ITCZ Crossing: The Tale of Two Worlds

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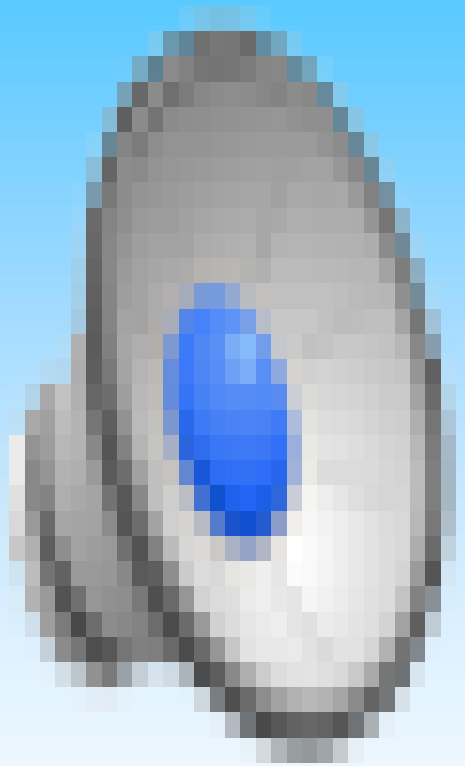
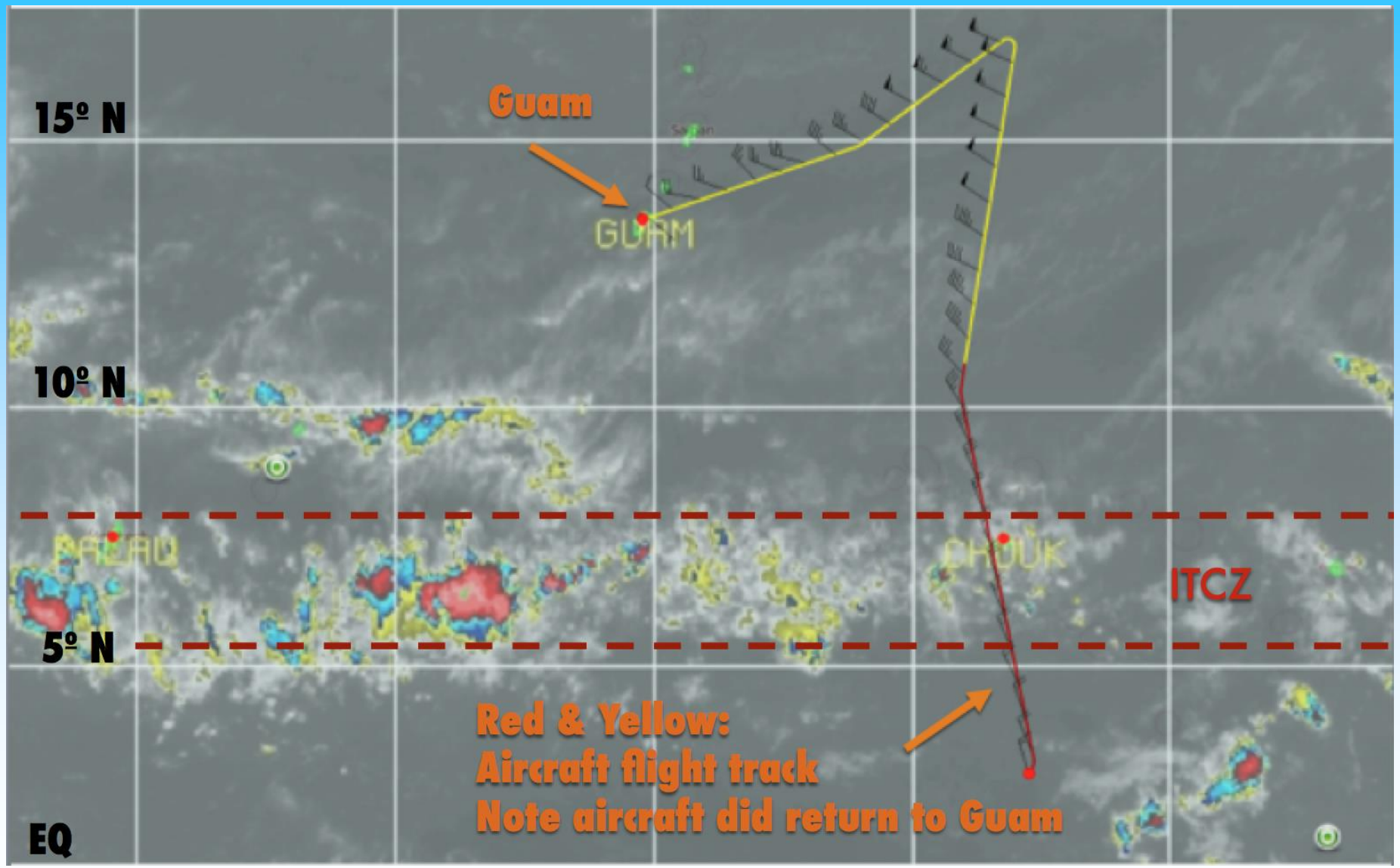
University of Maryland
12 February 2014

