

Hydrogen Peroxide
Methylhydroperoxide
Formaldehyde & (Peroxyacetic Acid)

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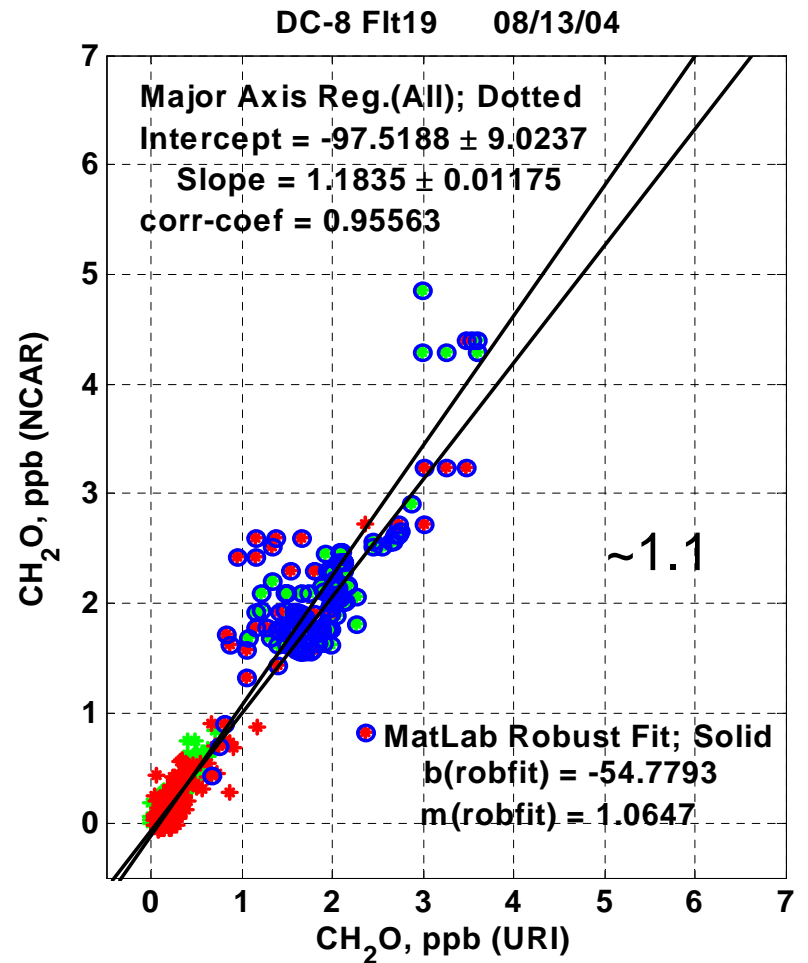
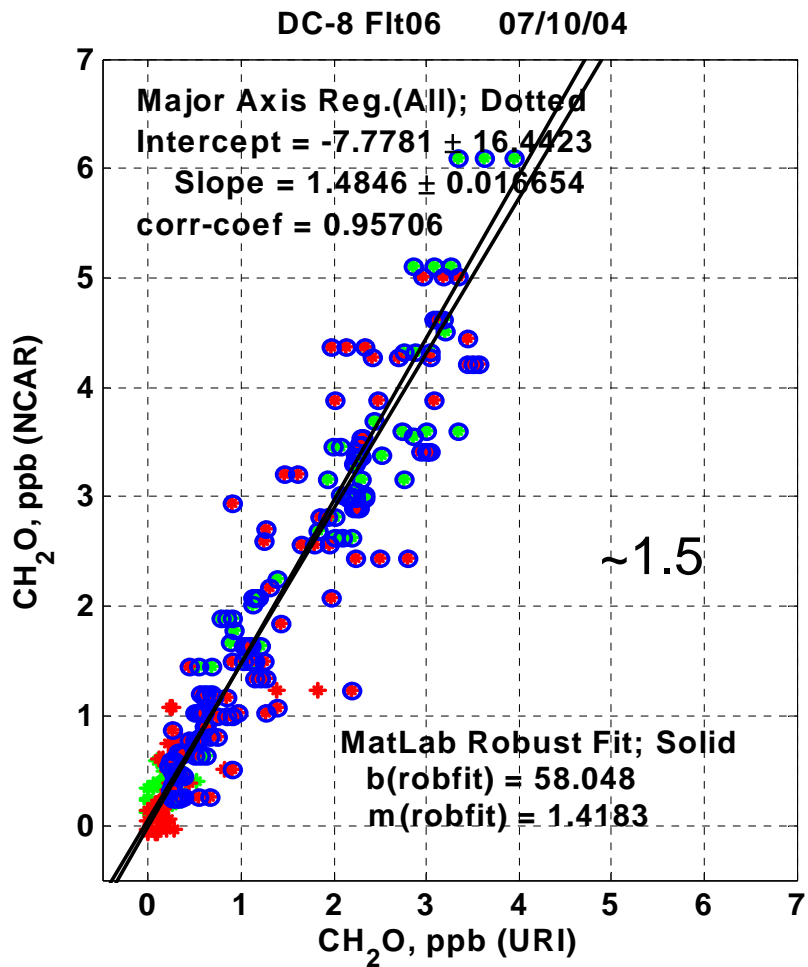
Our INTEX Objectives

In Measuring Title Compounds

- Tropospheric Ozone
- Radical Oxidants: HO, HO₂, CH₃OO, CH₃C(O)OO ?
- Carbon Processing:
 - HC's -> CH₂O -> CO ; CH₂O lifetime and carbon flux through CH₂O
 - CH₃OOH or CH₂O ; methane world vs nonmethane world
 - CH₃C(O)OOH (HO₂ vs NO₂) ;
- Extension of Trop-Chem Measurements by Satellite:
 - CH₂O directly
 - Combined with other compounds and campaigns
- Vertical Transport & Mixing
 - Tracers, Yes
 - Working on being quantitative
- Instrument Development & Comparison
 - H₂O₂ : URI, CIT & BAE146
 - CH₂O: URI, NCAR & WP3

Instrument Changes and Comparison

- CH₂O – pre-mission, during, & prototype
 - Simplified FIA system; improved noise
 - Modified signal processing; noise vs response time
 - Stability allows for continuous measurements
- Last Five Flights (16-20; 8/6,7,11,13 &14)
 - 1 minute resolution with continuous sampling
 - 25 pptv level of detection
- CH₂O Relationships with Other Compounds



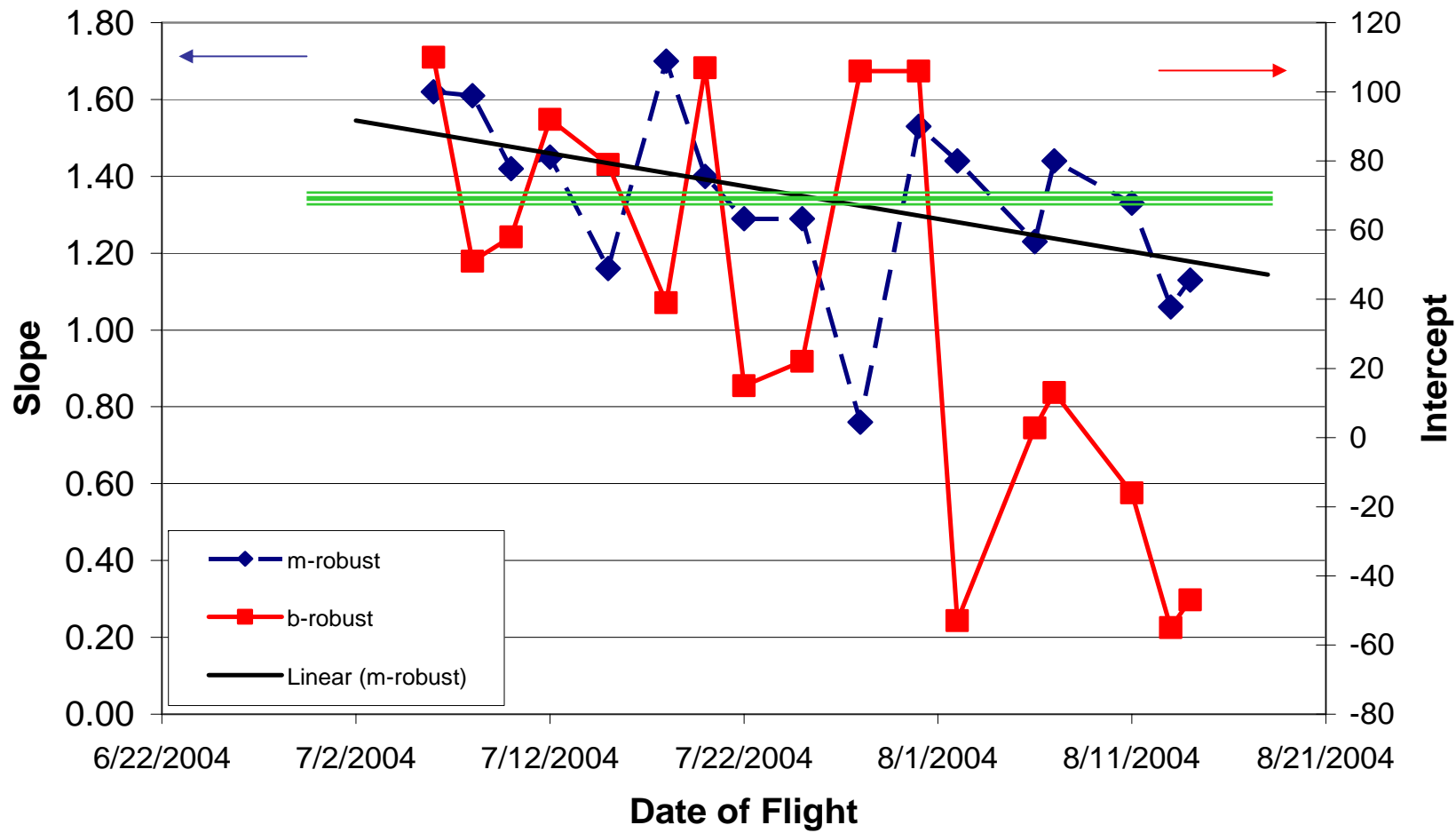
Direct comparison, URI & NCAR, 10-s Merge Product

