

# Using Aircraft Data for Model Evaluation

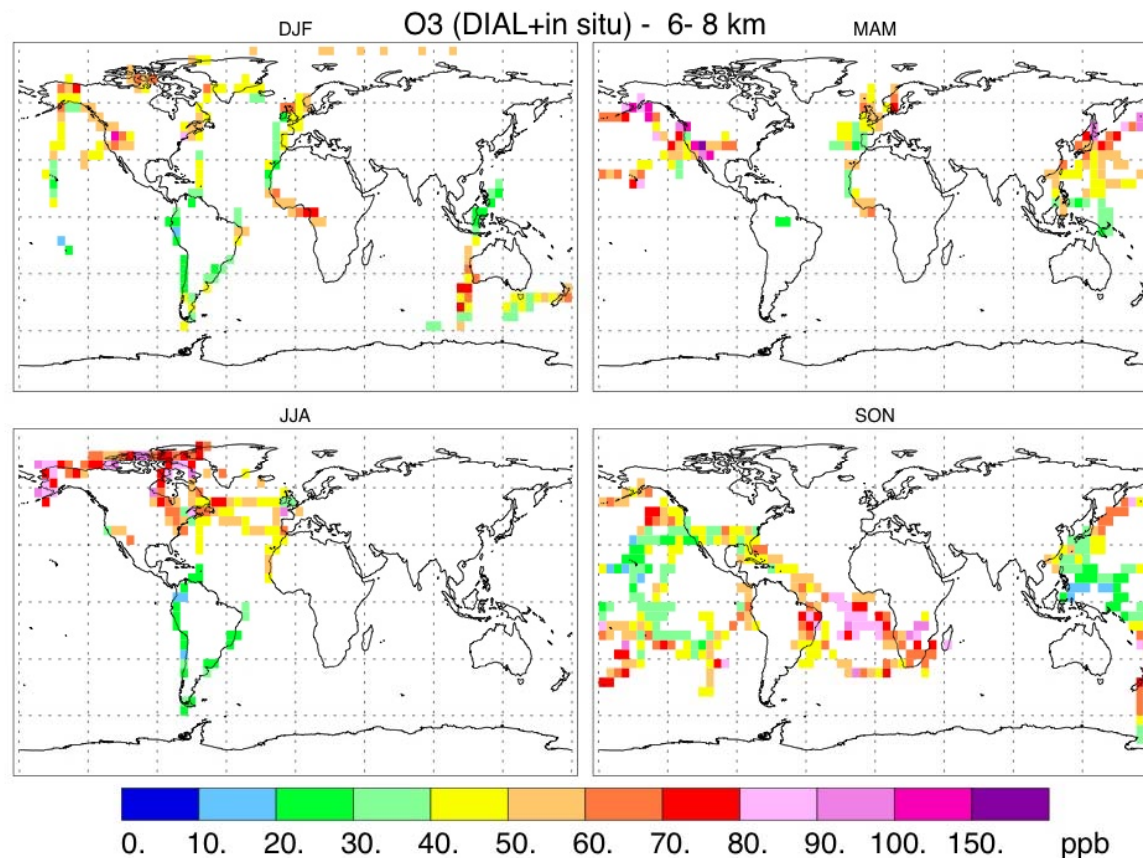
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# Data Composites of Aircraft Measurements

[*Emmons et al., JGR, 2000*]

Initial goal – to create climatologies

Created for evaluation of global chemistry models driven by climatological (climate model) meteorology