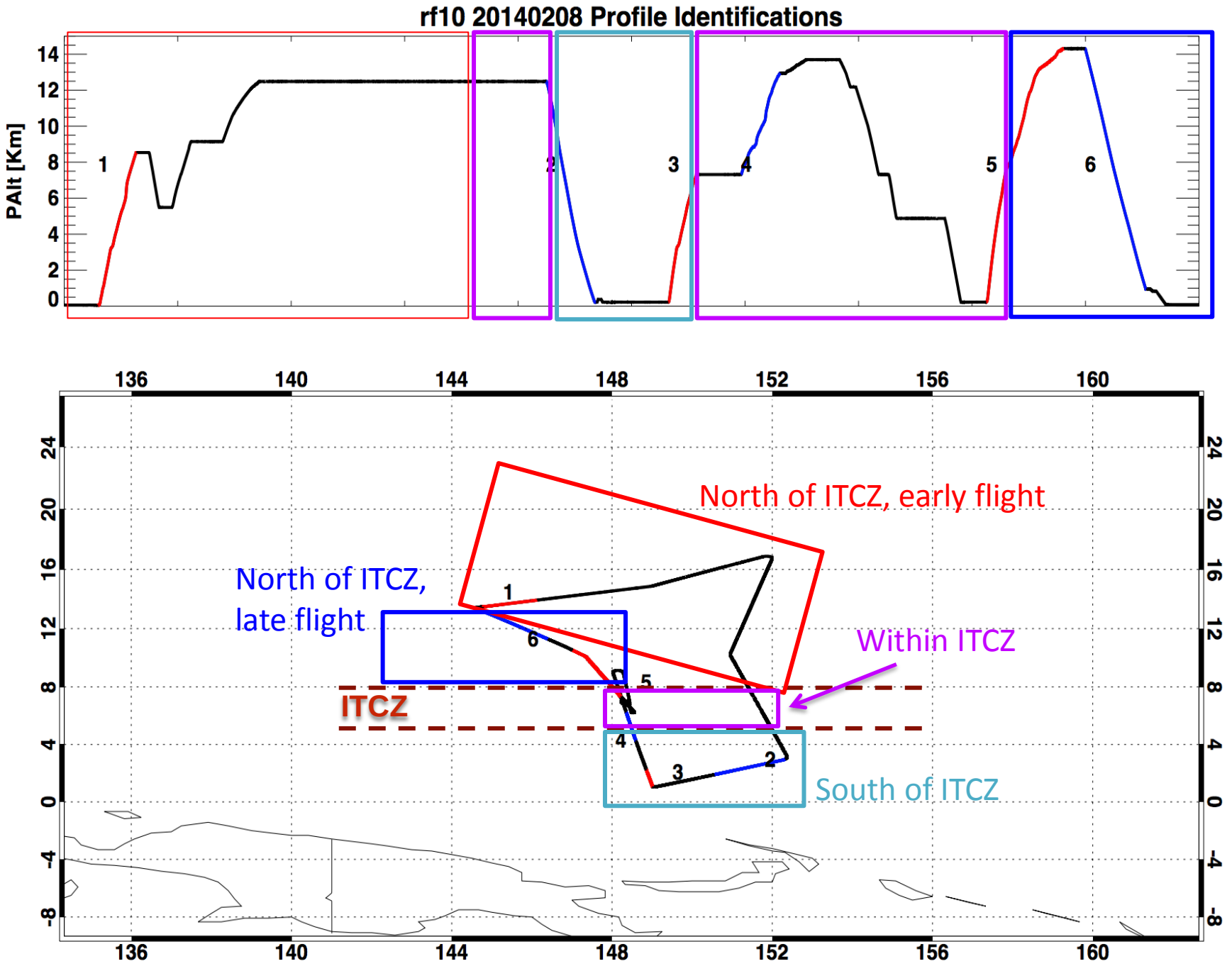
Ross Salawitch, Tim Canty, Doug Kinnison, Cameron Homeyer, Andy Weinheimer, Teresa Campos, et al.