red – ascent/descent

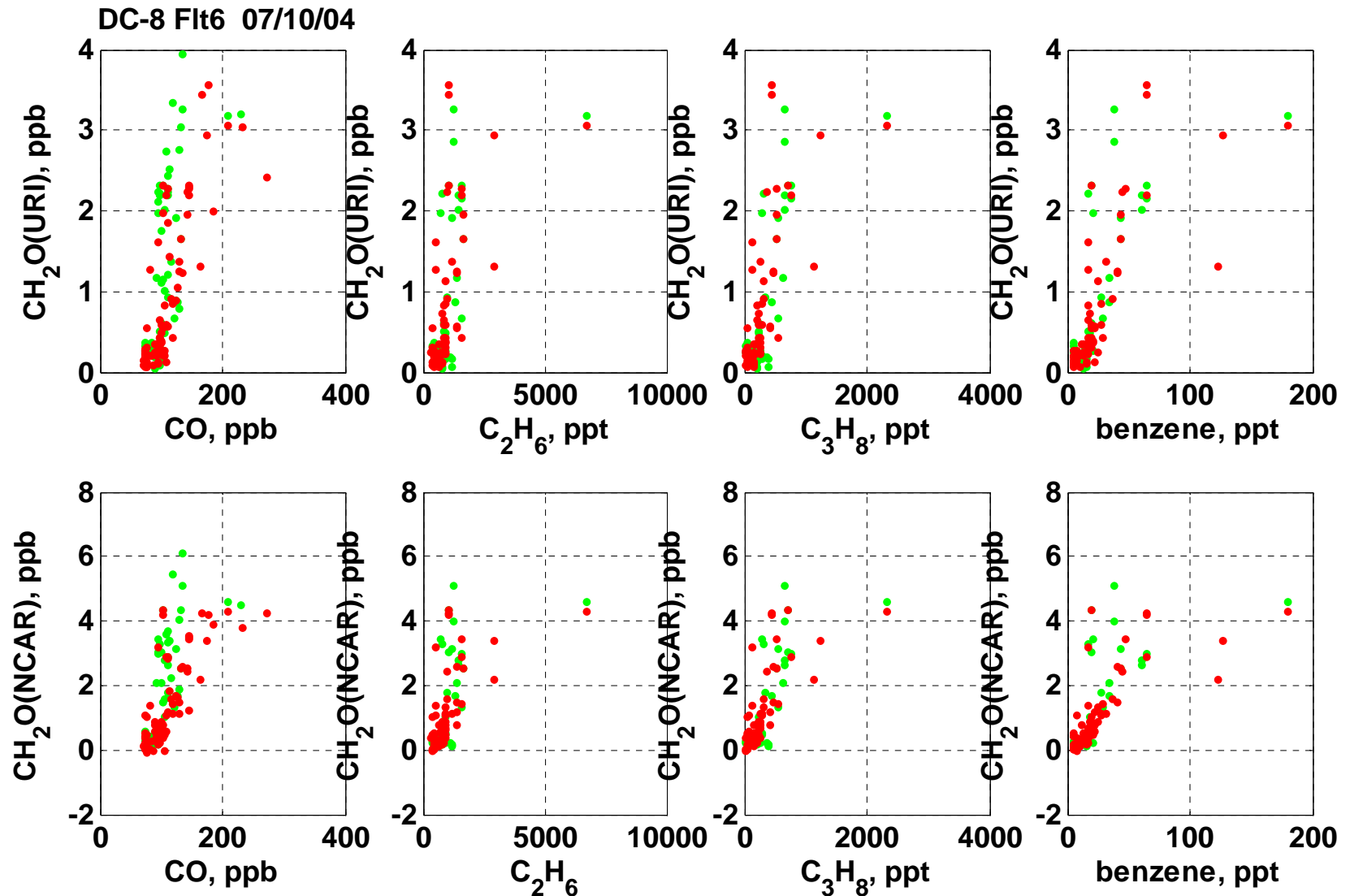
green – level

blue – $X_w > 1\%$

Formaldehyde Robust Fit Regression: NCAR = URI*slope + intercept

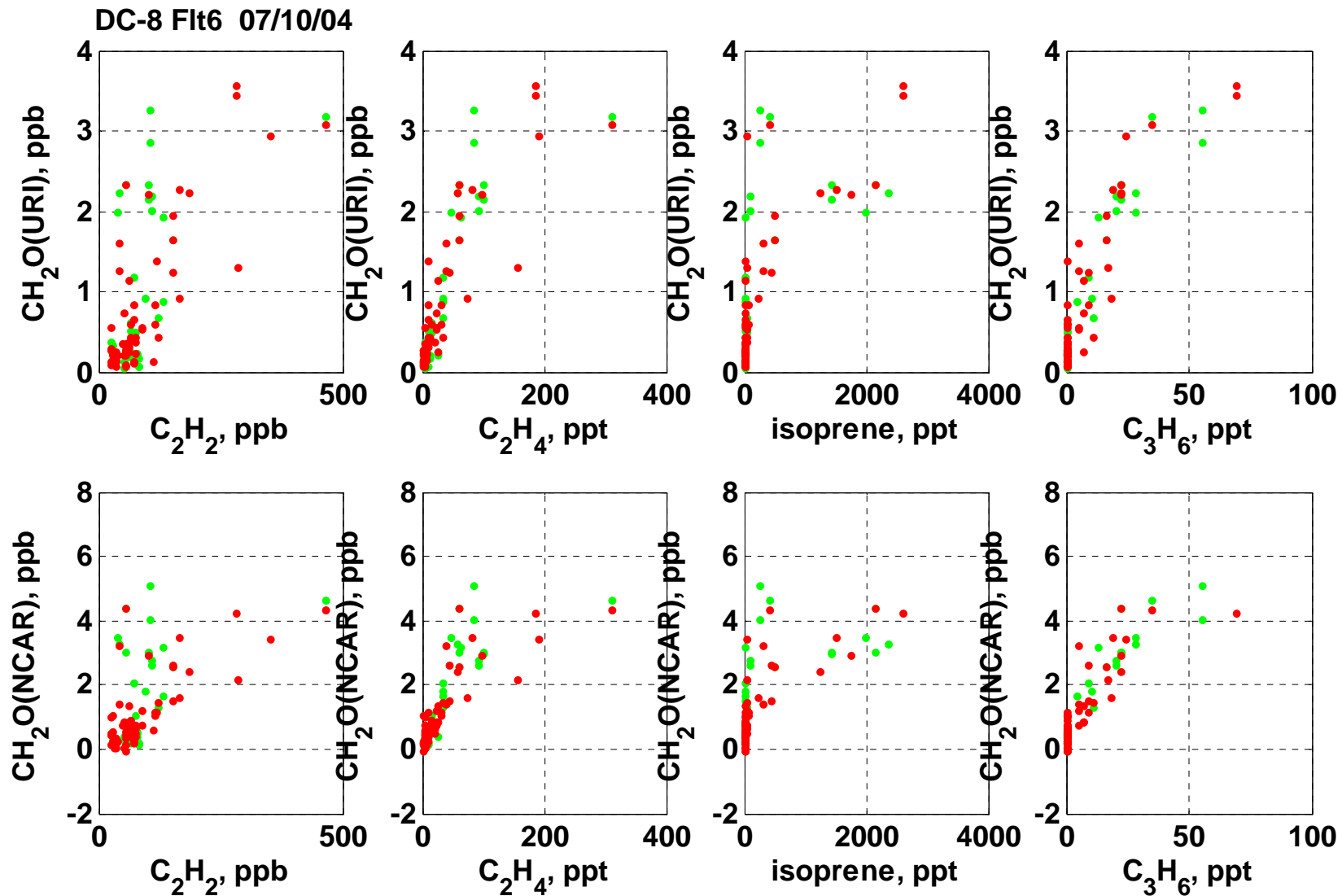


Formaldehyde Relationships with Parents & Daughter Carbon Monoxide, Ethane, Propane, & Benzene



