INTRODUCTION

From 28 June to 12 July, 2000, The DOE G-1 research aircraft participated in the CCOS (Central California Ozone Study) field campaign in California's Central Valley and the adjacent airshed. The objectives of the G-1 mission are

1) to document the inflow boundary conditions over the Pacific Ocean in order to support the CCOS modeling efforts, and

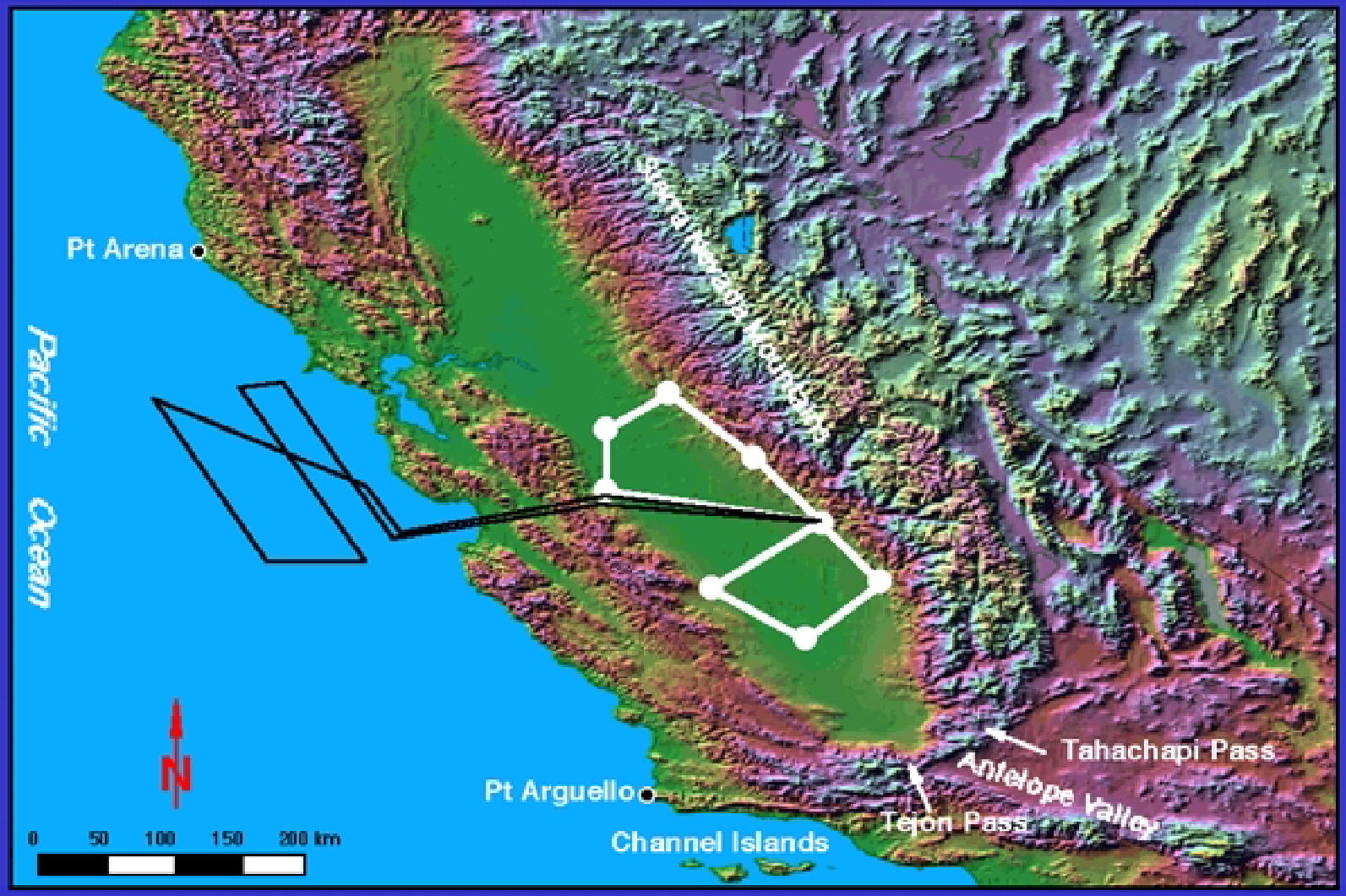
2) to identify important chemical and dynamical processes that have large influence on pollutant distributions in the Central Valley, especially those that can lead to the formation of pollution layers aloft.

