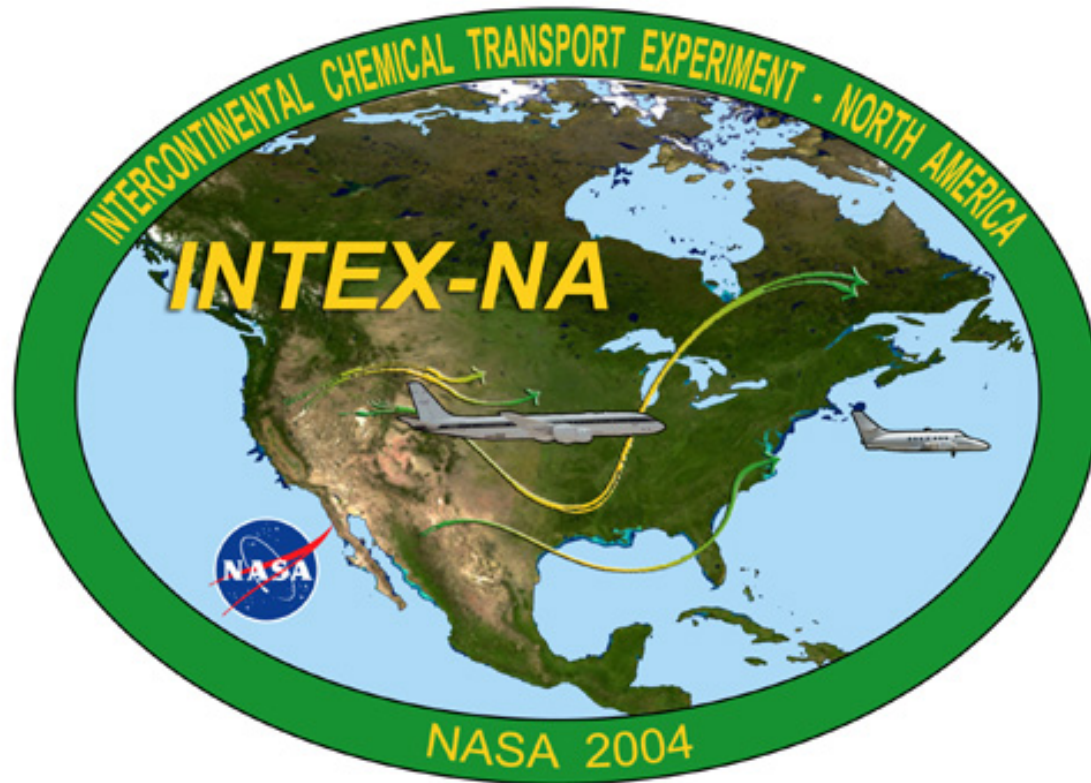


# An Initial Look at Testing Photochemical Theory During INTEX



Jim Crawford, Gao Chen, Jennifer Olson, and Margaret Pippin

## **Purpose:**

**Characterize the relationship between measurements and photochemical theory**

## **Ultimate Goals:**

**Seek to understand differences between observations and expectations based on current knowledge**

**Estimate the contribution of photochemistry to the observed ozone distribution**

**Assess the impact of convection on chemical processing in the upper troposphere**

**Assess the impact of NMHCs on ozone and oxidant levels**

## ***Time-dependent photochemical box model***

**Detailed HO<sub>x</sub>-NO<sub>x</sub>-CH<sub>4</sub>-NMHC mechanism**