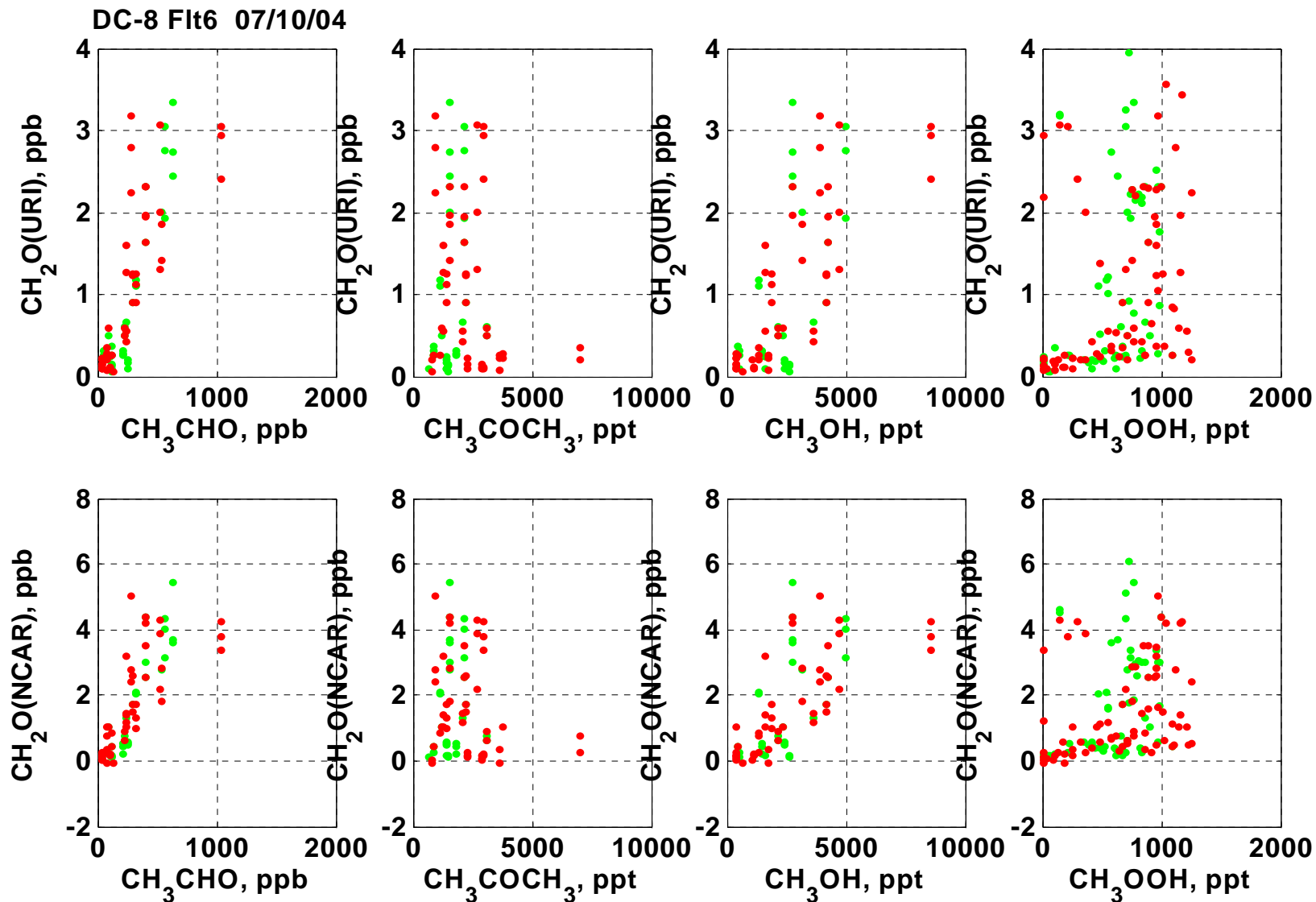
Formaldehyde Relationships Continued

Ethyne, Ethene, Isoprene, & Propene

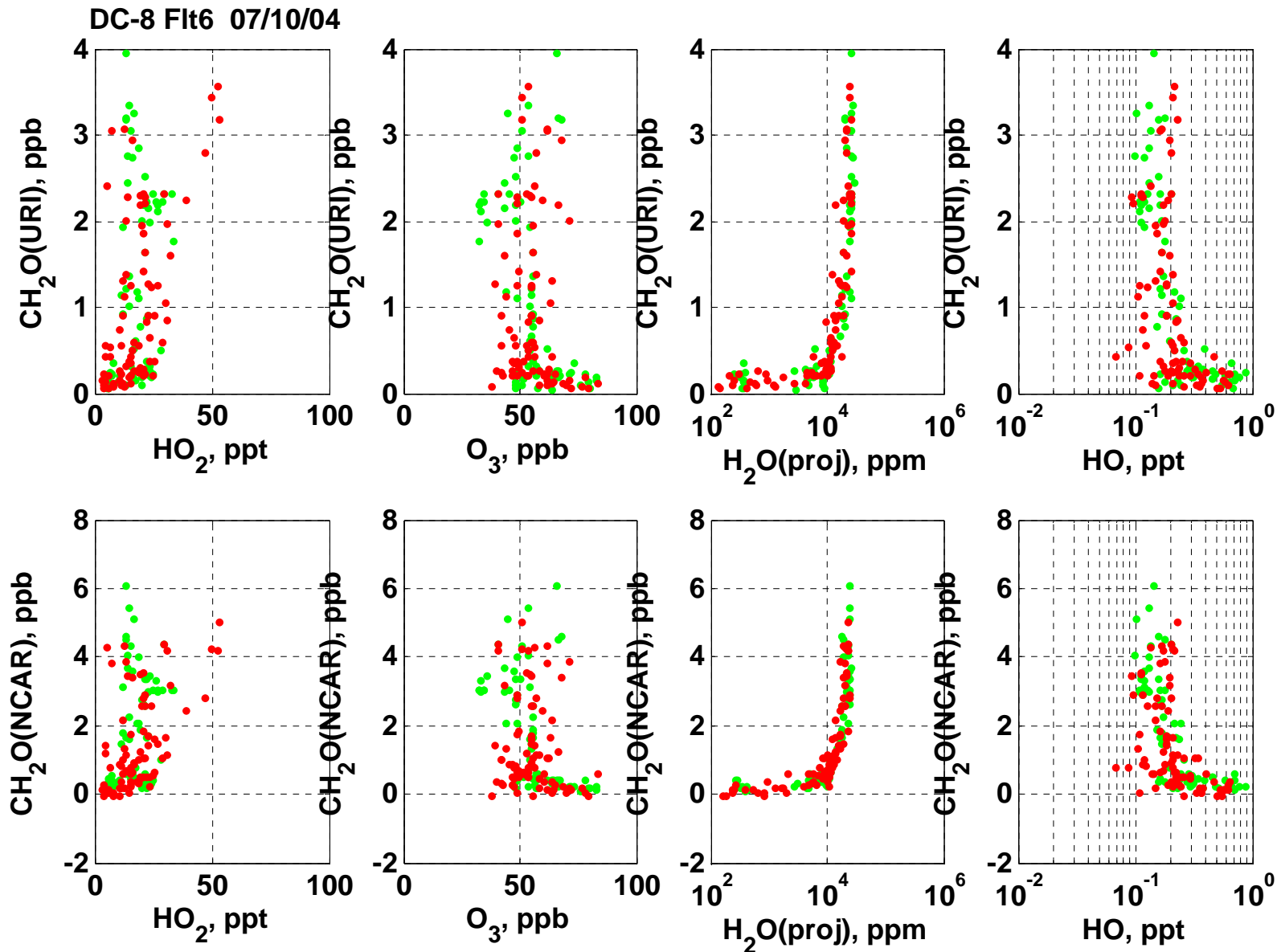


Formaldehyde ...

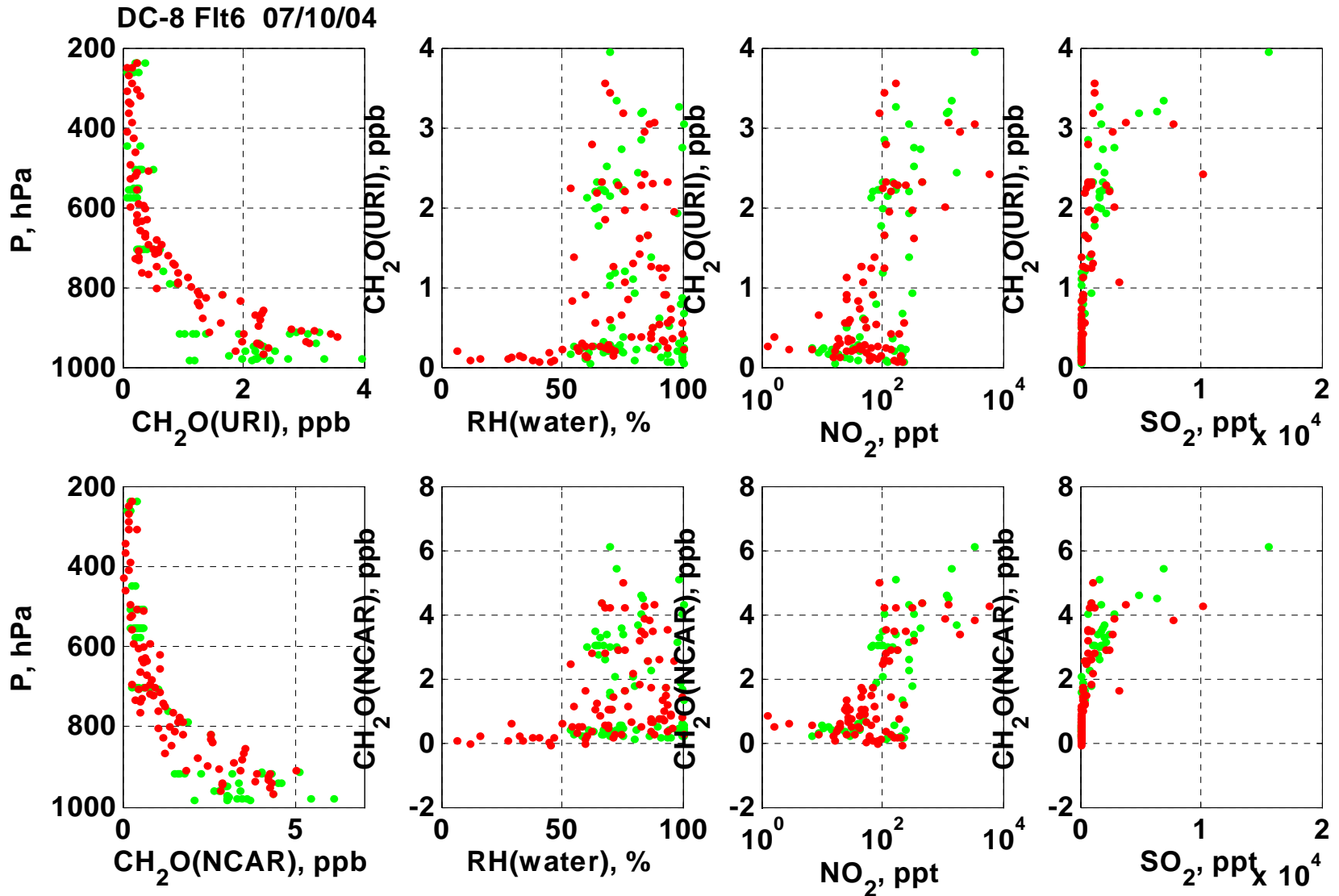
Acetaldehyde, Acetone, Methanol, Methylhydroperoxide



Formaldehyde ... Perhydroxyl, Ozone, Water, & Hydroxyl

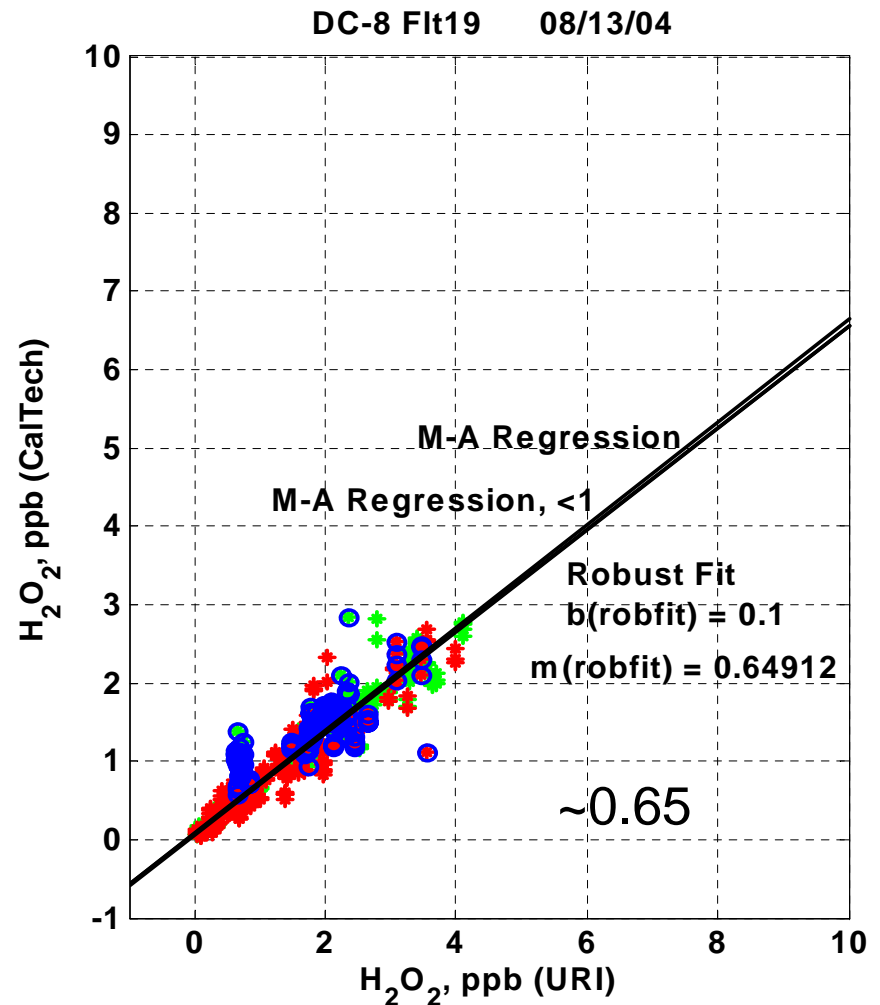
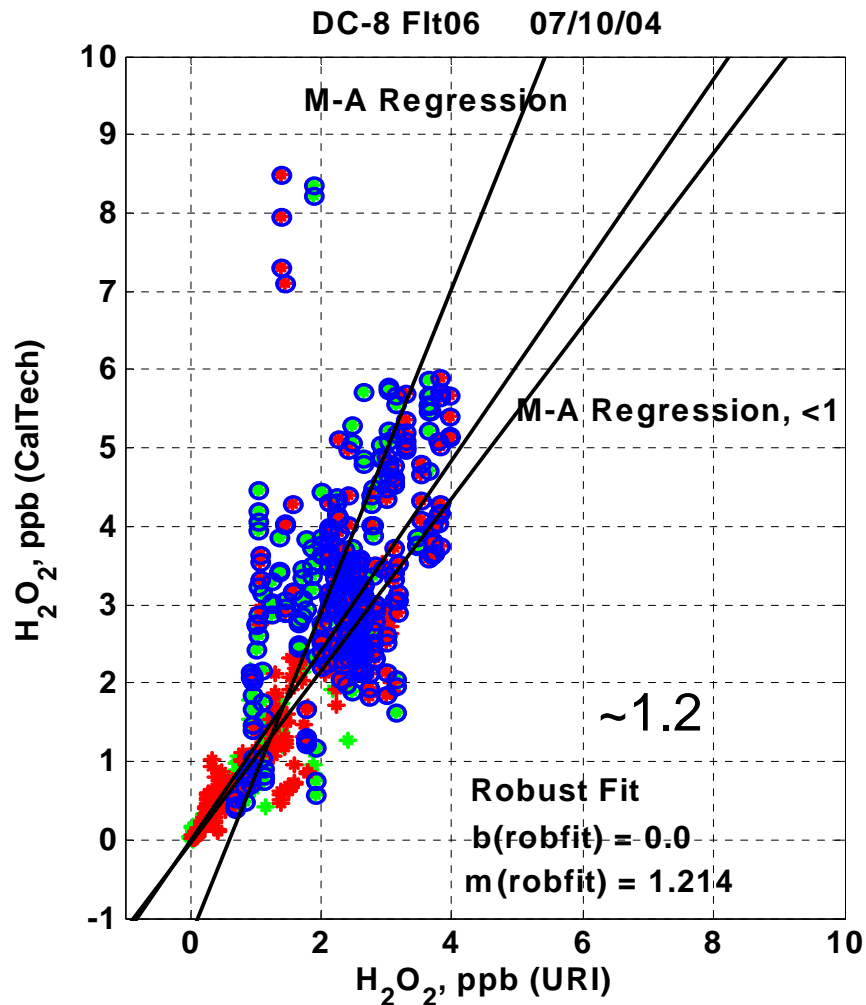