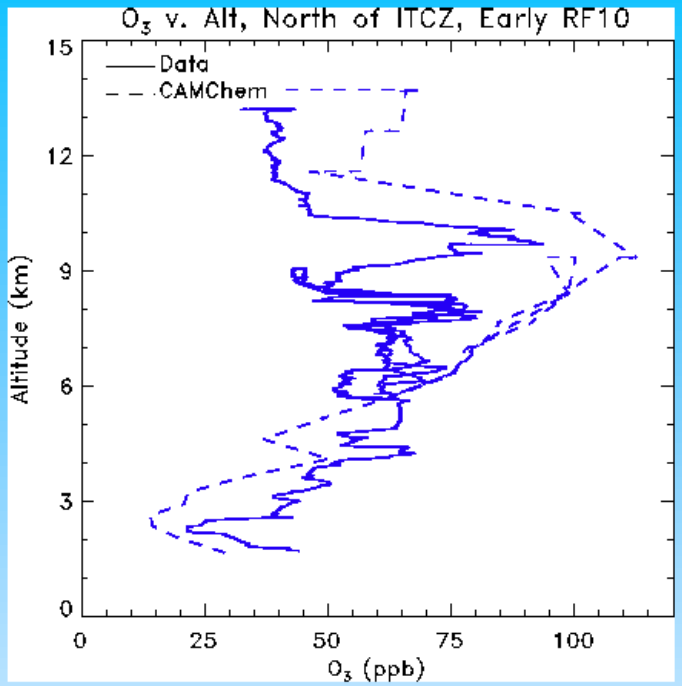
Movie provided courtesy of Janine Aquino

RF10 Flight Track: Crossing the ITCZ



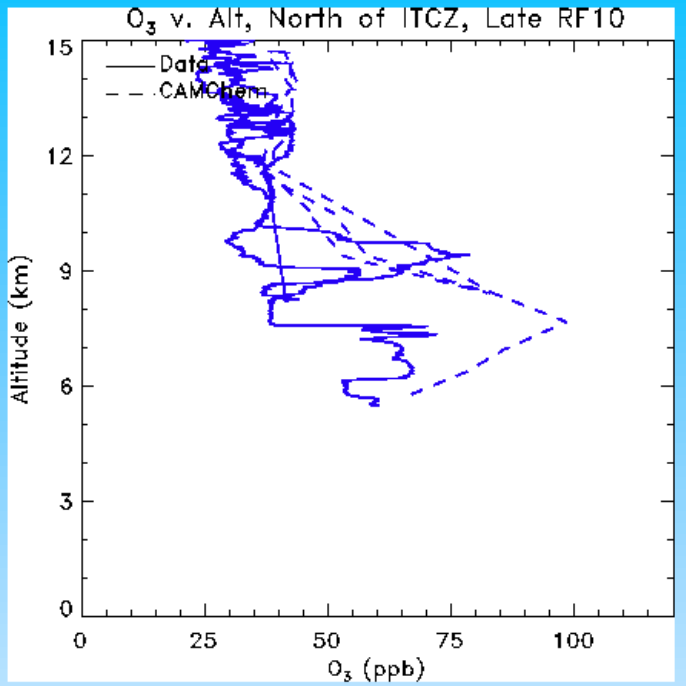


Plot courtesy of Shawn Honomichl

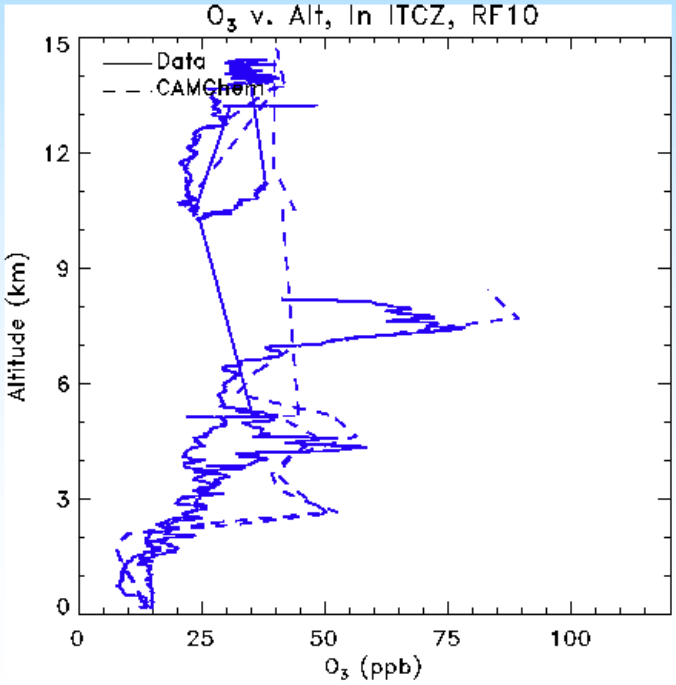


North of ITCZ

(Early) (Late)