**Constrained by observations:**

**T, P, H<sub>2</sub>O, O<sub>3</sub>, CO, NO, non-methane hydrocarbons, acetone, photolysis rates**

**When observations are available, additional model constraints include:**

**H<sub>2</sub>O<sub>2</sub>, CH<sub>3</sub>OOH, HNO<sub>3</sub>, PAN, HCOOH, CH<sub>3</sub>COOH**

**Predicted species:**

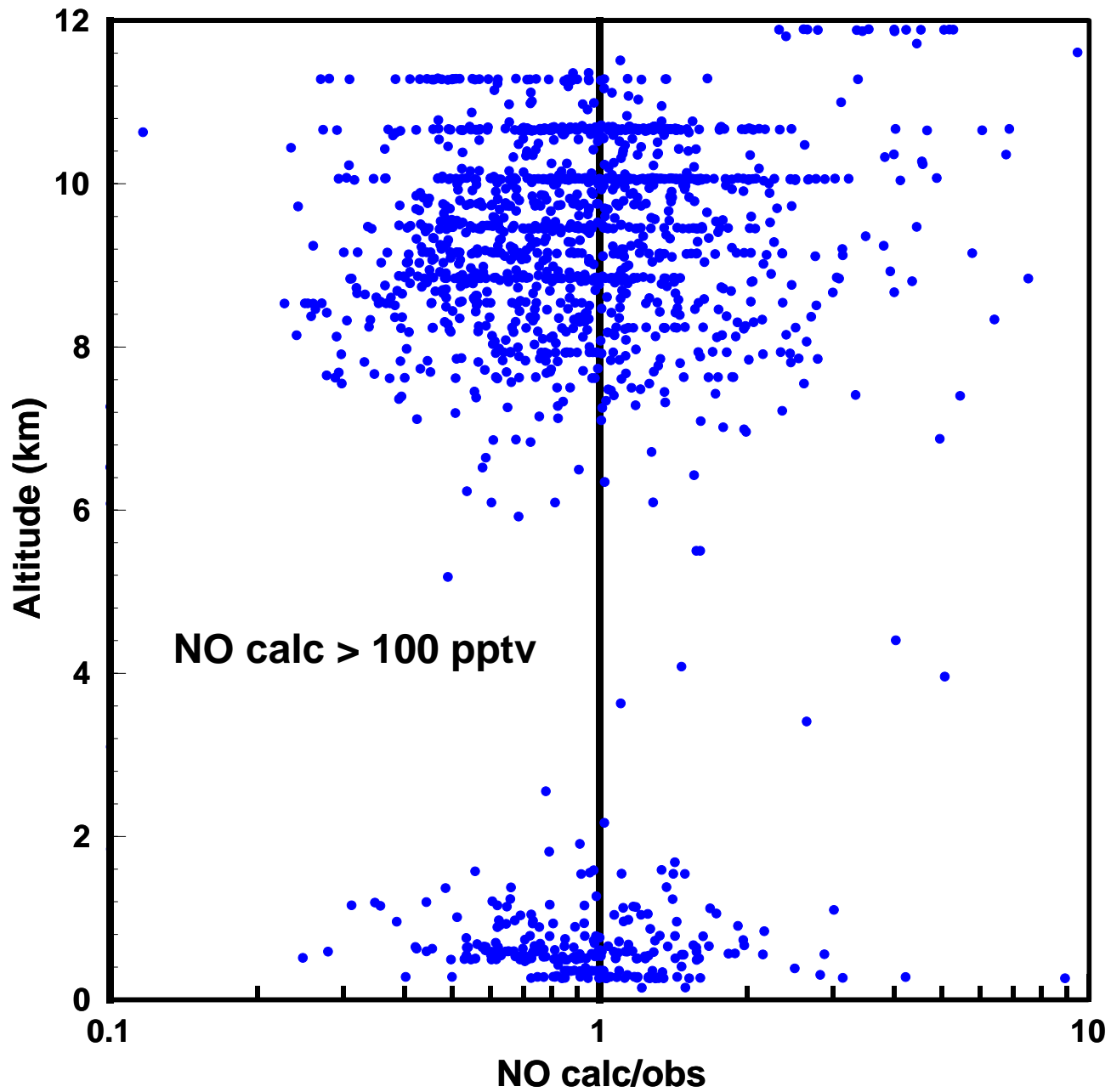
**OH, HO<sub>2</sub>, RO<sub>2</sub>, CH<sub>2</sub>O, H<sub>2</sub>O<sub>2</sub>, CH<sub>3</sub>OOH, ROOH, NO<sub>2</sub>, HNO<sub>3</sub>, PAN, ROOH, etc.**

**Calculated species are integrated in time until diurnal profile converges.**

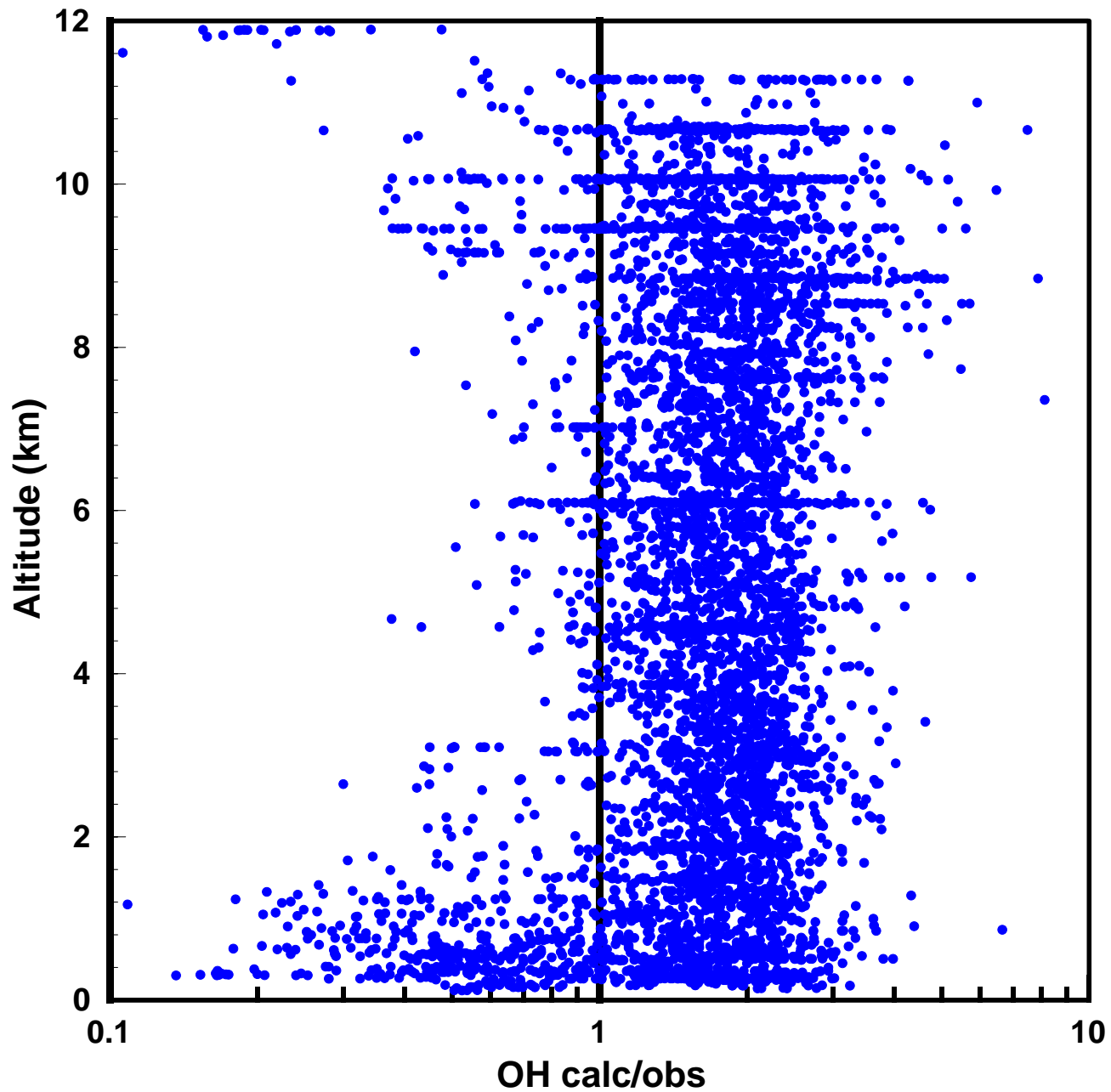
**NO<sub>x</sub> held constant, but partitioning varies throughout the diurnal cycle**