Formaldehyde vs Pressure, RH, Nitrogen Dioxide, Sulfur Dioxide



Instrument Changes & Comparison

- H₂O₂ / CH₃OOH / CH₃C(O)OOH
 - Initial setup for H₂O₂ / CH₃OOH alone
 - StL Samples Indicated 3rd ROOH;
PAA on CIT
 - New HPLC Column online in Portsmouth
 - Tests for hydroxymethylhydroperoxide – negative
 - Tests for peroxyacetic acid – positive
 - Modify mode and run times to resolve PAA,
PAA is a work in progress (~3 months more)
 - Hence, less frequent sampling from NH on.



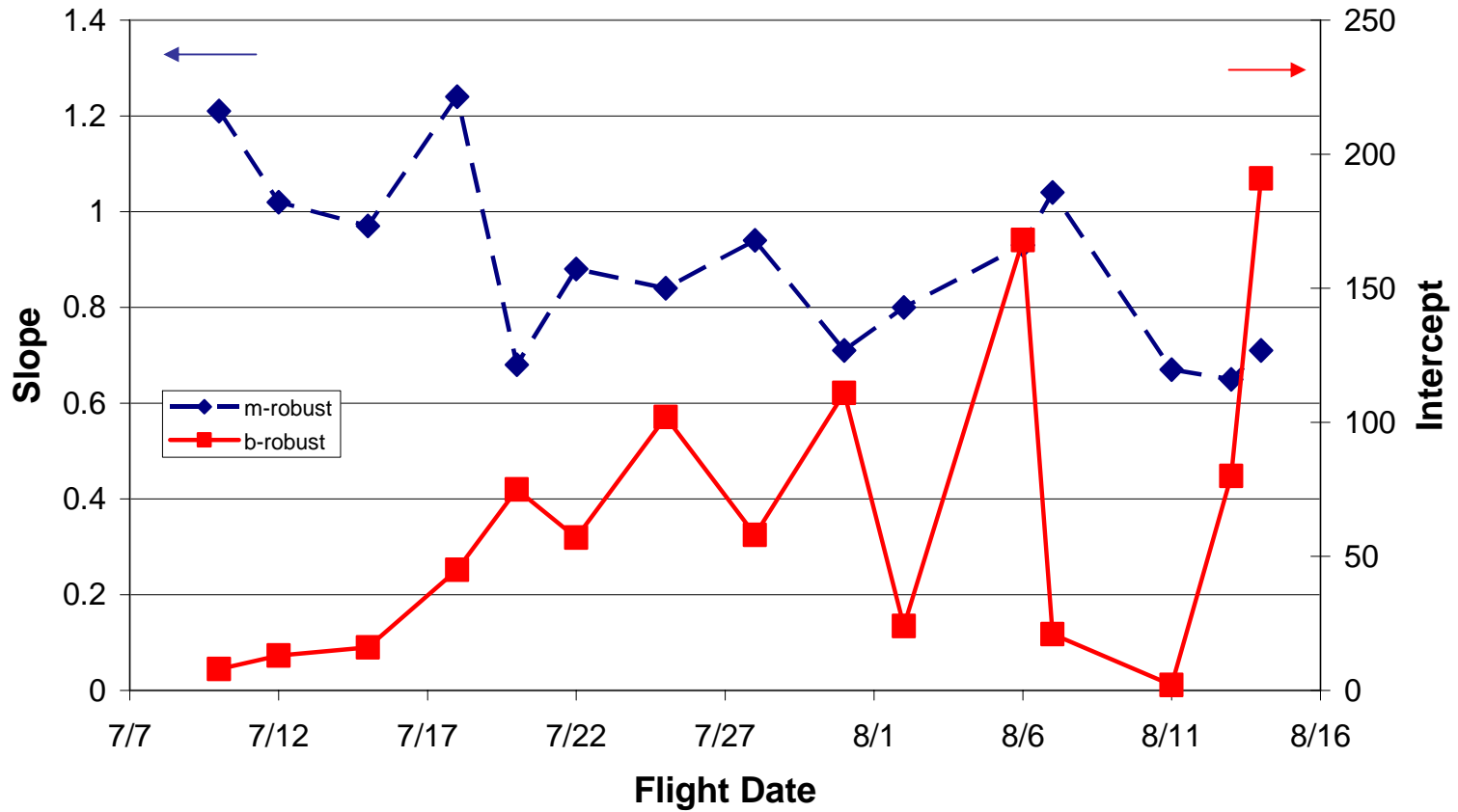
URI-CIT Direct Comparison – OUTLIERS – Robust Fit Algorithm (MatLab)