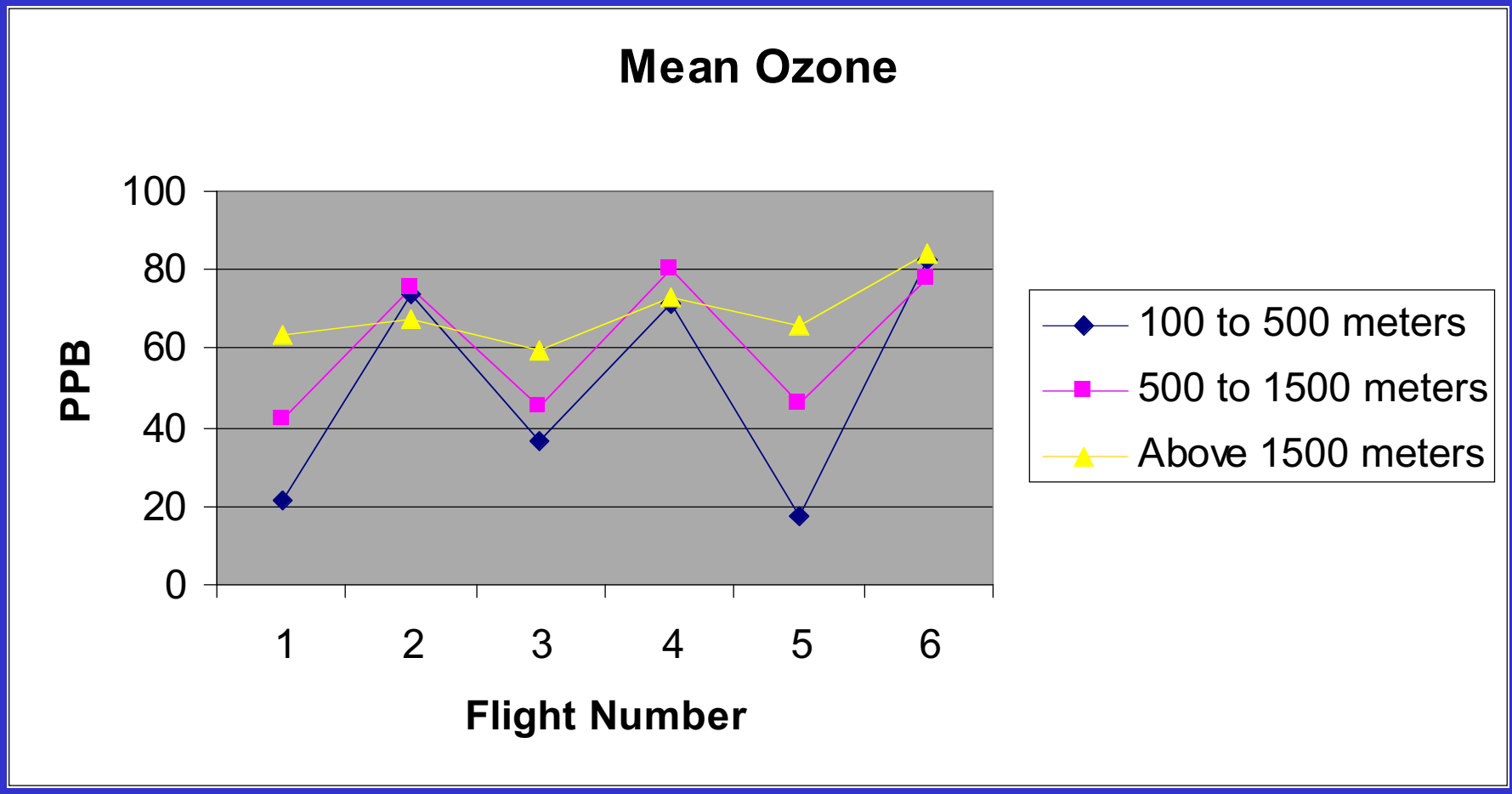
Two different flight patterns, one over the ocean and one in the San Joaquin Valley, were designed to achieve these two goals. What is shown here is a very preliminary look at some of the G-1 measurements in the valley during three consecutive days (9-11 July, 2000).