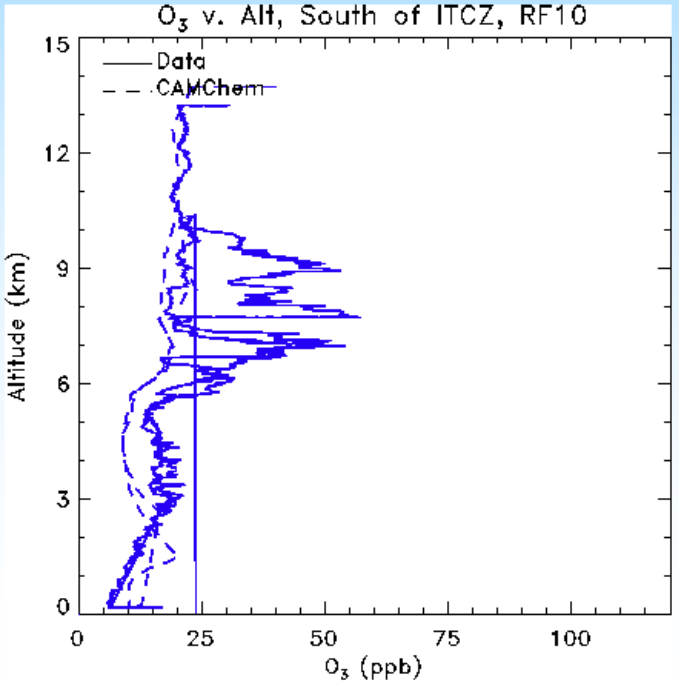


O_3



In ITCZ

South of ITCZ



Tropospheric Ozone Production

$$OH + CO \rightarrow CO_2 + H$$

$$H + O_2 + M \rightarrow HO_2 + M$$

$$HO_2 + NO \rightarrow OH + NO_2$$

$$NO_2 + h\nu \rightarrow NO + O$$

$$O + O_2 + M \rightarrow O_3 + M$$

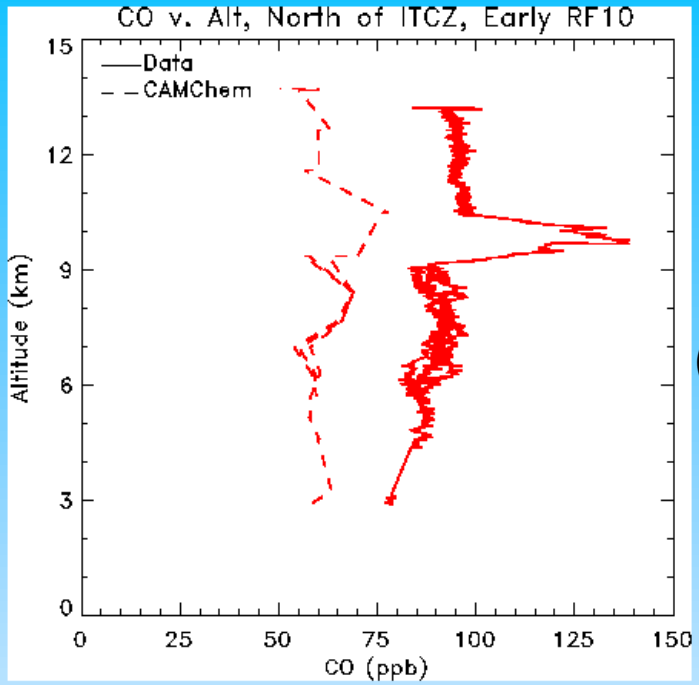
$$\text{Net:} \quad CO + 2\,O_2 \rightarrow CO_2 + O_3$$

Chain Mechanism for production of ozone

Chemical Initiation: $H_2O+O(^1D) \rightarrow 2OH$ & human emission of NO, CO

Since method for conversion of NO to NO_2 is *crucial* for whether O_3 is produced by this chain mechanism, chemists consider production of tropospheric ozone to be "limited" by $k[HO_2][NO]$

