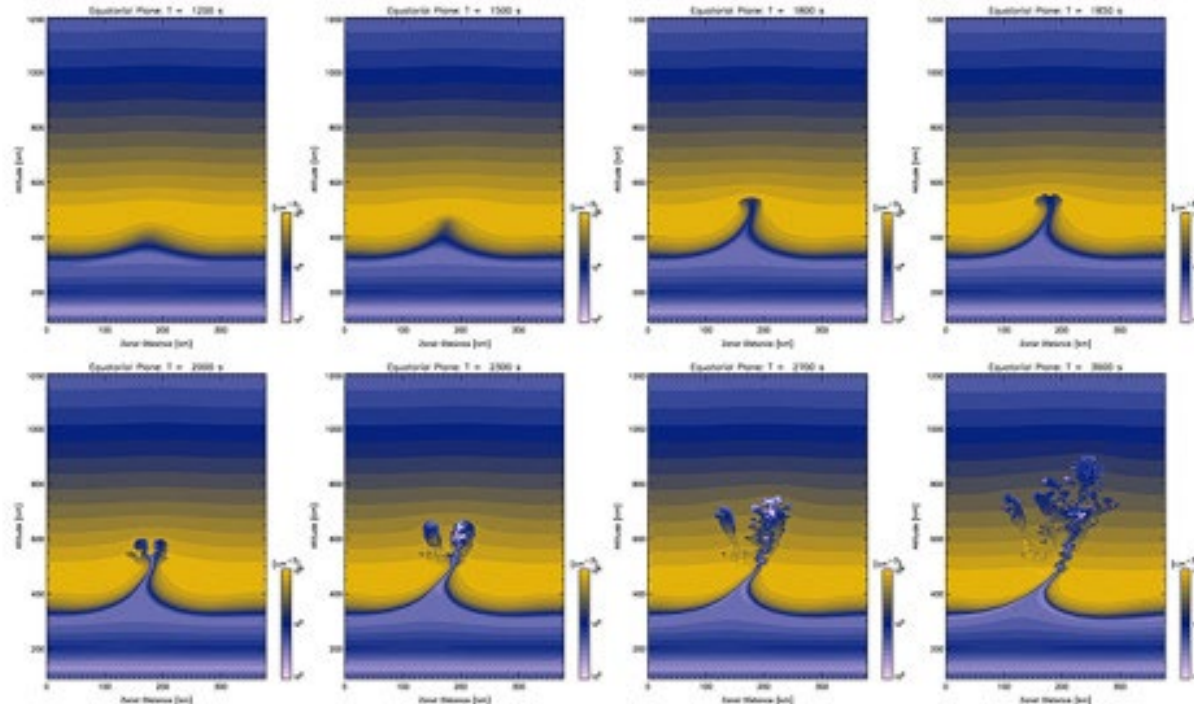
What Is Advanced Ionospheric Probe (AIP) ?

Equipped on Formosat   -5

Mesuring ion desity, ion temperature, ion drift deriction and velocity in F region.