red – ascent/descent

green – level

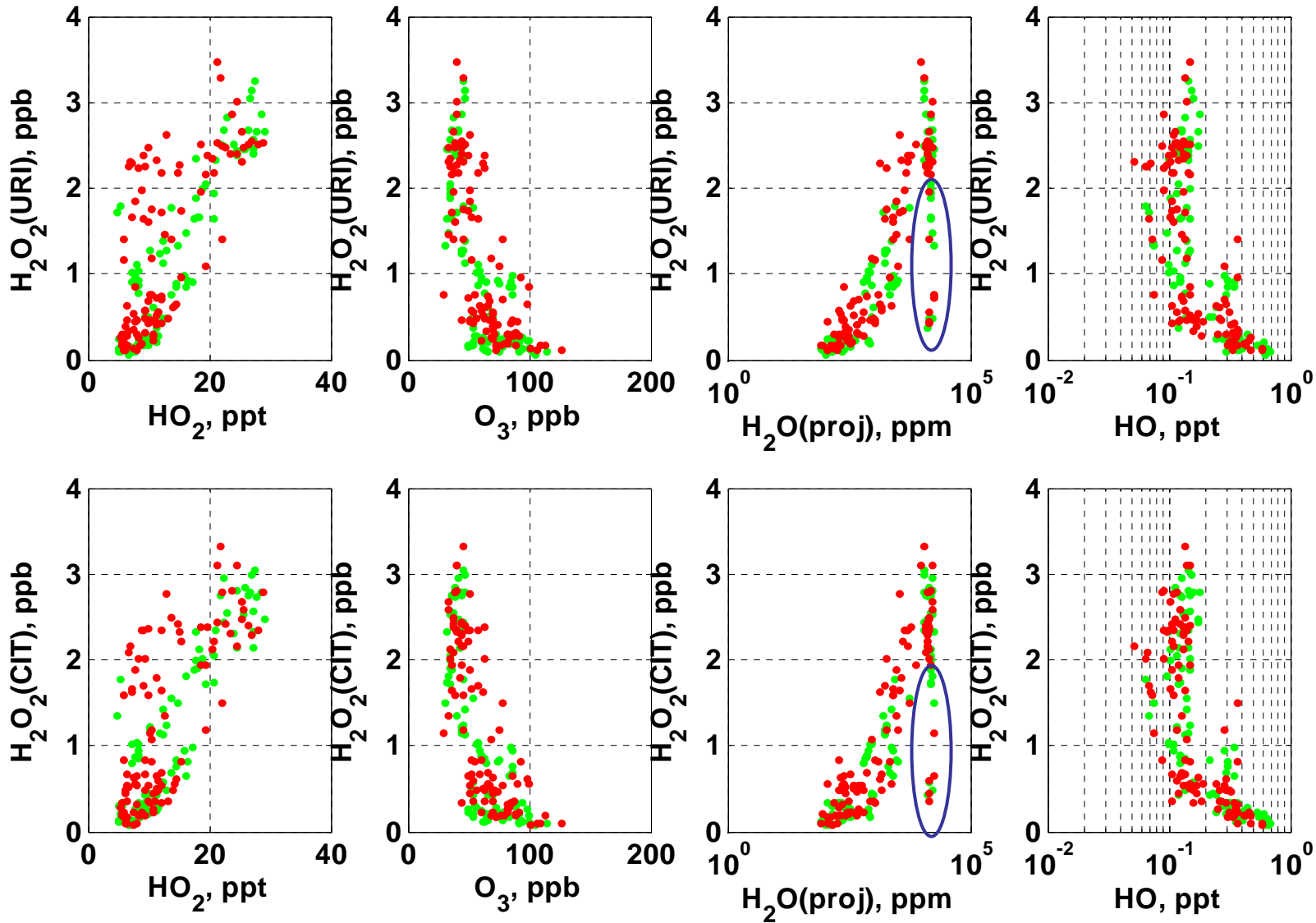
blue – $X_v < 1\%$

Hydrogen Peroxide Robust Fit: $CIT = URI * slope + intercept$



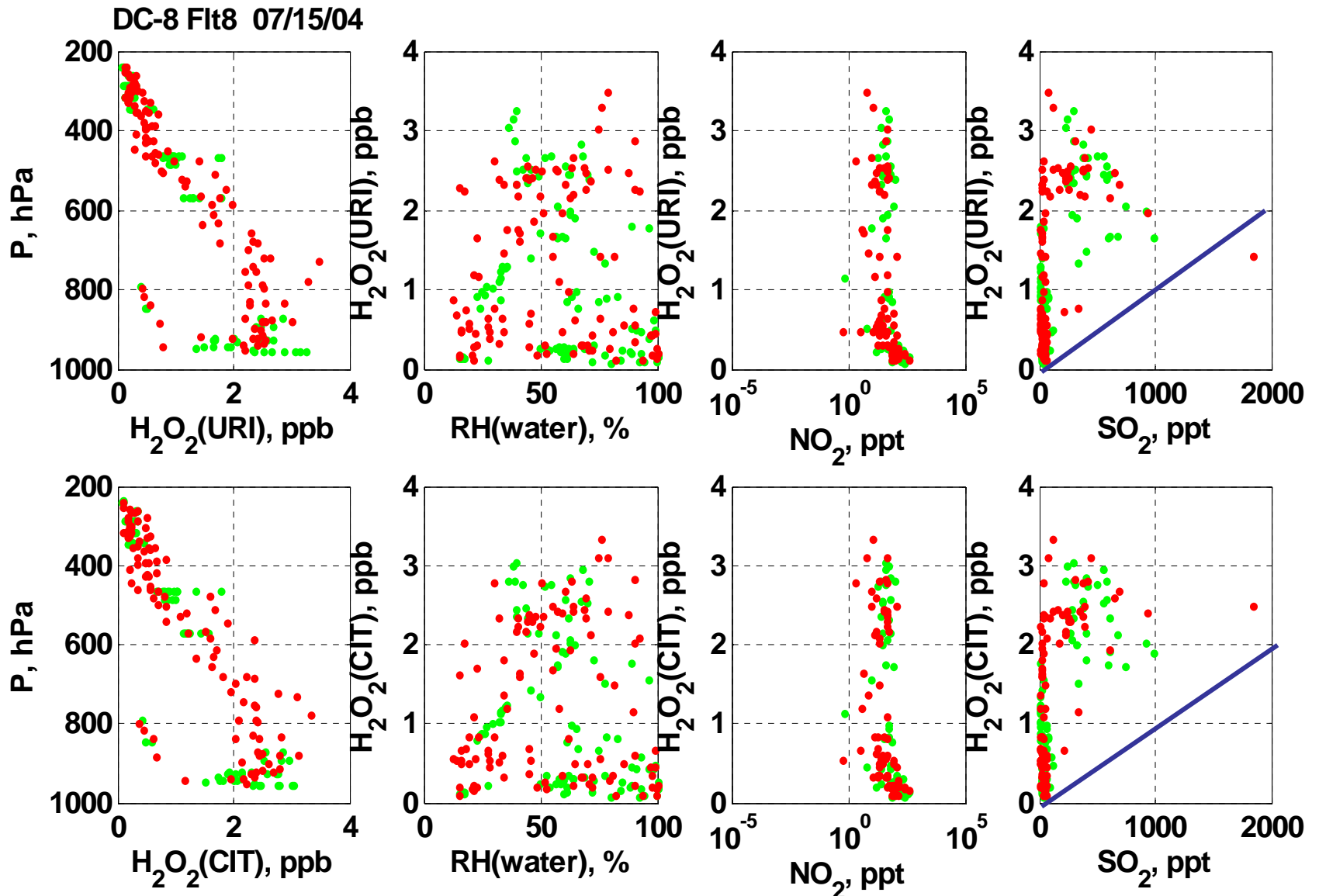
Hydrogen Peroxide Relationships Perhydroxyl, Ozone, Water, & Hydroxyl

DC-8 Flt8 07/15/04



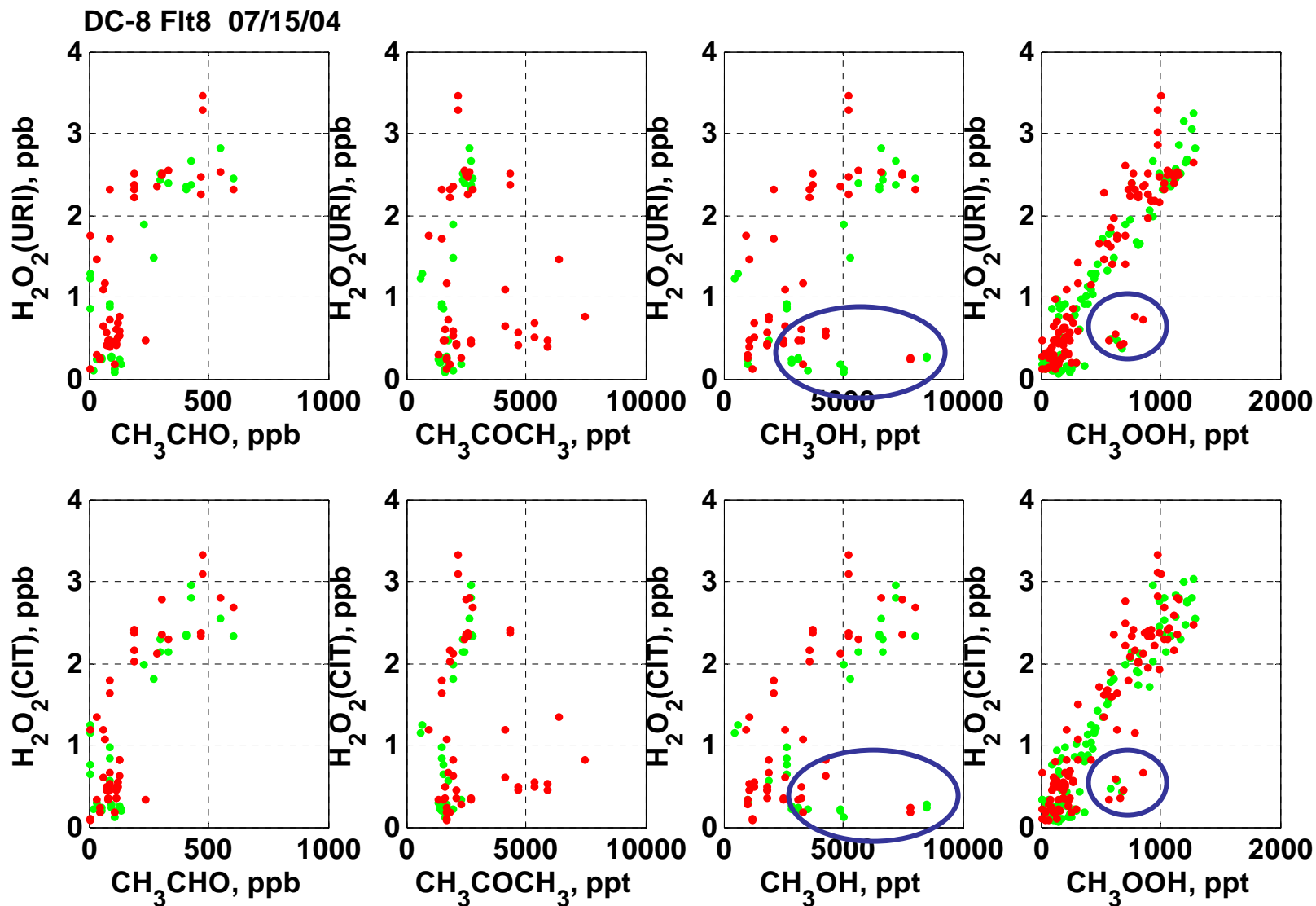
Hydrogen Peroxide ...

Pressure, RH, Nitrogen Dioxide, Sulfur Dioxide

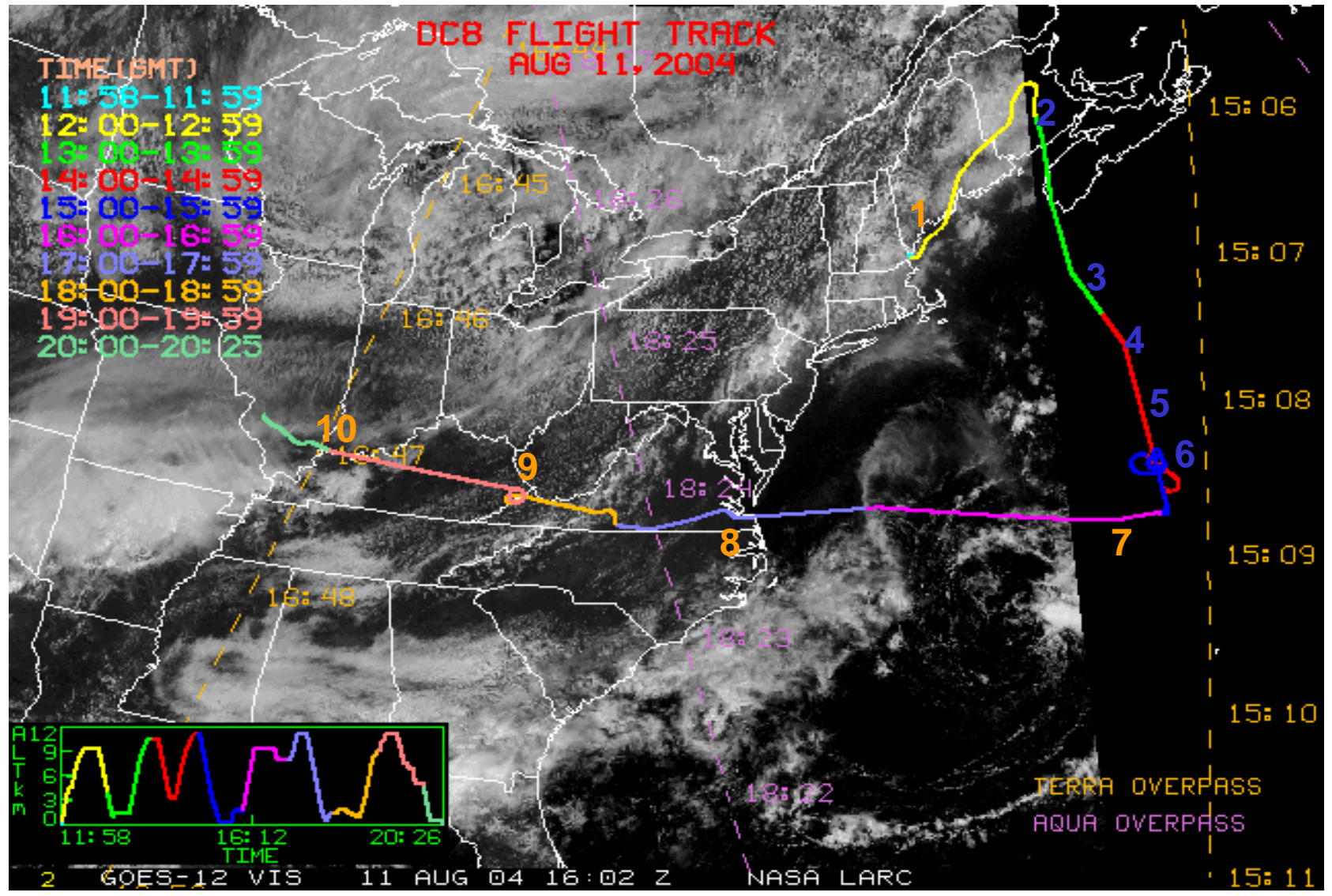


Hydrogen Peroxide ...