**Diurnal variation of photolysis rates from TUV (DISORT 8 streams)**

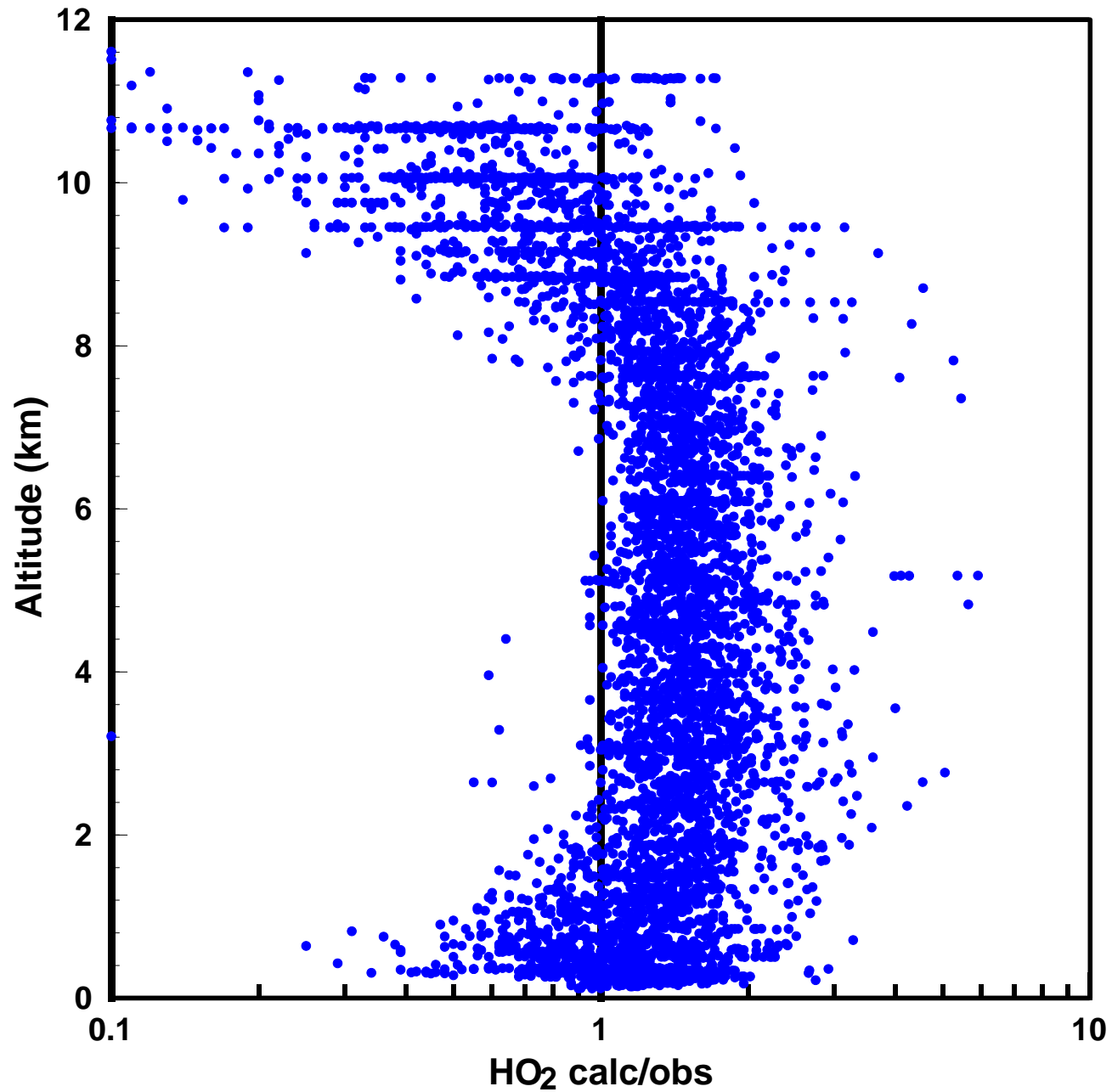
# Model-Measurement Comparison of NO (Brune)