Slide courtesy of Ross Salawitch



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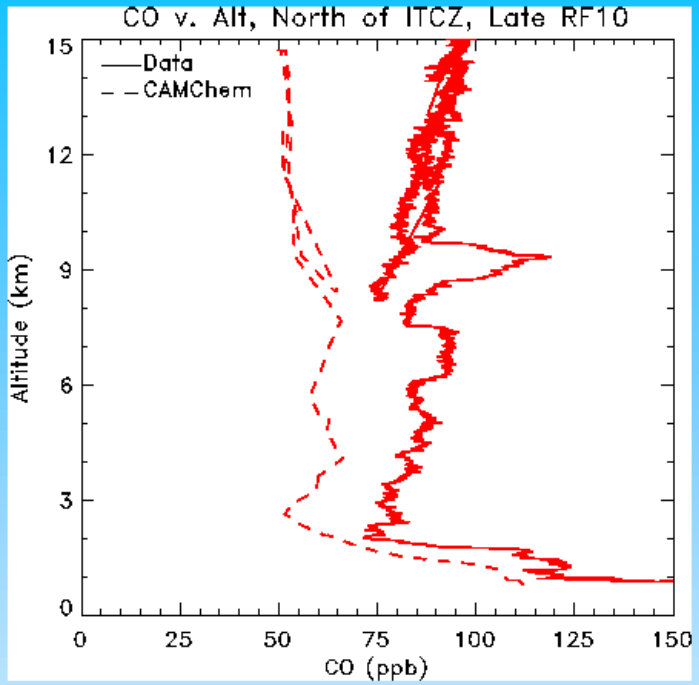
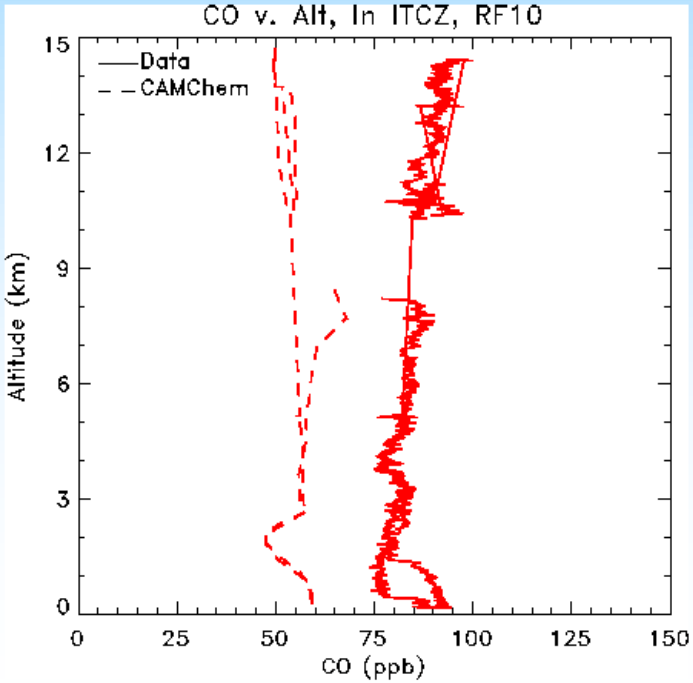
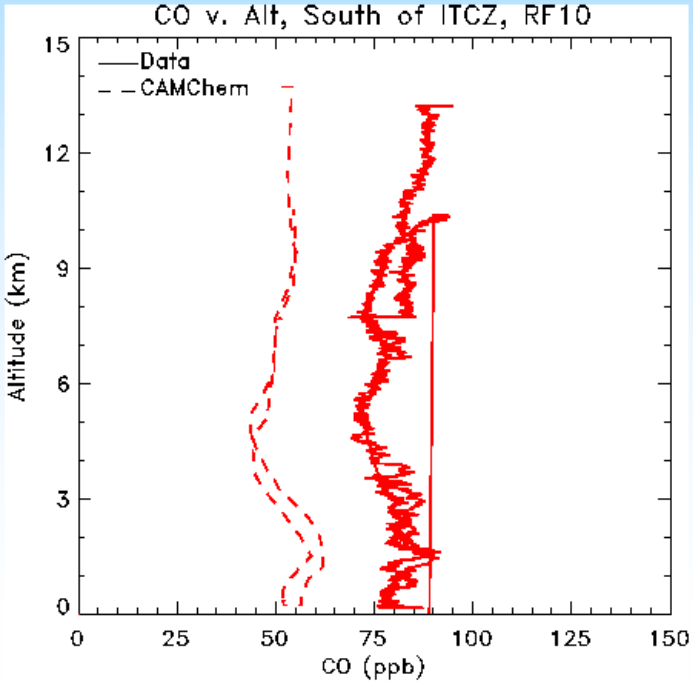