Acetaldehyde, Acetone, Methanol, Methylhydroperoxide



Case Study: August 11, 2004; DC-8 Flight 18

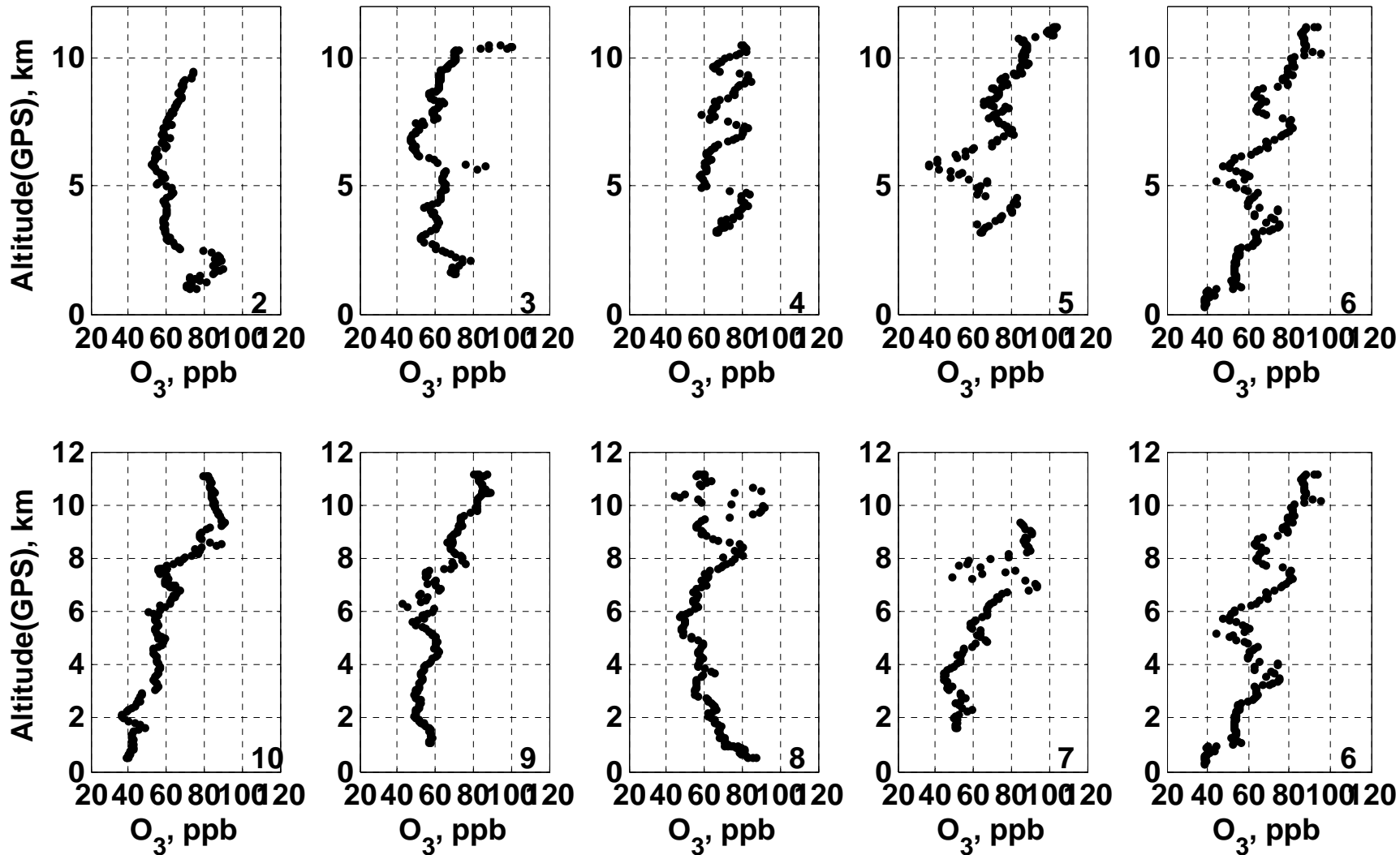


New Brunswick



Far Off N. Carolina

DC-8 Flt18 08/11/04



St Louis



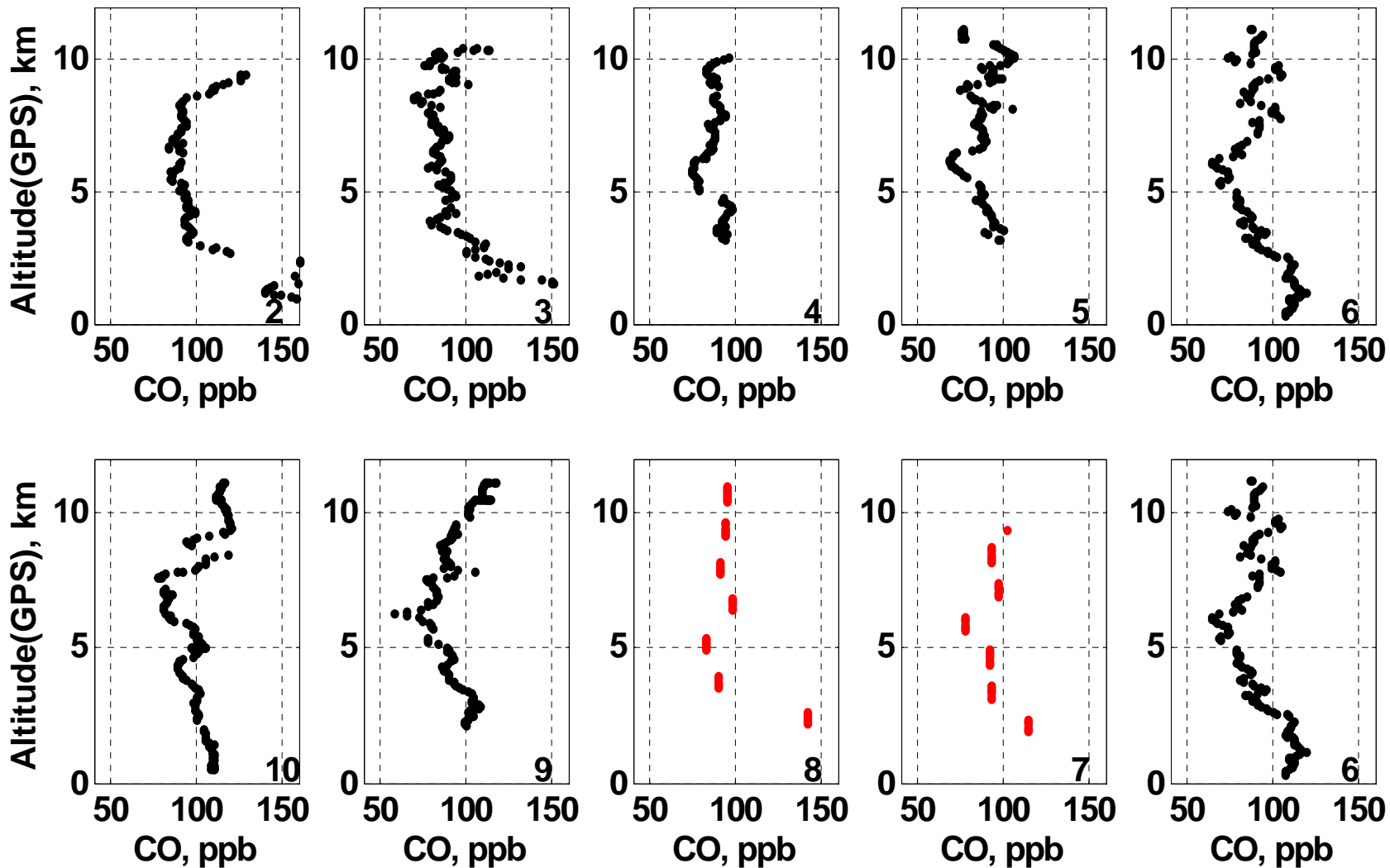
Far Off N. Carolina

New Brunswick



Far Off N. Carolina

DC-8 Flt18 08/11/04



St Louis



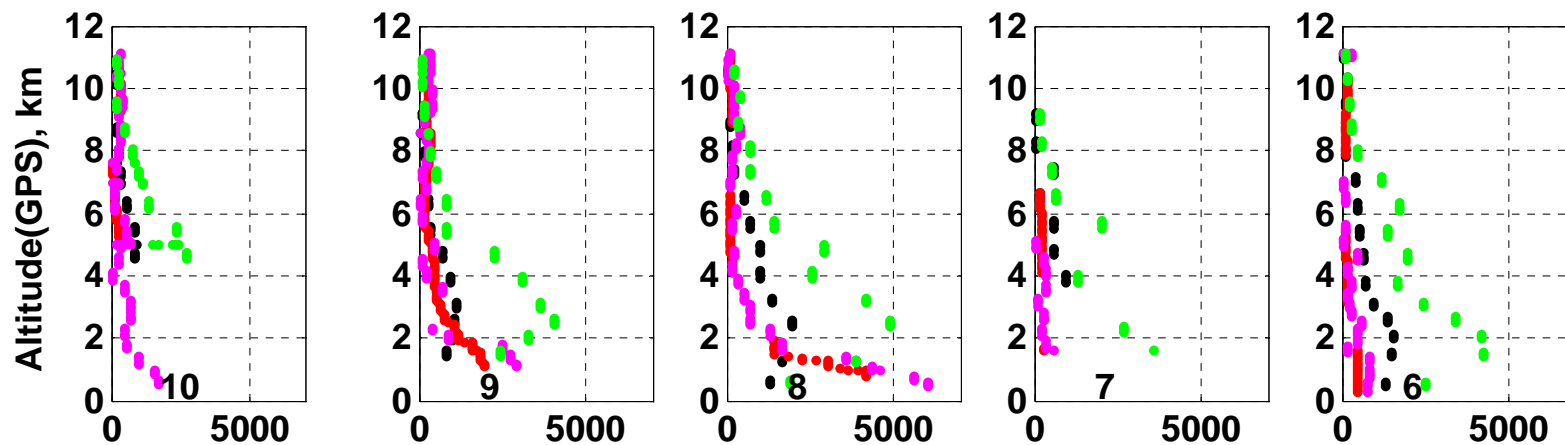
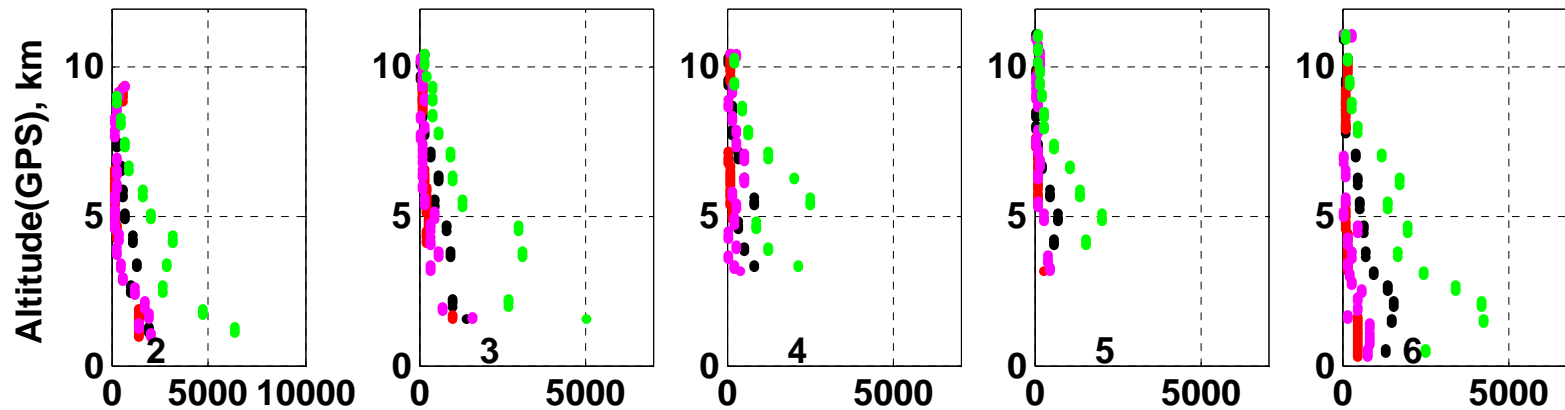
Far Off N. Carolina