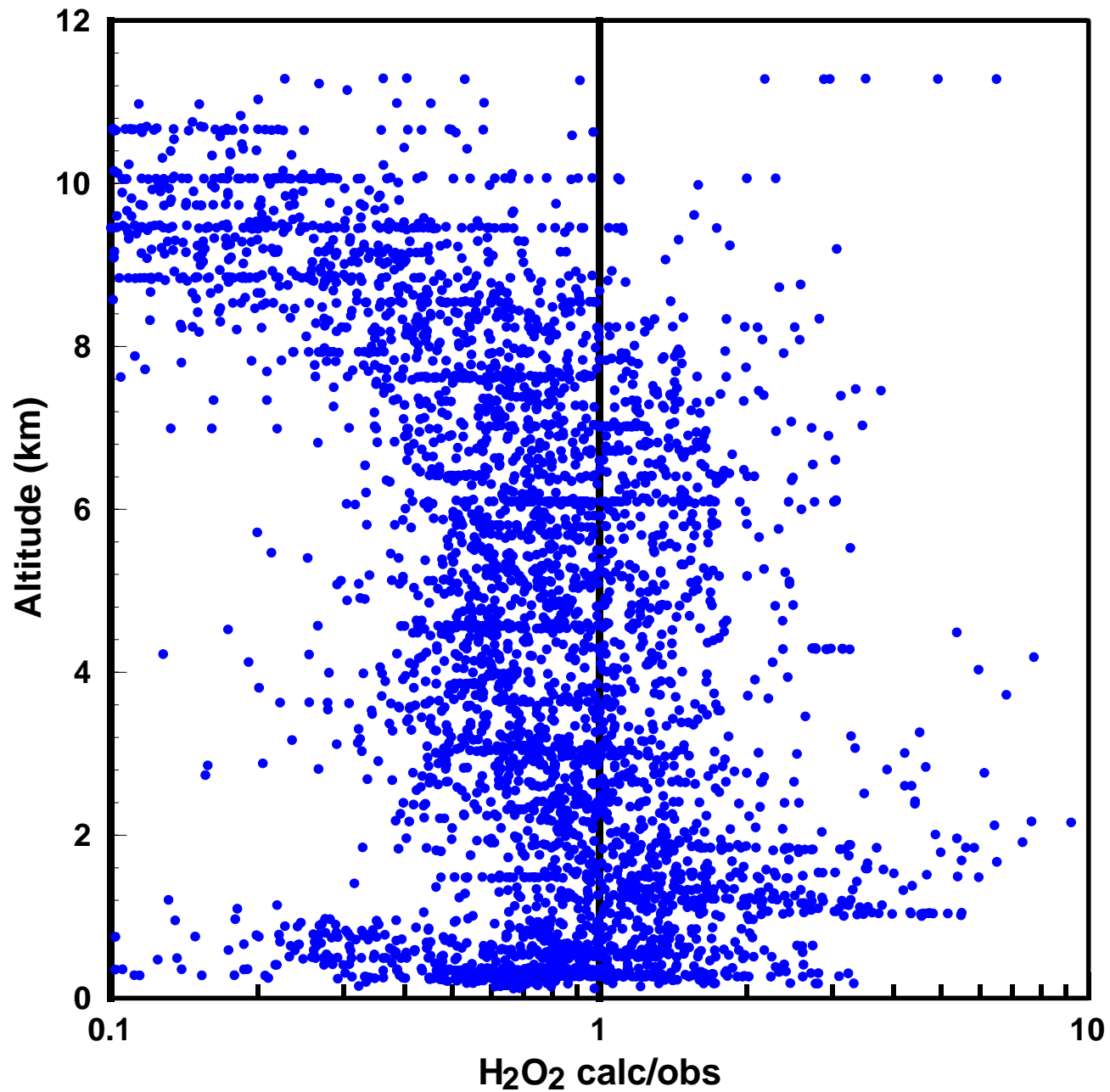
# Model-Measurement Comparison of OH (Brune)