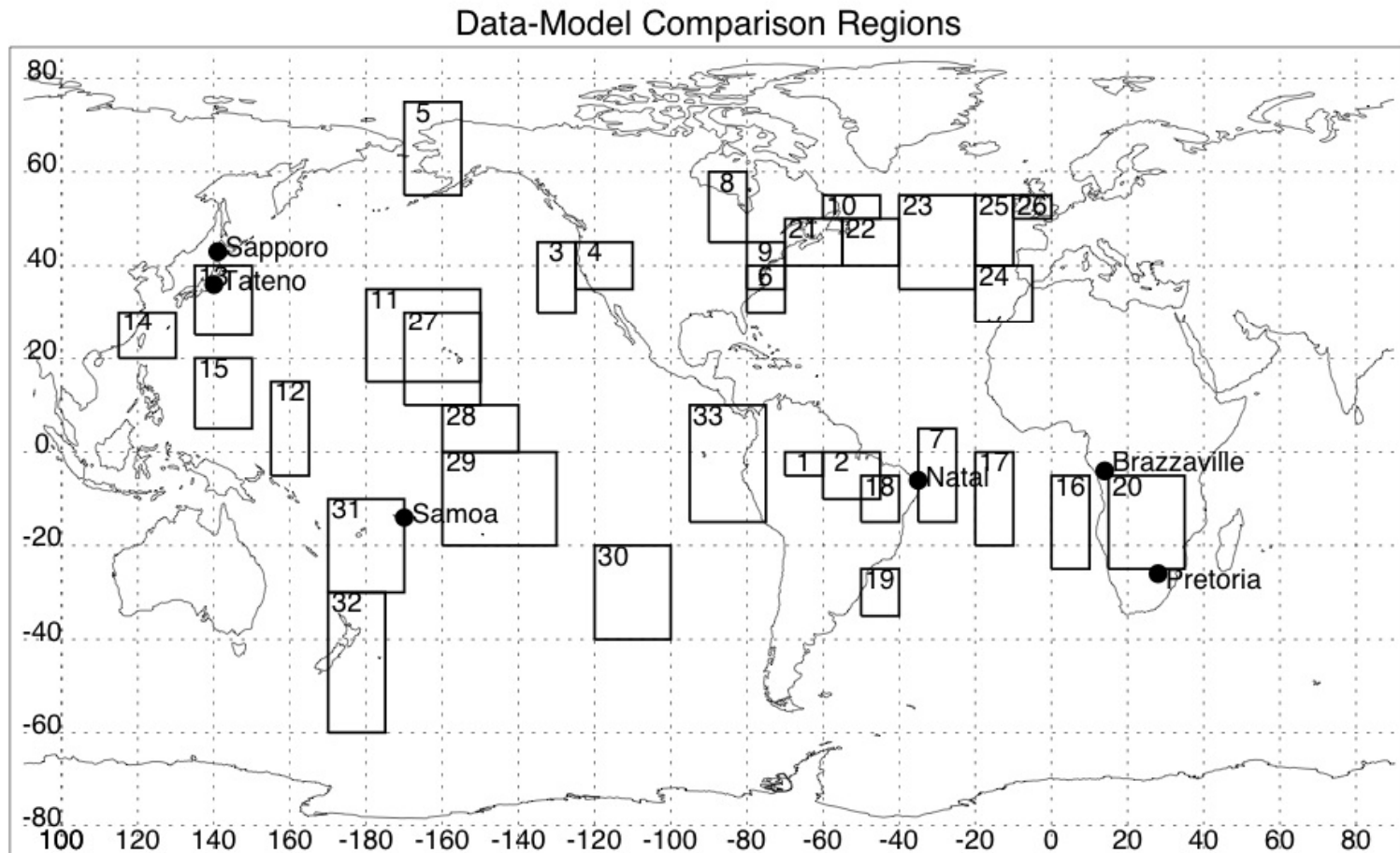


## Aircraft Campaigns 1983-1996

CITE-1,2,3  
ABLE-2A,B,-3A,B  
STRAT0Z, TROPOZ  
AASE-1,2  
PEM-West-A,B  
MLOPEX  
TRACE-A  
OCTA  
ACE-1  
TOTE, VOTE  
SUCCESS  
PEM-Tropics-A

# Data Composites – regional profiles

For each aircraft campaign, large regions chosen –  
measurements averaged over each km in altitude –  
average profiles created