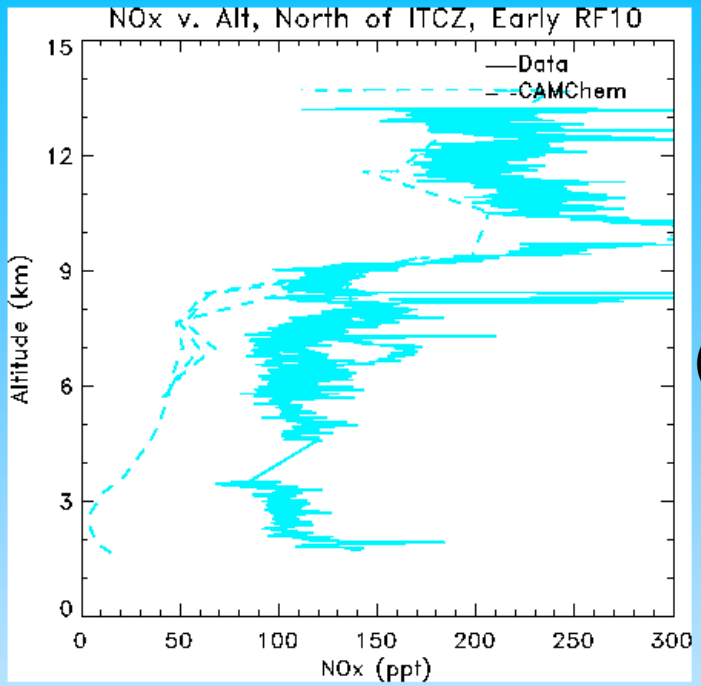
CO



In ITCZ

South of ITCZ





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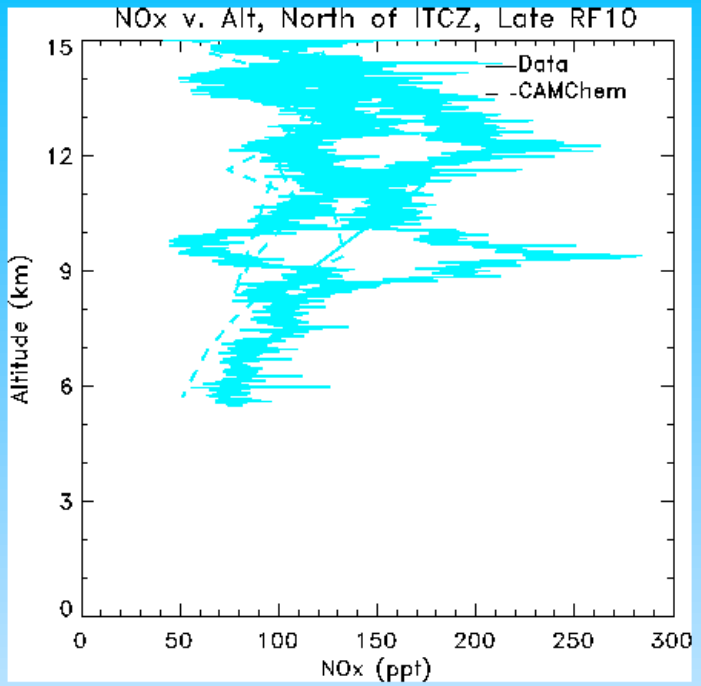
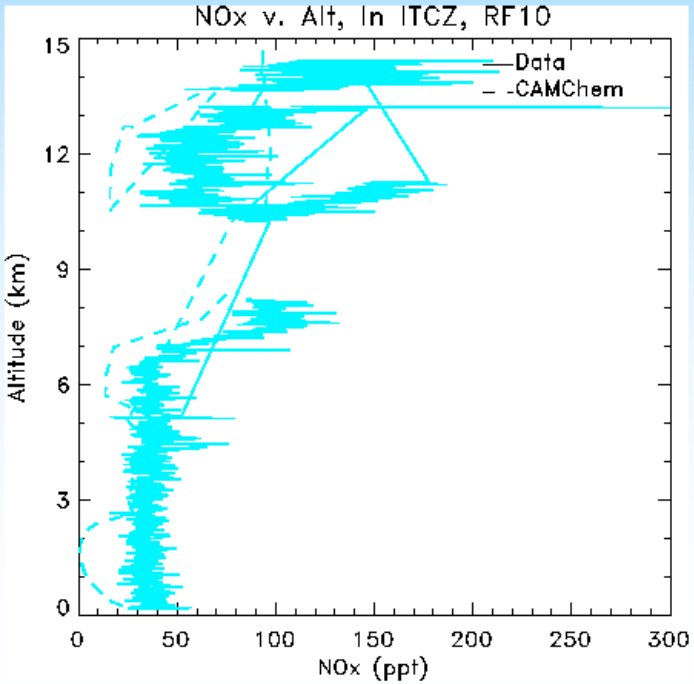
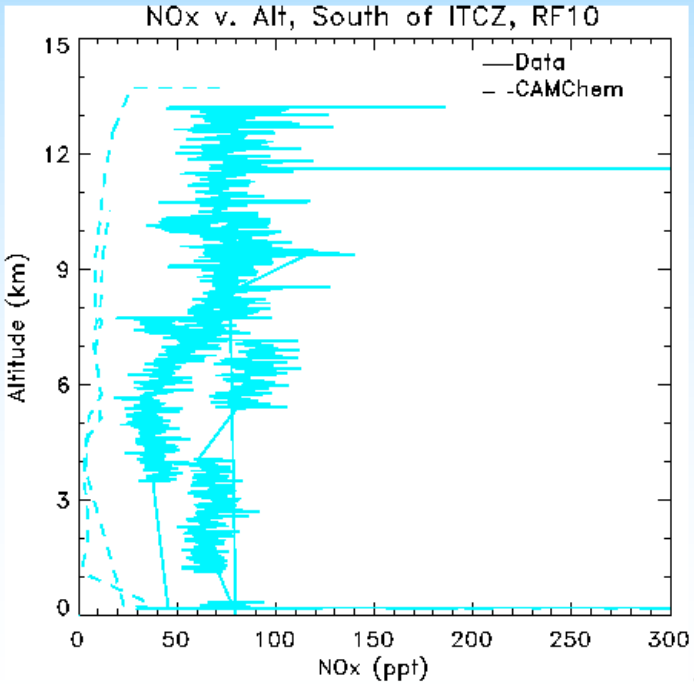