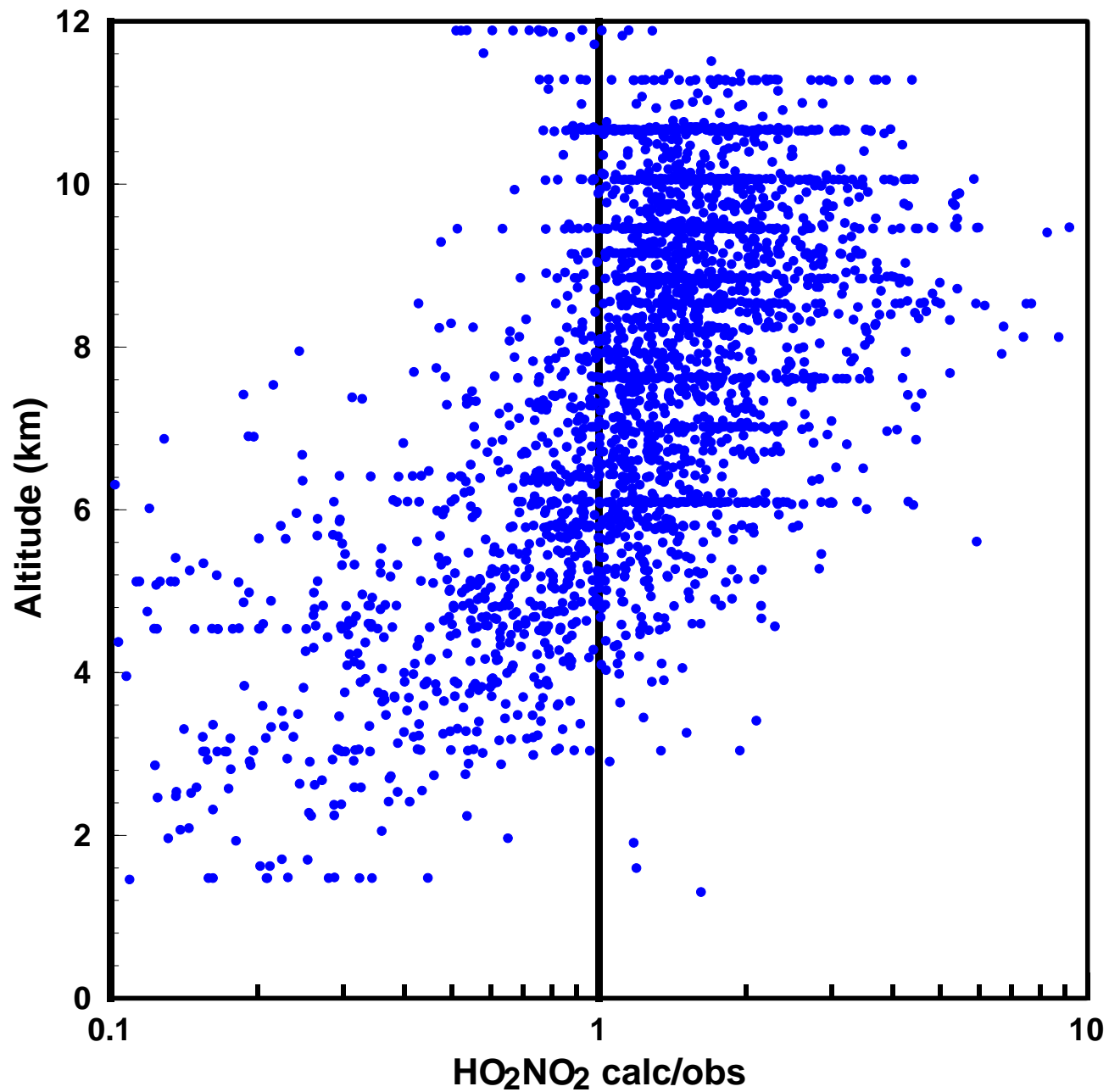
# Model-Measurement Comparison of HO<sub>2</sub> (Brune)