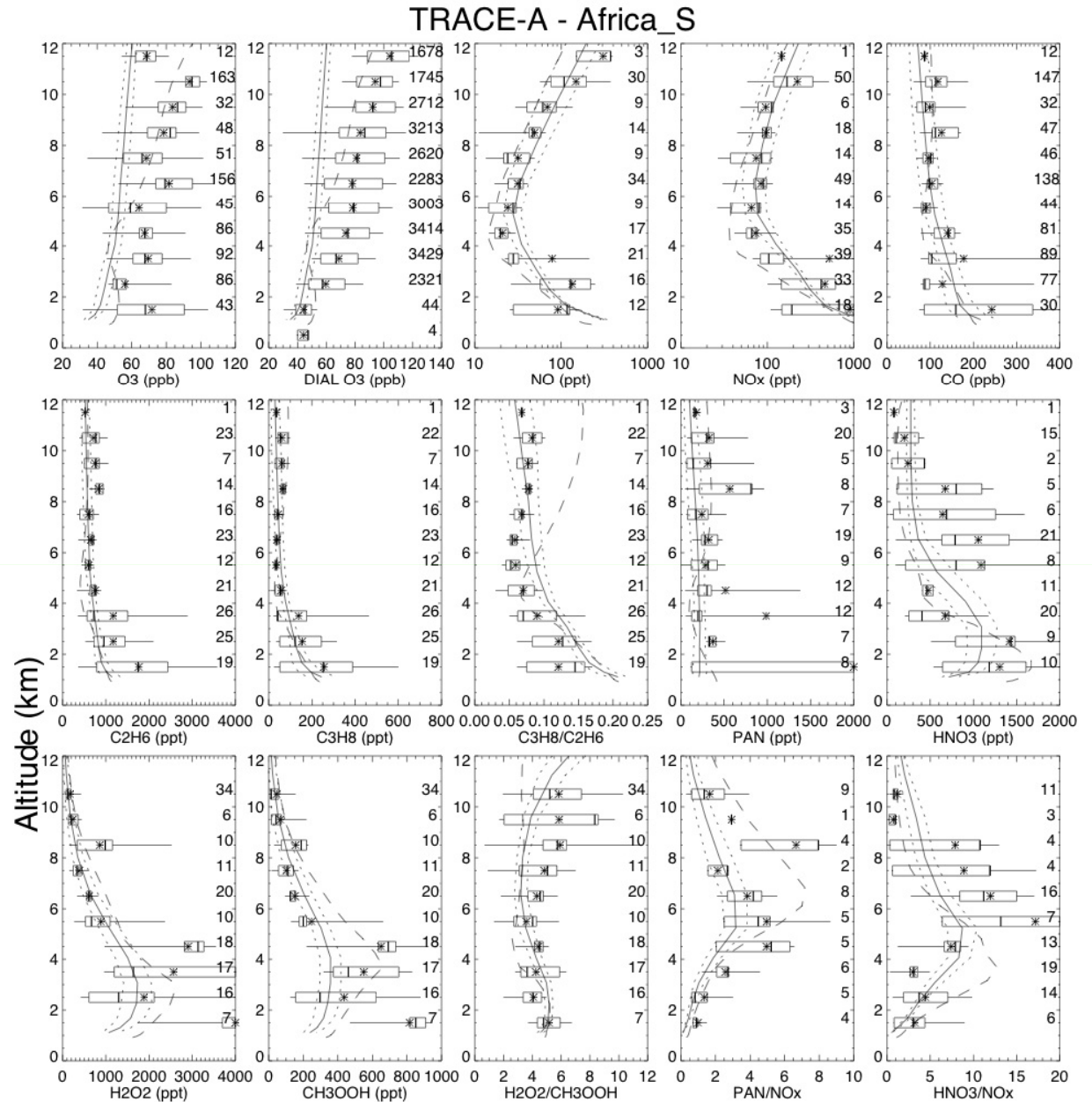
# Data Composites – regional profiles

Model results were averaged over same region and time period

Lines: MOZART-2, IMAGES

Box-whisker: Obs – median, quartiles, 90%

Star: Obs mean



# Data Composites -- Details

Species (chosen because available in many campaigns and in models):