source

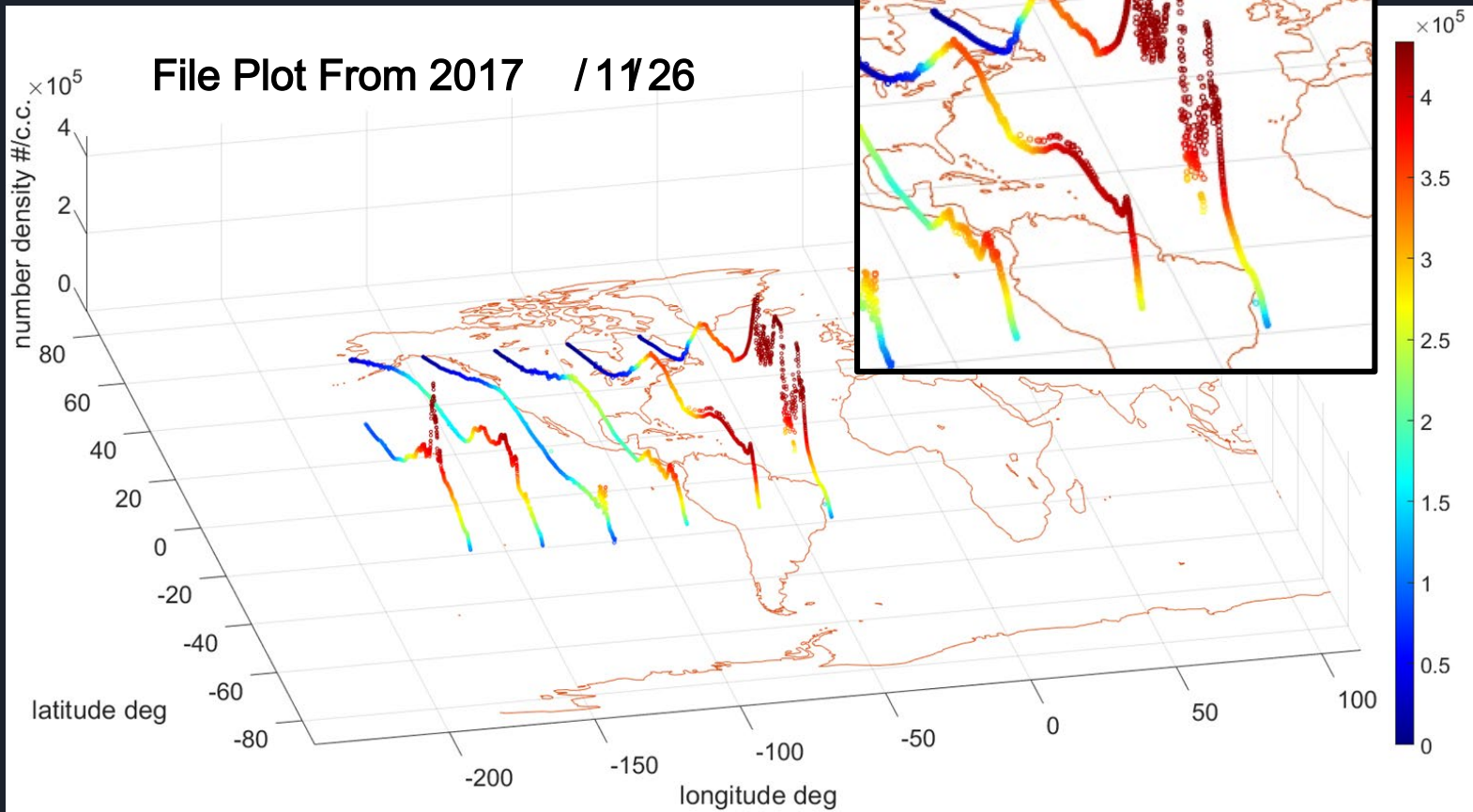# Plasma Bubbles

Nonlinear growth, bifurcation, and pinching of equatorial plasma bubble simulated by three-dimensional high-resolution bubble model

Data Example From AIP

File Plot From 2017   / 11/26

How to Deal With These Parameters ?

Ionospheric plasma bubbles formation mechanisms may related to :

- Solar activity
- Latitude
- Seasons
- Vertical plasma drift

Lets Try Artificial Neural Network (ANN)

- It can be non   -linear, because the middle layer of the network   can be any number.
- The number of parameters can be changed.
- Strong model building ability.
- Accept all kinds of variable input.
- Can express the interaction between input variables.