# Model-Measurement Comparison of H<sub>2</sub>O<sub>2</sub> (Heikes)

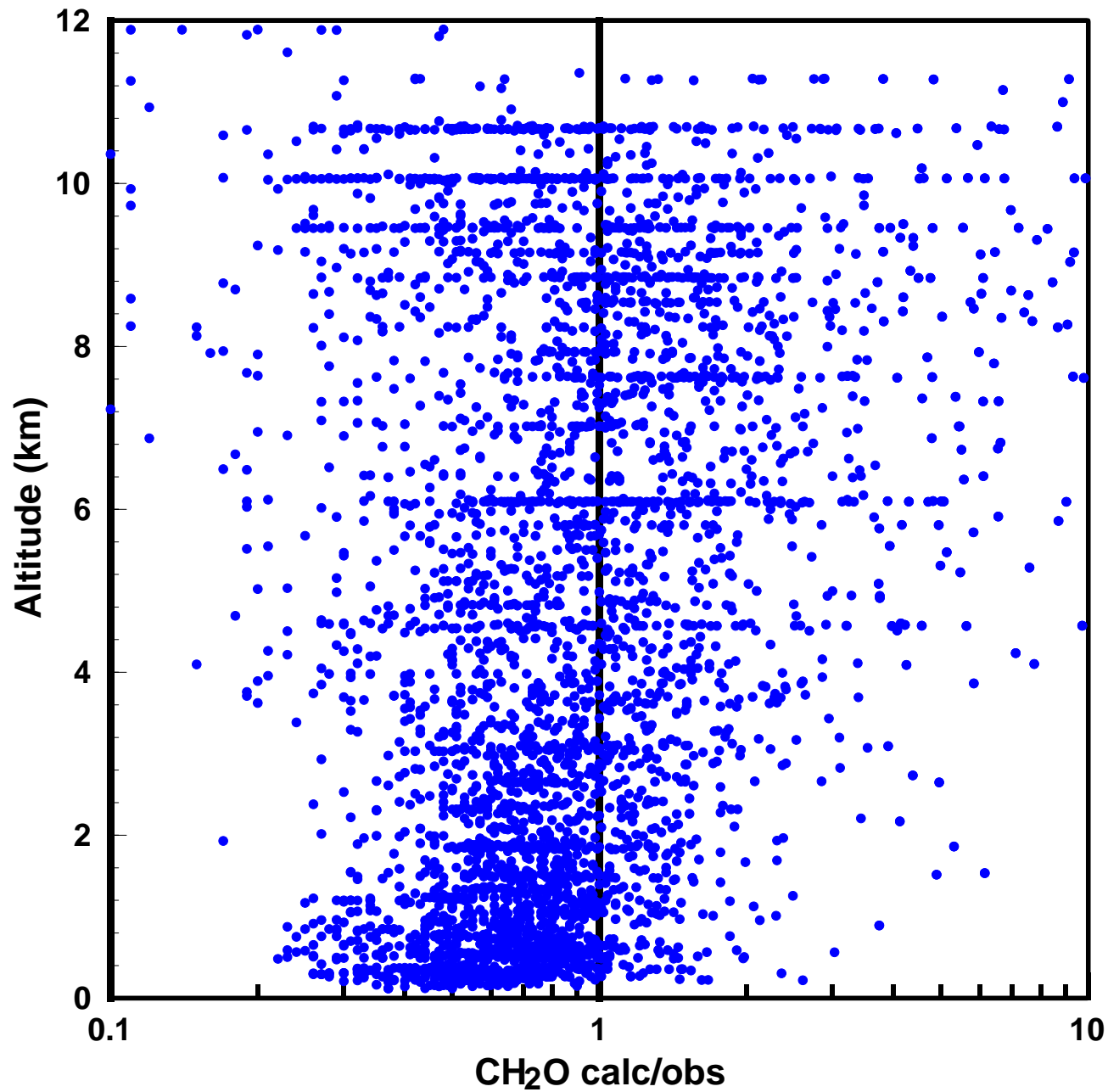


# Model-Measurement Comparison of HO<sub>2</sub>NO<sub>2</sub> (Huey)

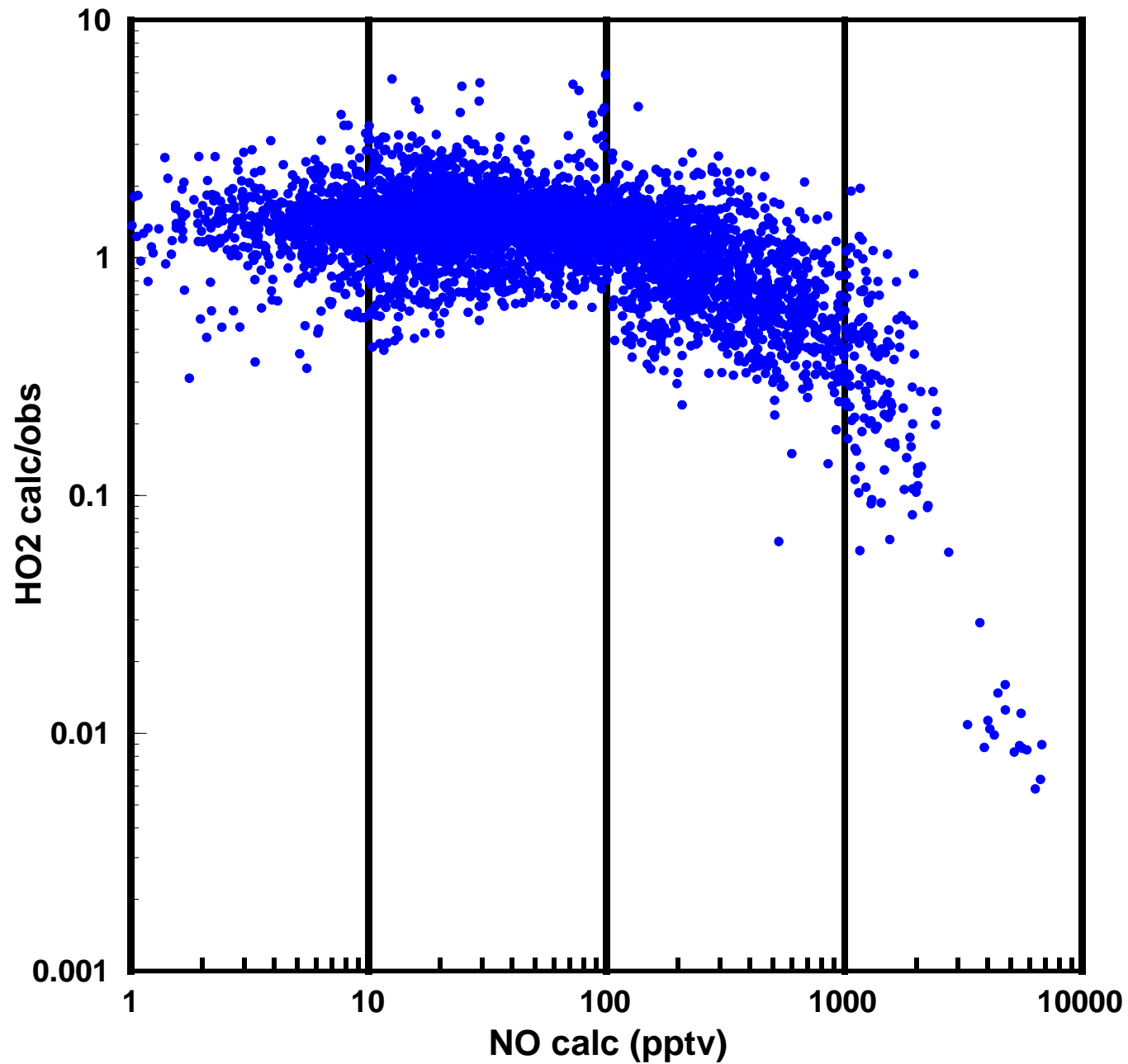