O<sub>3</sub>, CO, NO, NO<sub>2</sub>, PAN, HNO<sub>3</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>3</sub>H<sub>8</sub>, CH<sub>2</sub>O, CH<sub>3</sub>COCH<sub>3</sub>, H<sub>2</sub>O<sub>2</sub>, CH<sub>3</sub>OOH

Ratios:

PAN/NO<sub>x</sub>, HNO<sub>3</sub>/NO<sub>x</sub>, H<sub>2</sub>O<sub>2</sub>/CH<sub>3</sub>OOH, C<sub>3</sub>H<sub>8</sub>/C<sub>2</sub>H<sub>6</sub>

P(O<sub>3</sub>) from box model calculations

Started from 1-min merges

Observations below LOD were set to ½ of LOD

Statistics calculated for each 5° x 5° x 1km or regional profile box:

Nobs, min, max, mean, std.deviation, median, quartiles

Use of median reduces influence of plumes, etc.

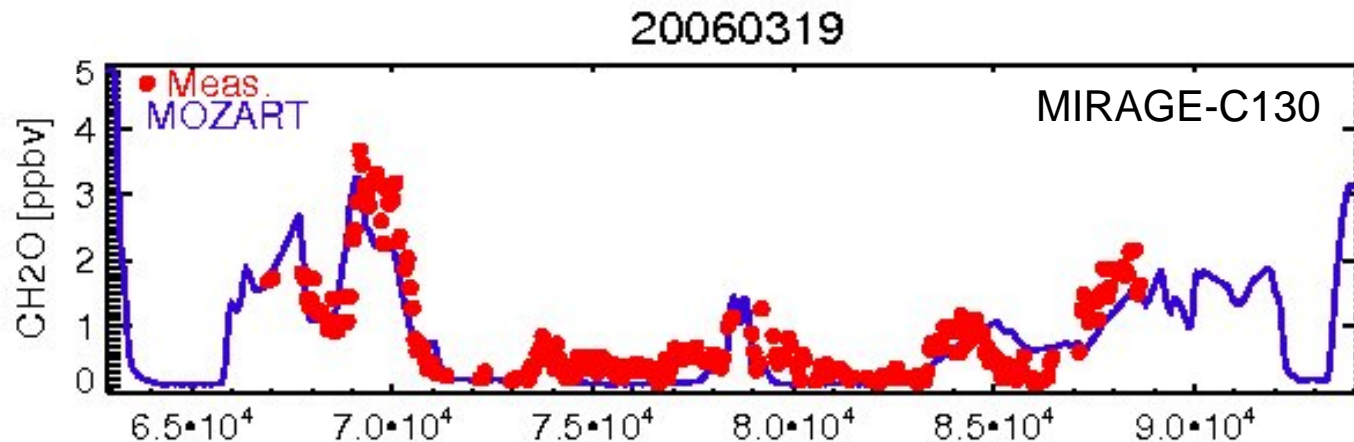
# Model vs Aircraft Measurements

## Regional profiles:

- Still valuable for rough model evaluation
- Used for coupled chemistry-climate model evaluation
- But limited value for identifying source of model deficiencies (too many possibilities – time/location mismatch, fire emissions not for measurement year, etc.)