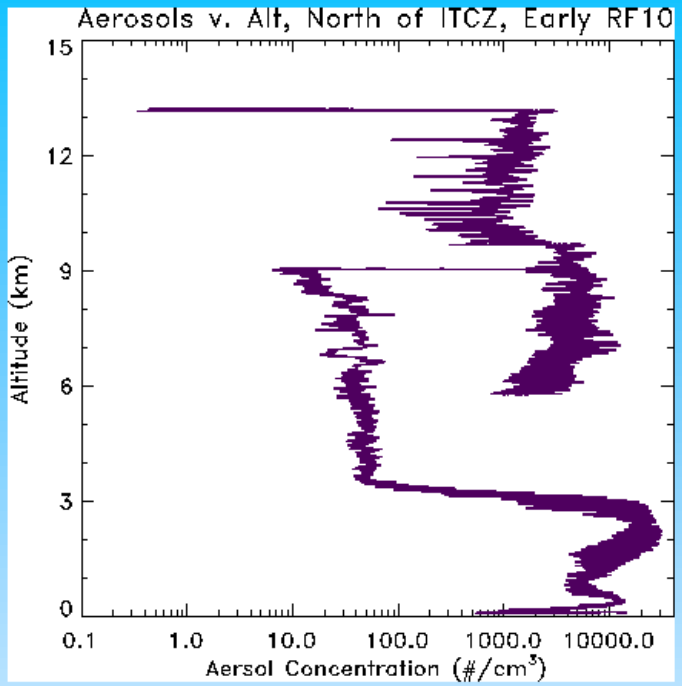
NO_x



In ITCZ

South of ITCZ





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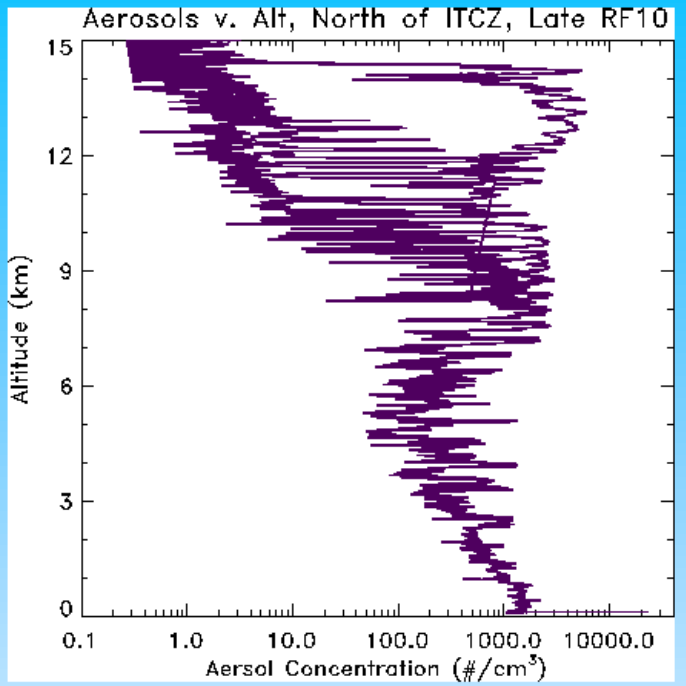
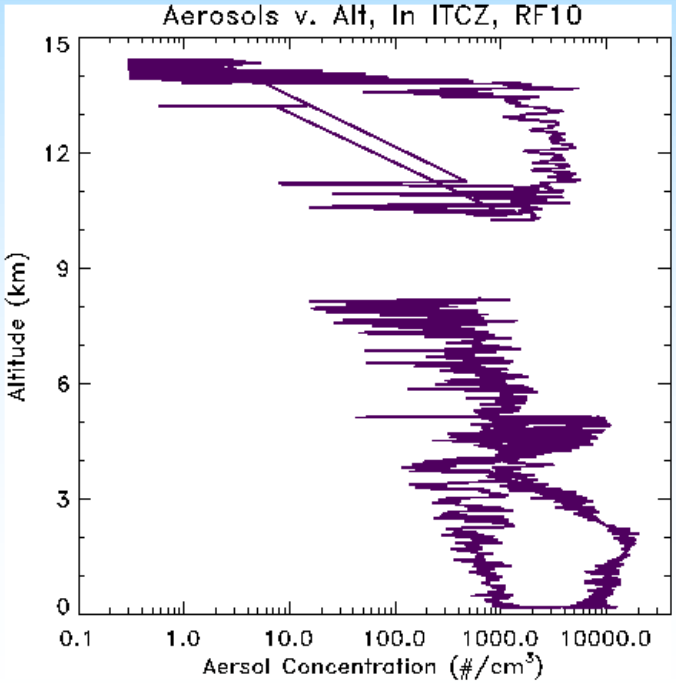


Aerosols

(from UHSAS)



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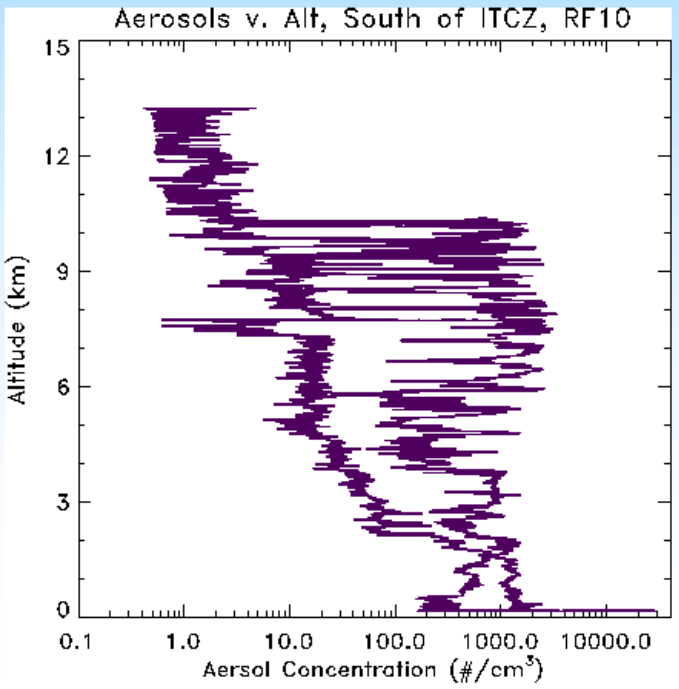
South of ITCZ



Conclusions

- Chemical composition of atmosphere N and S of the ITCZ drastically different
- O_3 significantly higher in NH relative to SH
- Hemispheric difference in O_3 captured by CAMChem
- NO_x and aerosols not represented as well by the model (according to preliminary data)