Science Questions

- What are the dynamical and chemical processes that can lead to the formation of pollution layers aloft in the Central Valley?
- How does the relative importance of these processes change with changes in synoptic conditions ?
- How much do the layers aloft contribute to the near-surface concentrations?
- How does the chemical processing in the elevated layers differ from that in the surface layer?
- How does the chemical partitioning between chemically active and reservoir species vary with time in the elevated layers?
- What is the relative importance of transported via locally-emitted pollutants in determining concentrations of various chemical species in the valley?
- How effective are the upslope flows in removing pollutants from the valley and how much does the cross-valley circulation contribute to horizontal mixing ?
- How do the downslope flows that are conceivably hydrocarbon rich modify the air chemistry within the valley ?
- How do the nocturnal jet and associated eddies affect along-valley transport and mixing ?

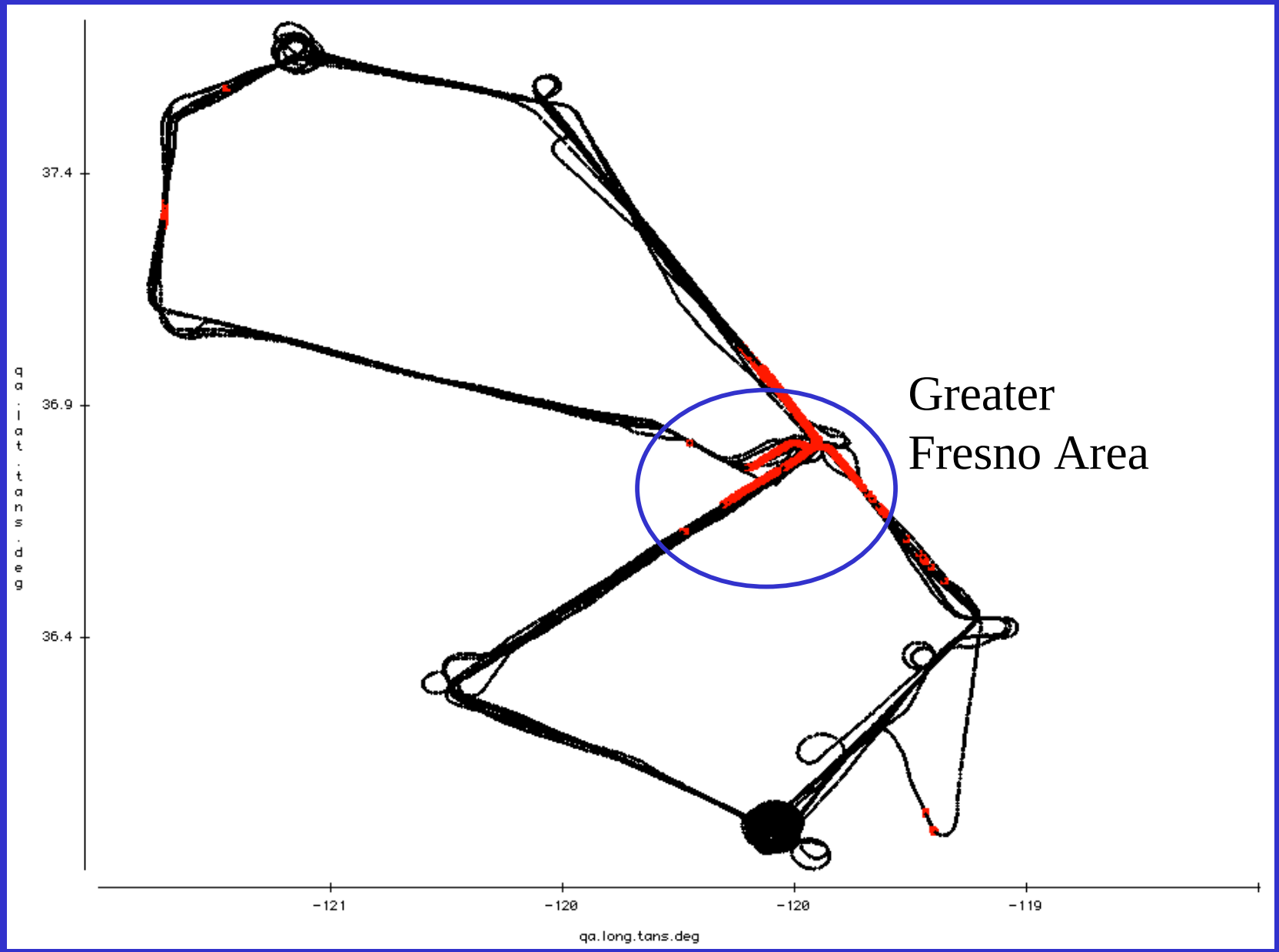
2000 CCOS G-1 Flight path





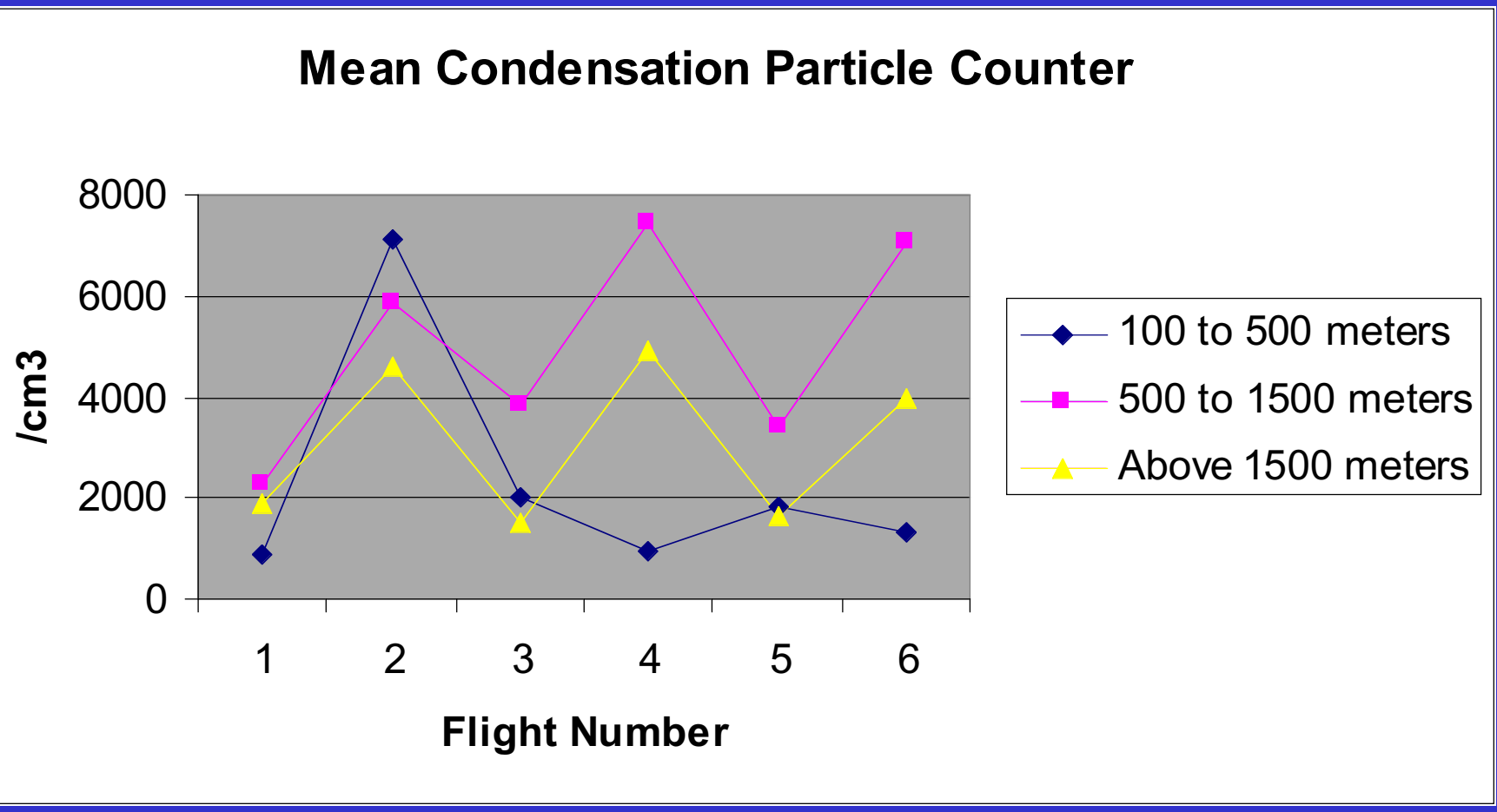
Ozone concentrations averaged over each flight. Flight No. 1, 3, and 5 were morning flights usually between 0630 and 0930 PST and No. 2, 4, and 6 were the afternoon flights between 1400 and 1700 PST