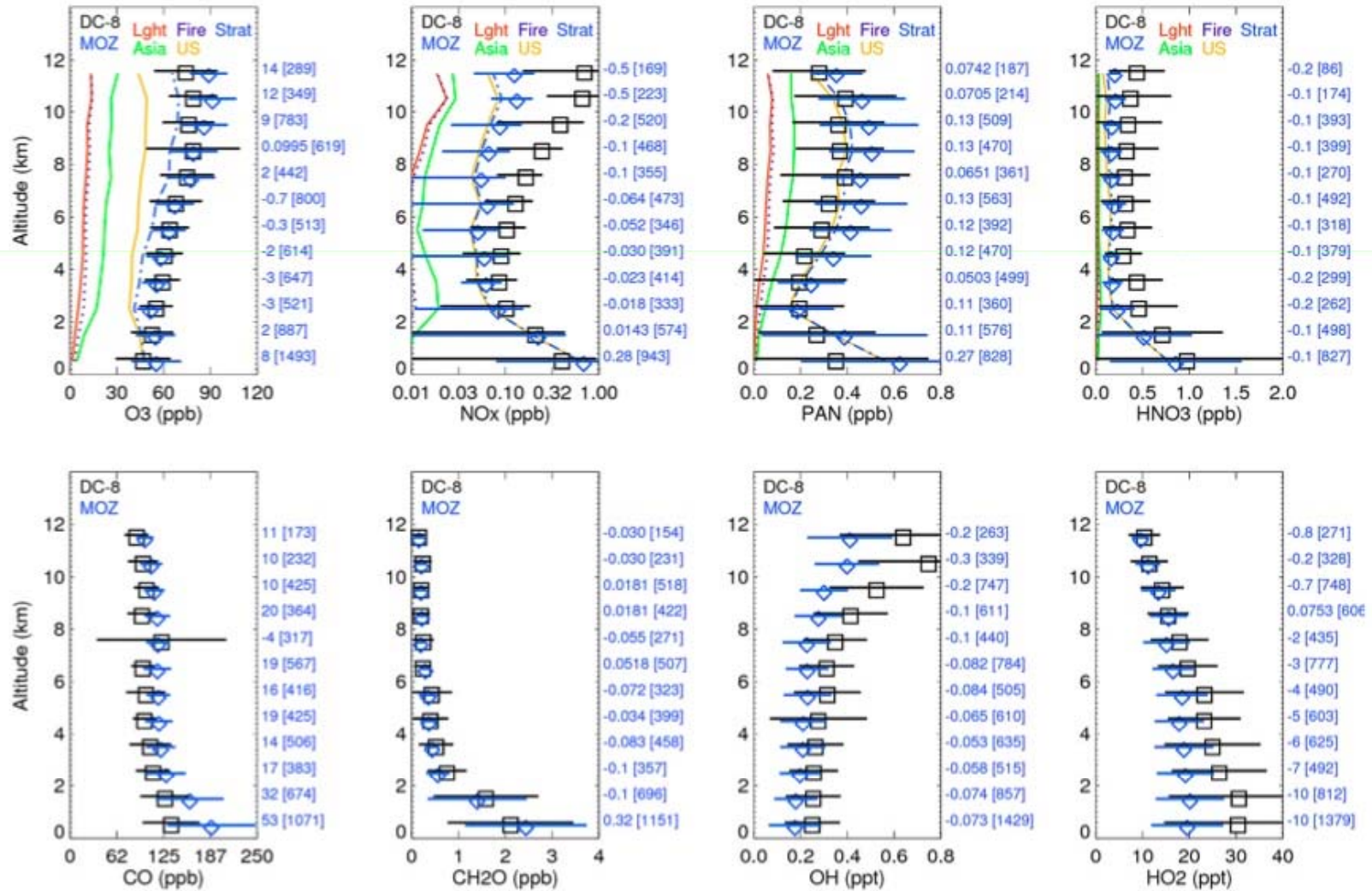
## Model interpolated to flight tracks:

- New standard for evaluation of models used in field campaign support
- Allow for more critical evaluation of processes, model chemistry, etc.