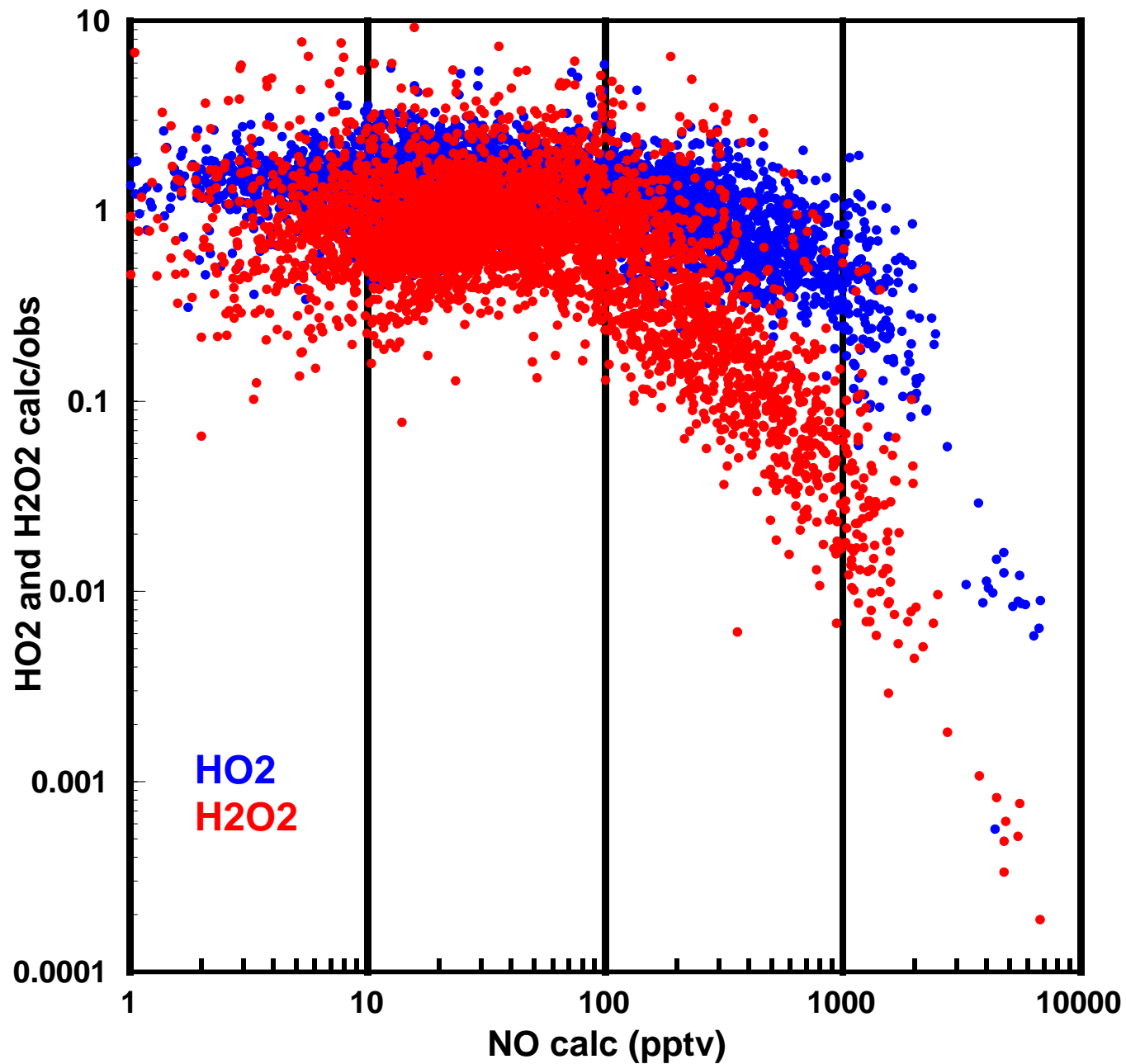
# Model-Measurement Comparison of CH<sub>2</sub>O (Fried)



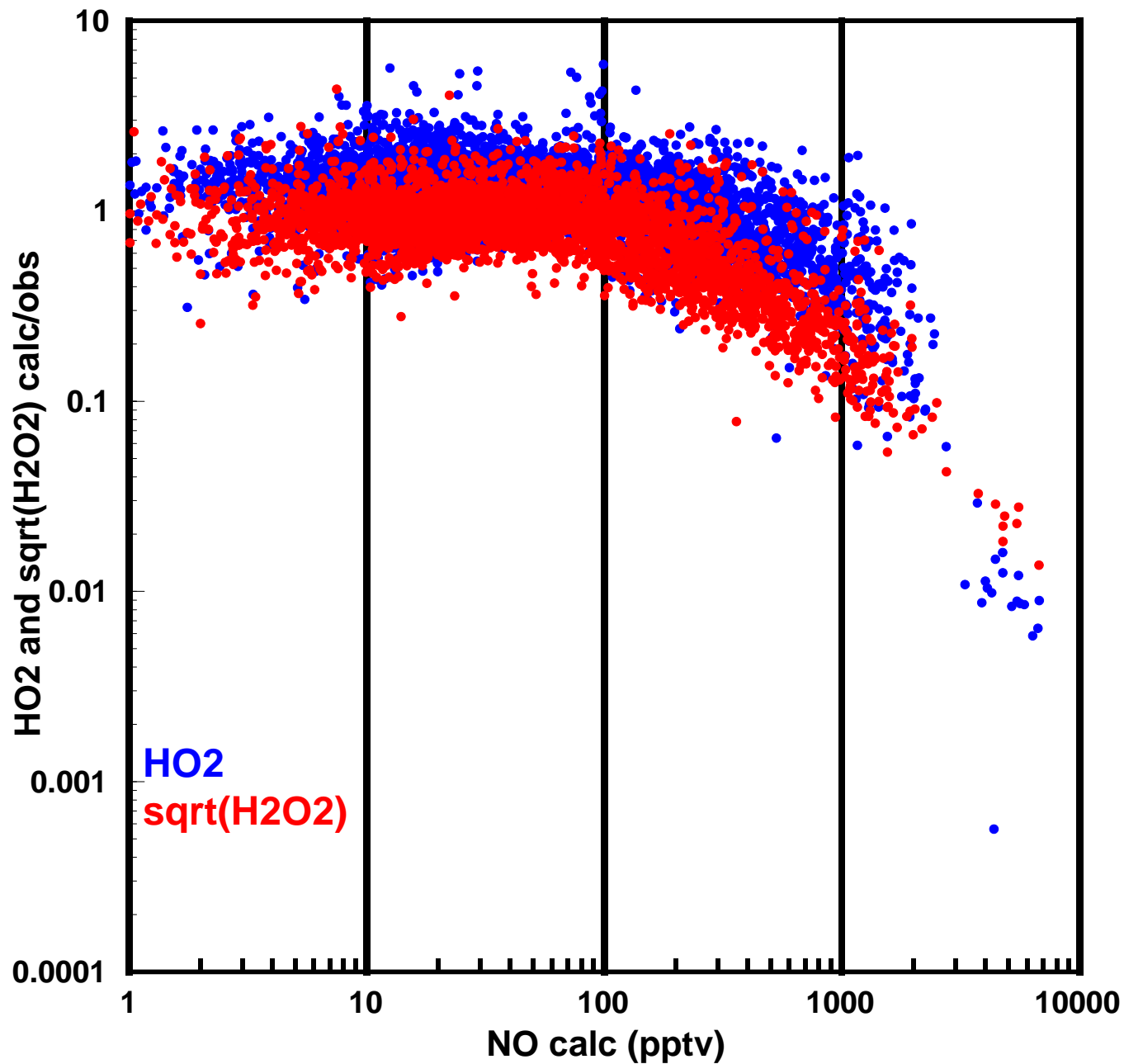
# Trends in Model-Measurement Agreement with NO