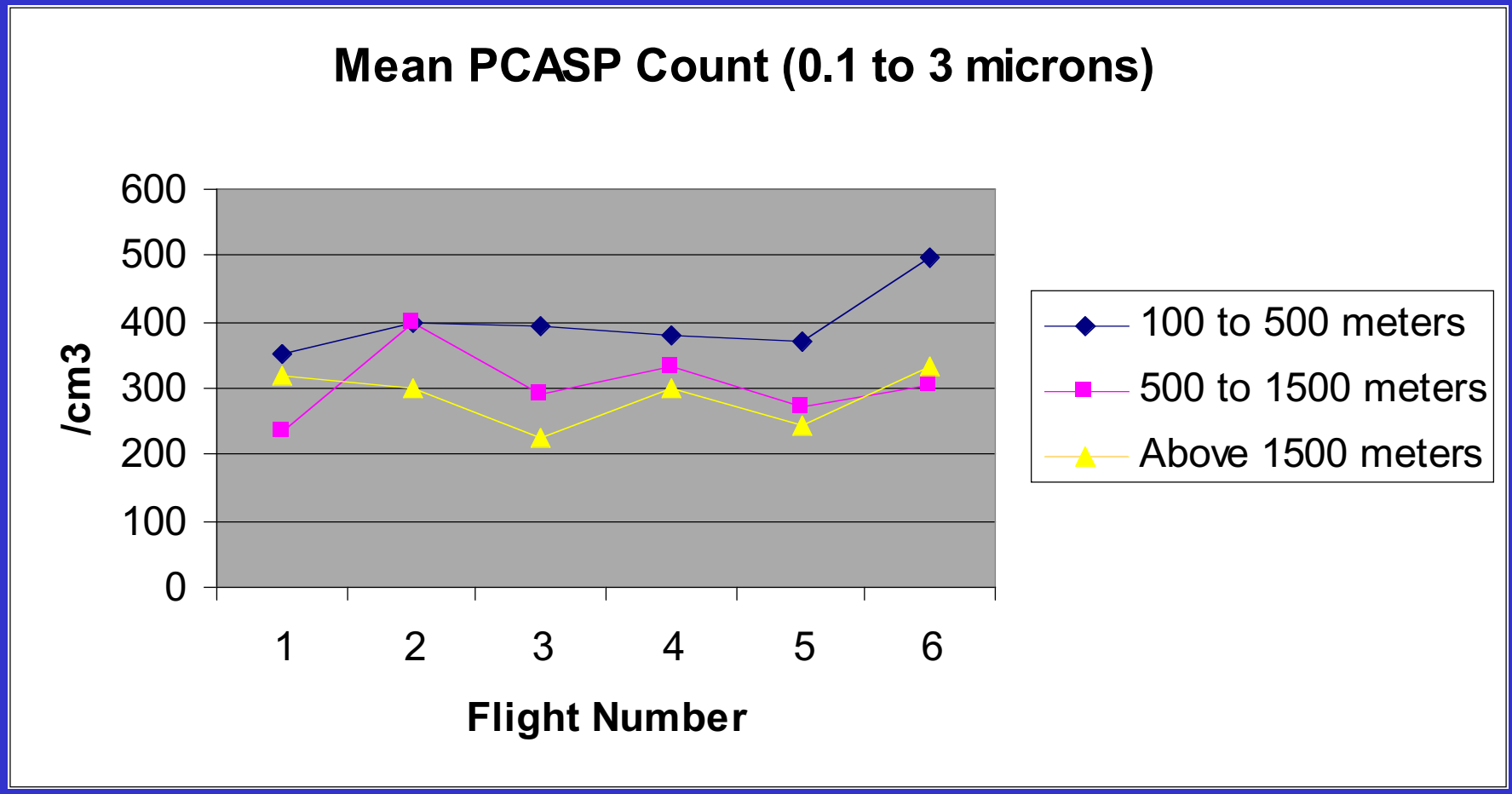
Latitude

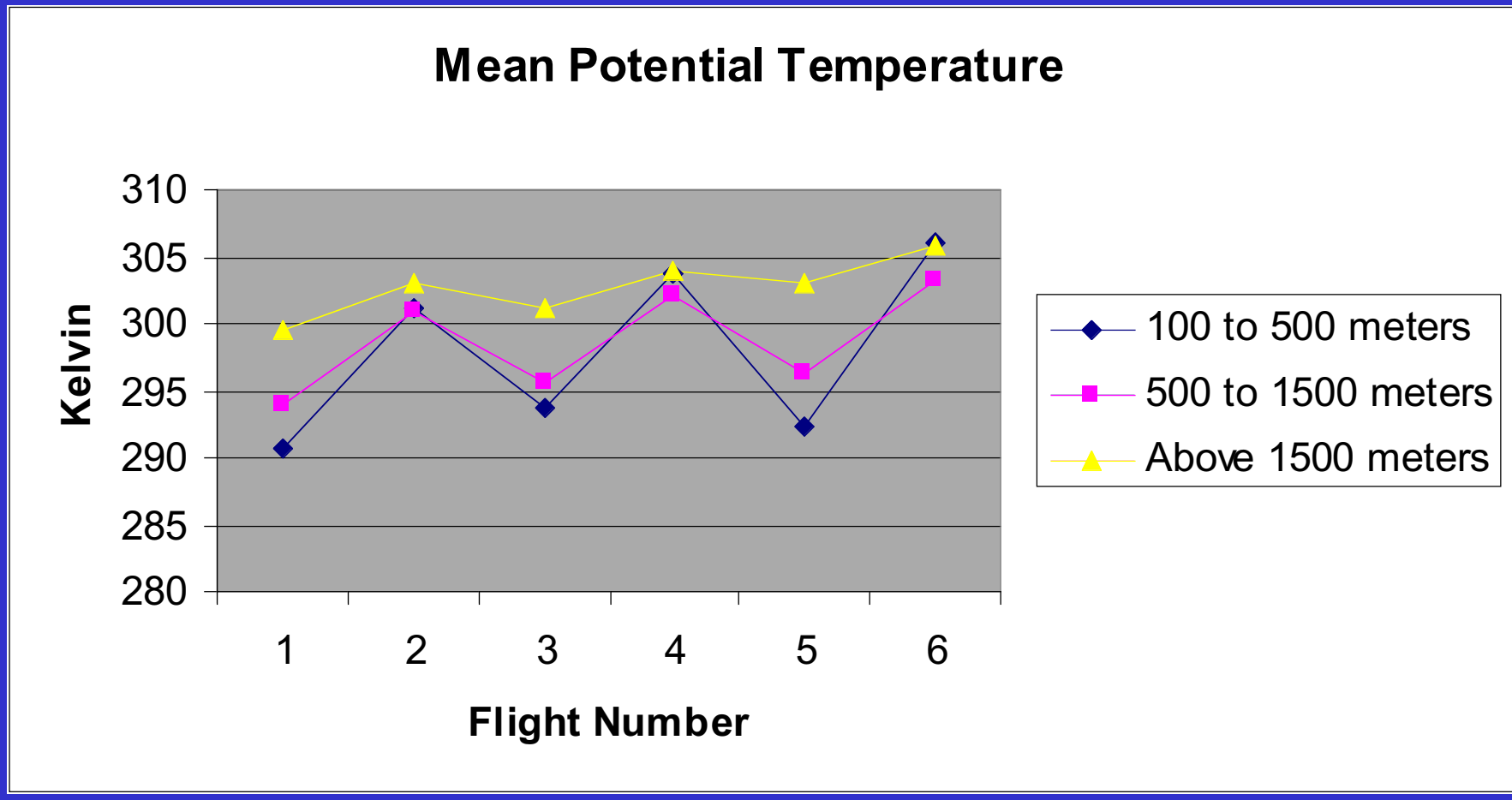


Ozone concentrations along flight paths,
Red denotes values greater than 100 ppb

Longitude


Mean Condensation Particle Counter
8000
6000
4000
2000
0
/cm3
1
2
3
4
5
6
Flight Number
100 to 500 meters
500 to 1500 meters
Above 1500 meters


Mean PCASP Count (0.1 to 3 microns)
600
500
400
300
200
100
0
/cm3
1
2
3
4
5
6
Flight Number
100 to 500 meters
500 to 1500 meters
Above 1500 meters


Mean Potential Temperature
Kelvin
310
305
300
295
290
285
280
1
2
3
4
5
6
Flight Number
100 to 500 meters
500 to 1500 meters
Above 1500 meters

Preliminary Results

- Local and regional terrain-induced circulations can develop with moderate synoptic forcing.
- High ozone values were associated with urban areas in the valley, not agricultural regions.
- Local emissions from urban centers in the valley appear to be more important than regional transport.