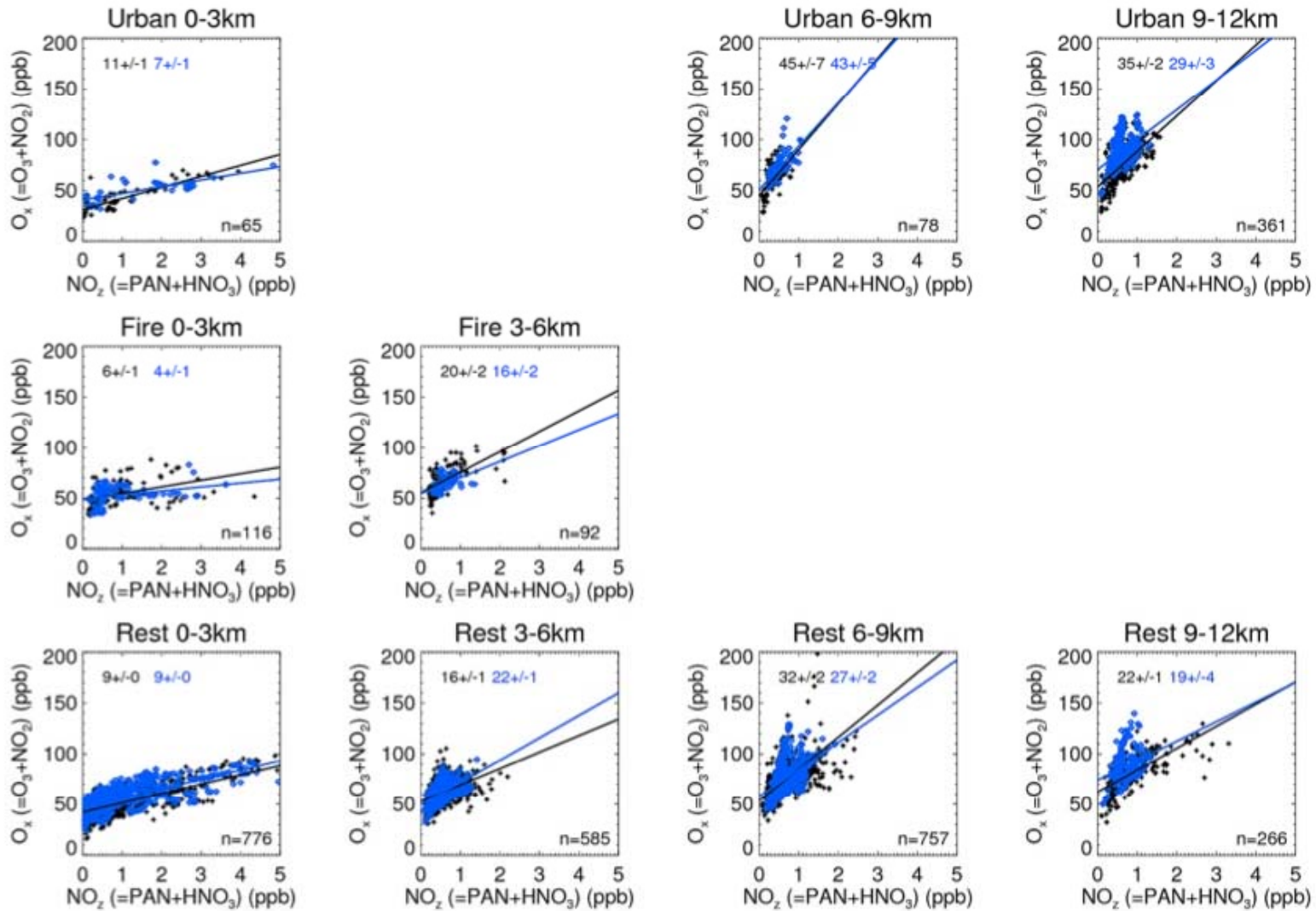
# INTEX-A MOZART evaluation

MOZART-4/GFS interpolated to INTEX-A DC8 flight tracks,  
then binned by altitude