New Brunswick



Far Off N. Carolina

DC-8 Flt18 08/11/04



St Louis



Far Off N. Carolina

grn – H₂O₂

blk – CH₃OOH

red – CH₂O(URI)

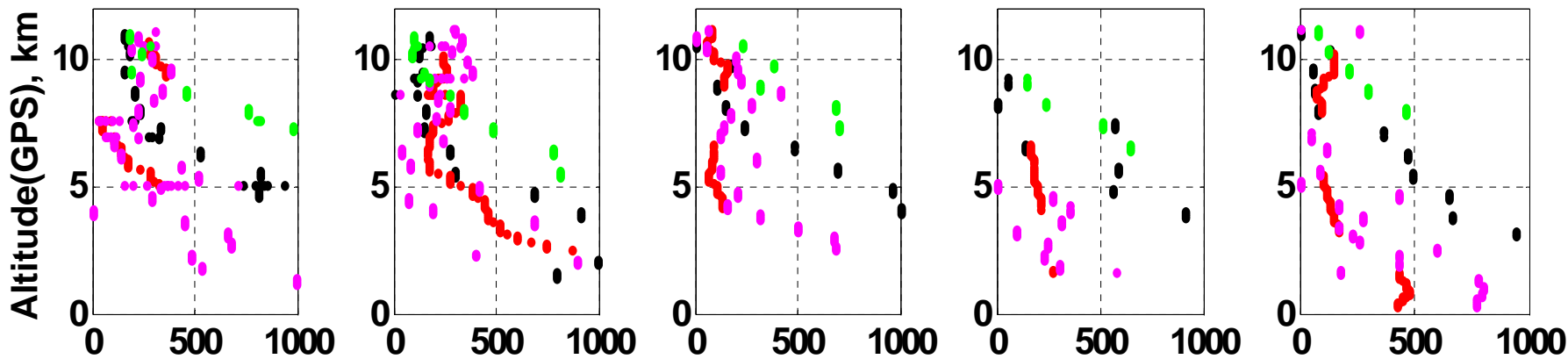
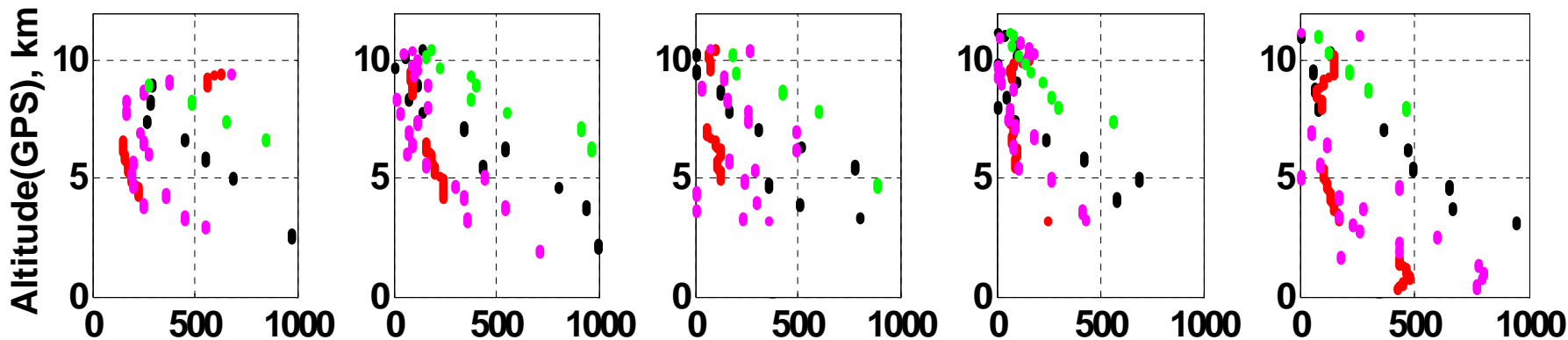
mag – CH₂O(NCAR)

New Brunswick



Far Off N. Carolina

DC-8 Flt18 08/11/04



St Louis



Far Off N. Carolina

grn – H₂O₂

blk – CH₃OOH

red – CH₂O(URI)

mag – CH₂O(NCAR)

Summary

CH₂O Measurements

URI to NCAR comparison factor of 1.1 to 1.6

Highly correlated

Indicate same functional relationships to other compounds

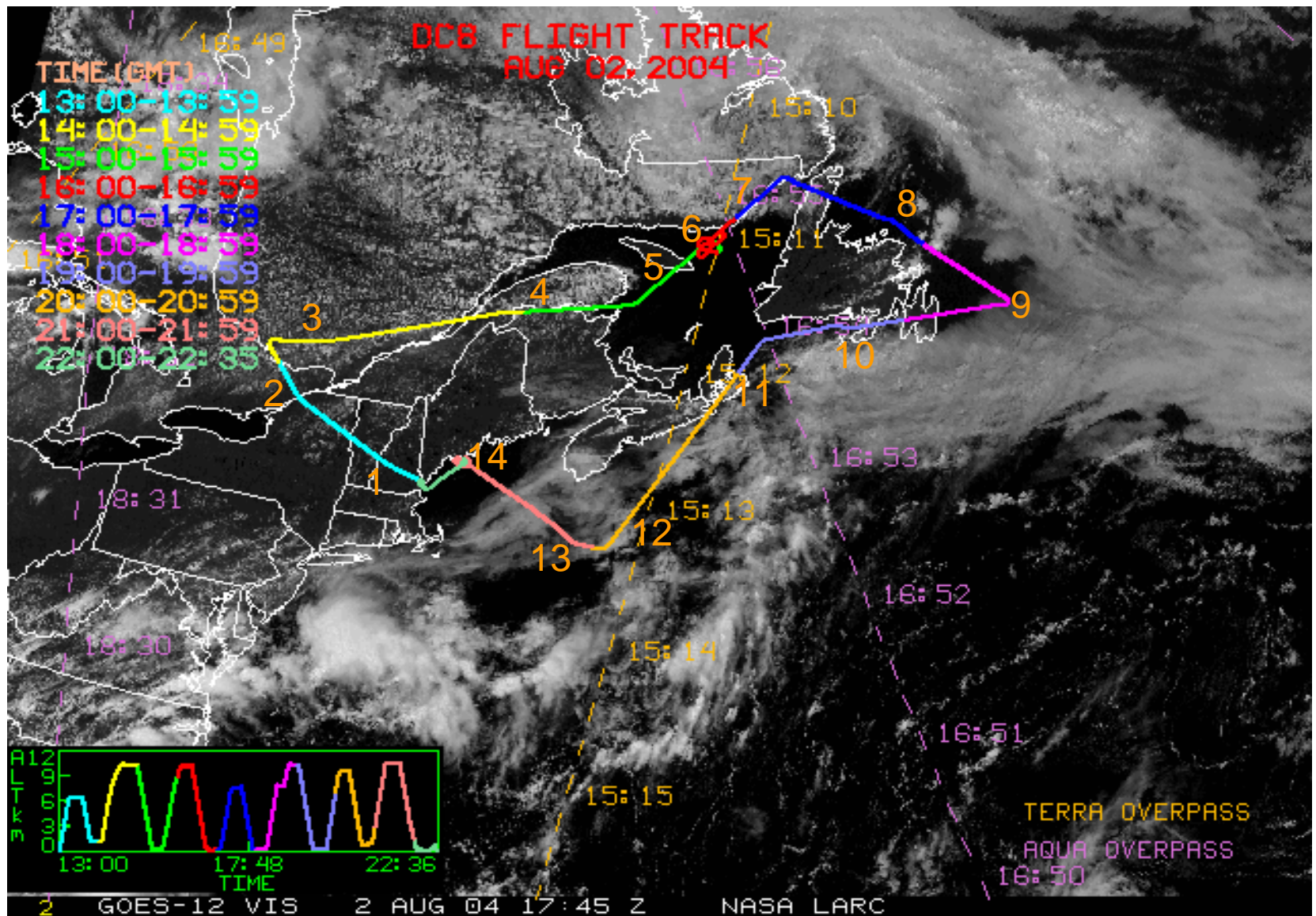
H₂O₂ Measurements

URI to CIT comparison factor of 0.7 to 1.2

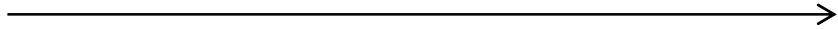
Well correlated with outliers, better when $X_v < 1\%$