- Vertical layering occurred with higher ozone values aloft.
- Buildup of ozone and aerosols occurred with the weakening of the synoptic forcing and increased surface heating.

Future Plan

Focus initially on the days when data from G-1 were available.

Extend to the rest of the four-month CCOS period to examine cases with different synoptic conditions.

Contrast non-episode cases with episode cases to identify the differences in the characteristics of the dynamical processes and relate them to changes in the observed air chemistry.

Compare the results to other EMP-ACP field studies in complex terrain (Phoenix, Salt Lake City ...)

Work Plan:

Data analyses

- Identify the occurrences and determine the characteristics of pollution layers aloft through analyses of aircraft data.
- Characterize various dynamical processes using data from the upper air and surface meteorological network.
- Relate the differences in the characteristics of vertical layering to the changes in various dynamical processes.
- Use surface measurements as well as upper air observations to determine the relative contributions of the layers aloft to surface concentrations.

Modeling

- Evaluate model simulations of the dynamical and chemical processes in the region using the extensive observations.
- Carry out sensitivity studies to evaluate the relative importance of various dynamic mechanisms in the formation of pollution layers aloft.
- Use 4DDA to produce the ‘best possible’ descriptions of the dynamics for evaluations of chemical mechanisms involved in vertical layering.
- Quantify the contribution of layers aloft to surface concentration.

Any comments and suggestions or potential collaborations, please contact

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