Program Framework

- Calculate the standard deviation of detrended number density in each longitude and latitude degree (± 0.5°).
- Put these grid data, corresponding vertical ion drift velosity, longitude, latitude, date of year and real time F10.7 index into ANN.
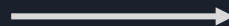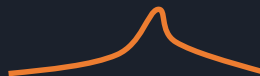
Filters

	Ion Number Density	Ion Drift Velosity
Latitude Filter	O	O
Attitude Filter	O	O
Standard Deviation Filter	O	
Extremum Filter	O	

Before Making Grids

Ion number density in a single file

Separate into different orbit

Use smooth function to detrend each orbit

The standard deviation of detrended number density in a singal file
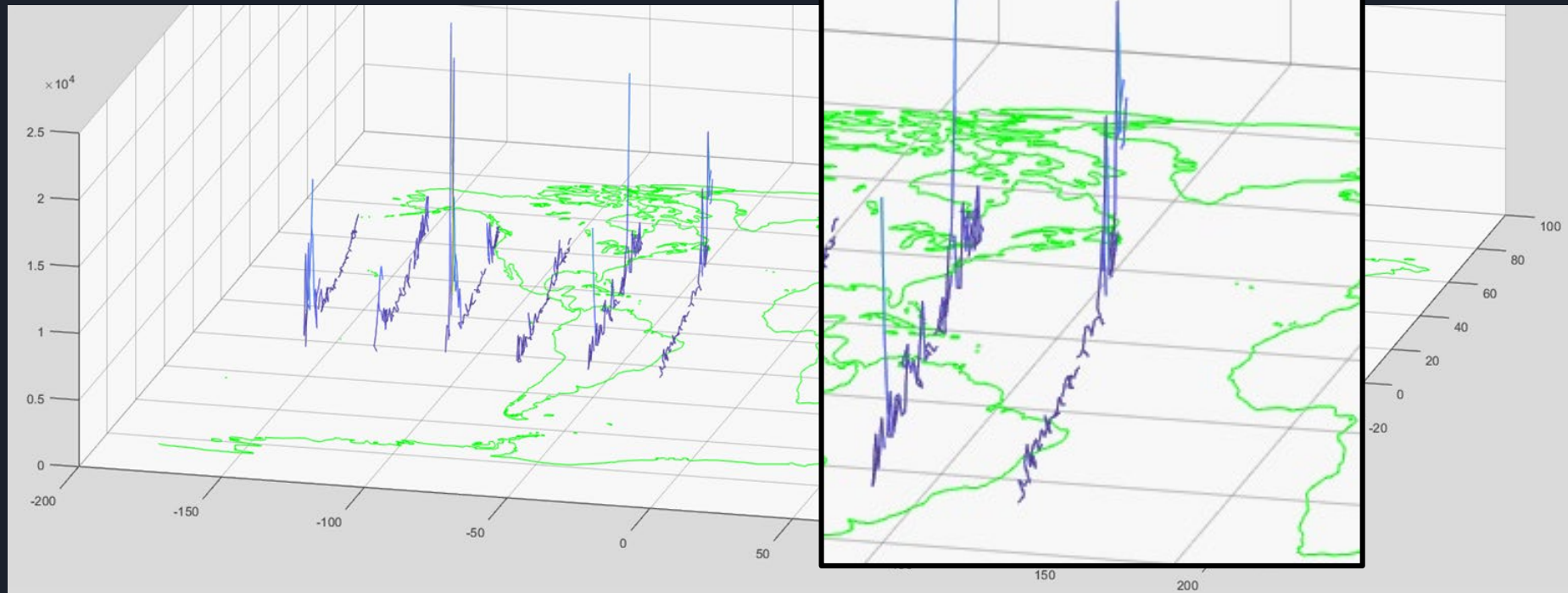
Future Works

- Compare the latest data (after 1812019) from AIP with the algorithm built by ANN.
- Compare the grid data with the data from GPS ground stations in Taiwan.

Reference

1. DMSP observations of equatorial plasma bubbles in the topside ionosphere near solar maximum

C. Y. Huang,

2. https://directory.eoportal.org/web/eoportal/satellite -missions/f/formosat -5

3. https://www.swpc.noaa.gov/phenomena/f107 -cm-radio-emissions

4. https://www.cyut.edu.tw/~lhli/coursedata/NeuralNetwork/Introduction.doc

Question Time

Thanks For Your Attention