Indicate same functional relationships to other compounds

Case Study: August 2, 2004; DC-8 Flight 15

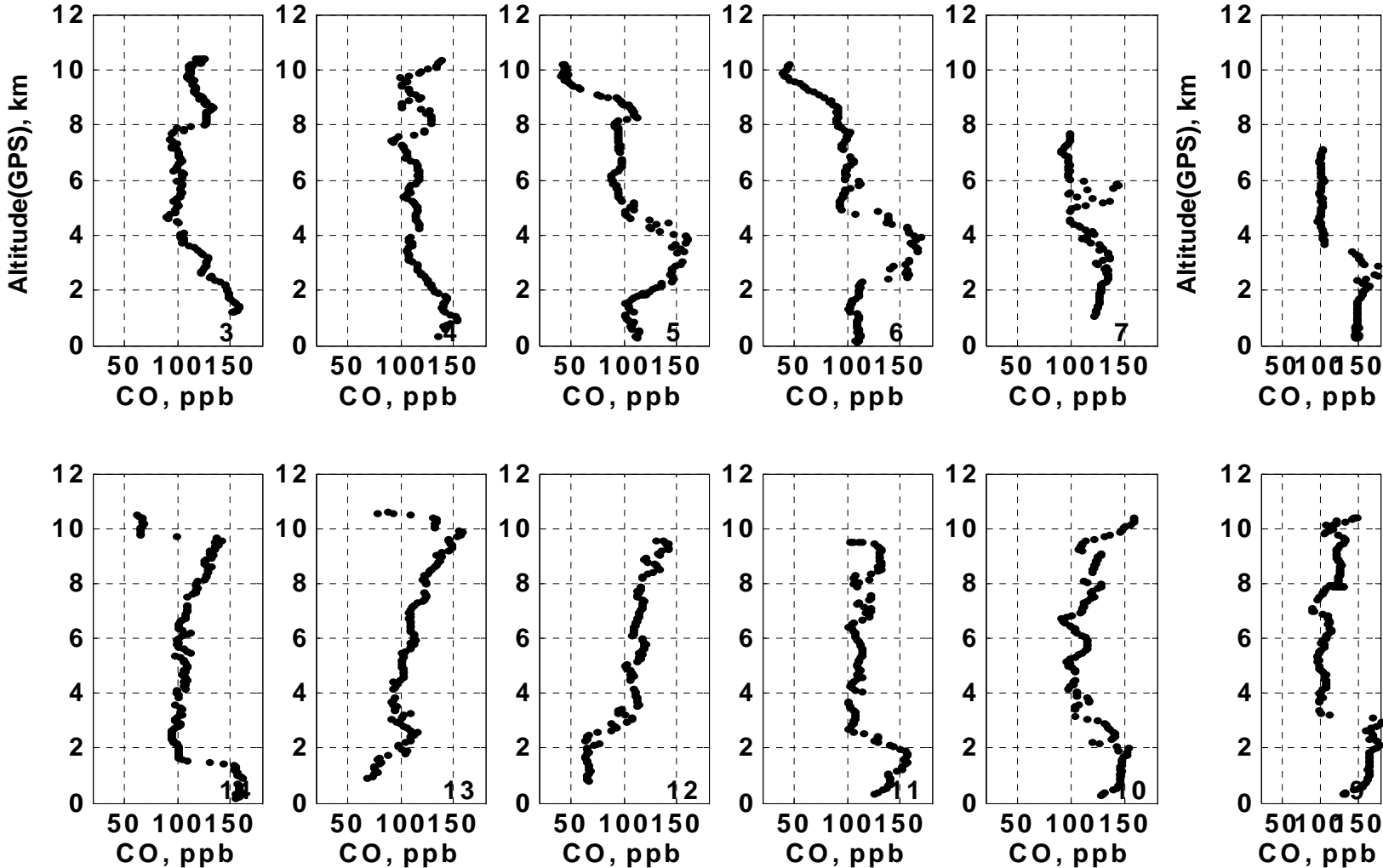


S. Quebec



N. New Foundland

DC-8 Flt15 08/02/04

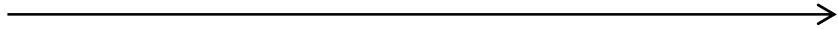


S. Maine

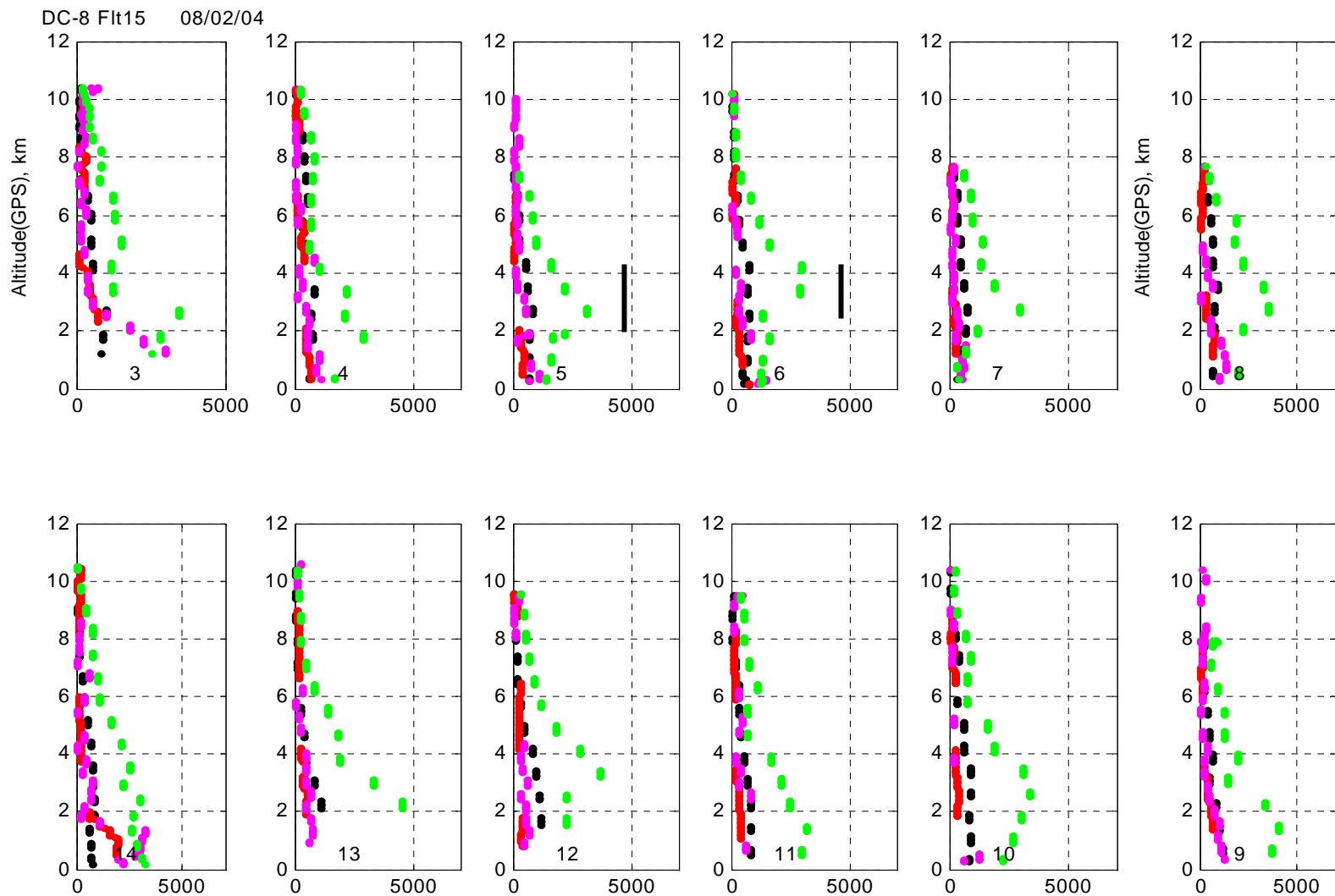


S. New Foundland

S. Quebec



N. New Foundland



S. Maine



S. New Foundland

grn – H₂O₂

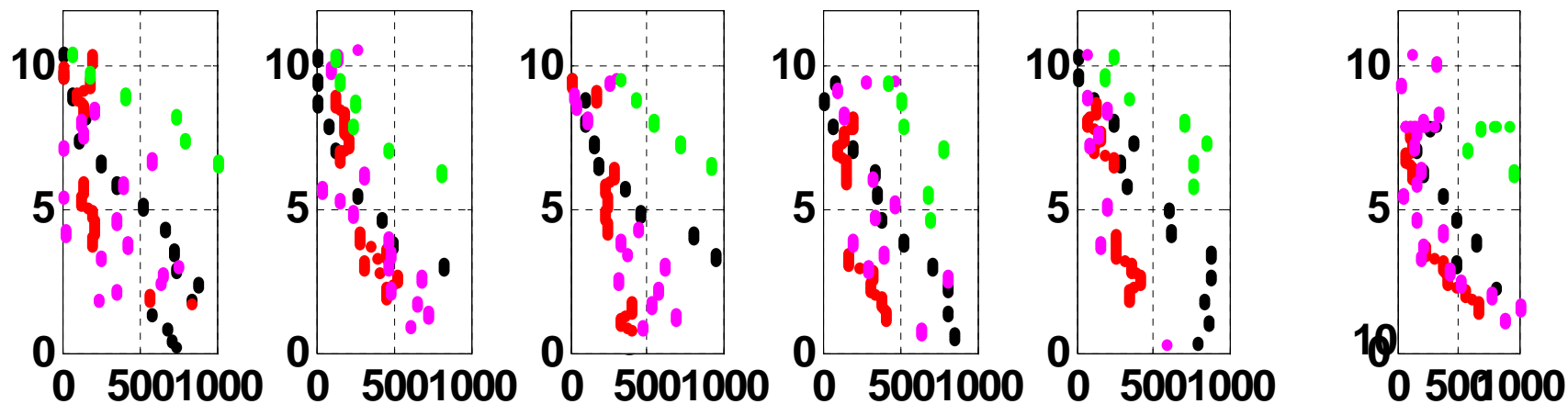
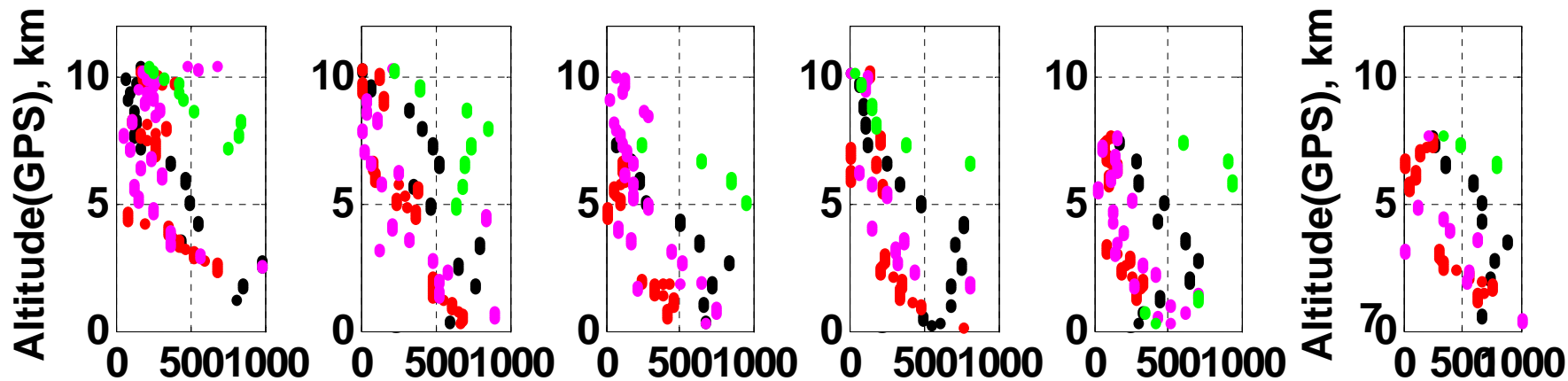
blk – CH₃OOH

red – CH₂O(URI)

mag – CH₂O(NCAR)

S. Quebec
DC-8 Flt15 08/02/04

N. New Foundland



S. Maine ←

→ S. New Foundland

grn – H₂O₂

blk – CH₃OOH

red – CH₂O(URI)

mag – CH₂O(NCAR)