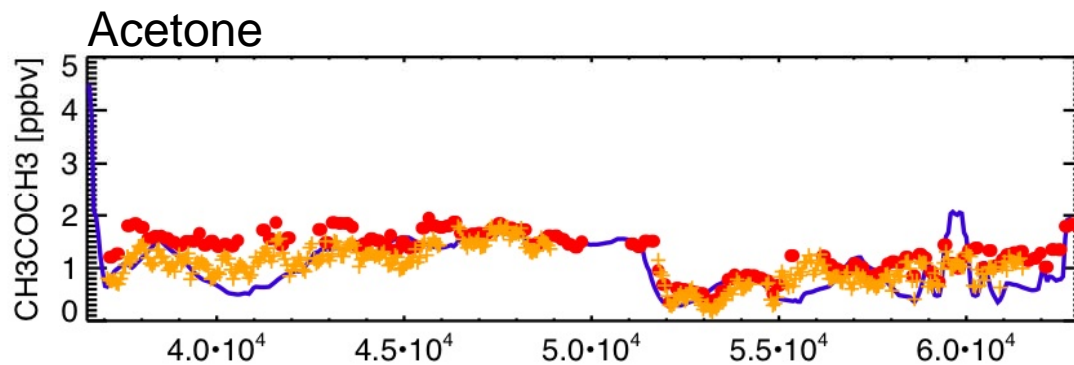
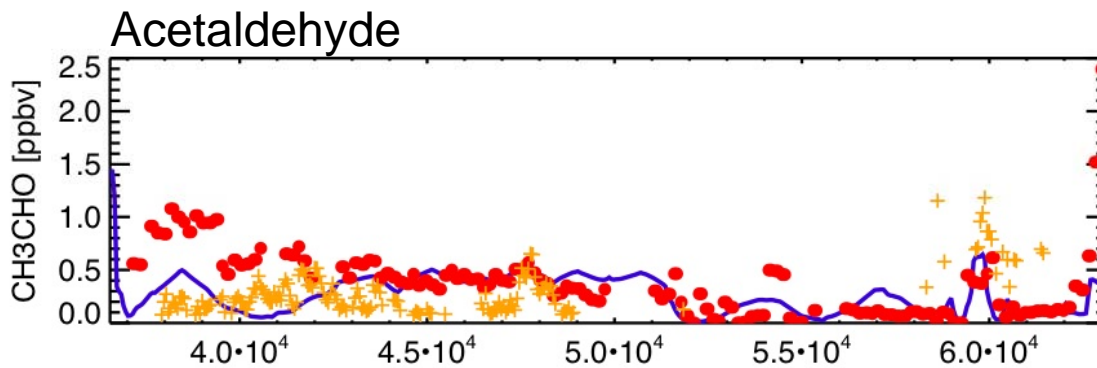
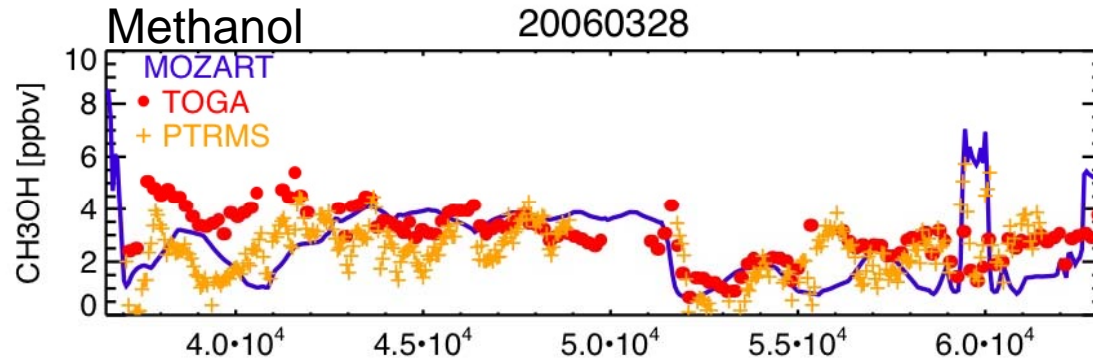
# INTEX-A MOZART evaluation

Evaluate model O3 production with correlations of Ox vs NOz





# MIRAGE – C-130



Modelers need guidance  
on using 2 simultaneous  
measurements of a  
species

C-130: TOGA (Apel) &  
PTRMS (Karl)

Some differences due to  
timing

Some systematic differences