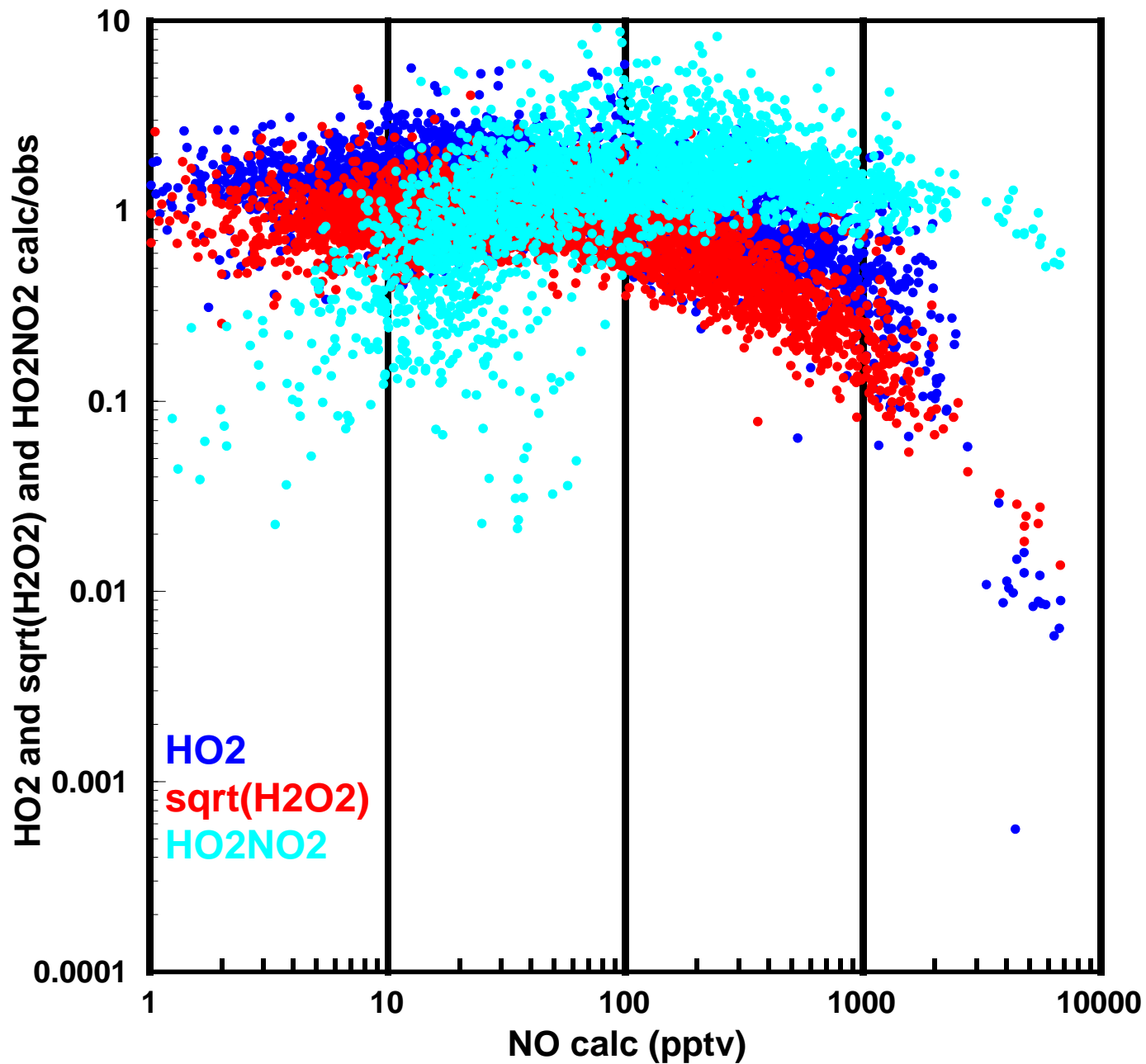
# Trends in Model-Measurement Agreement with NO



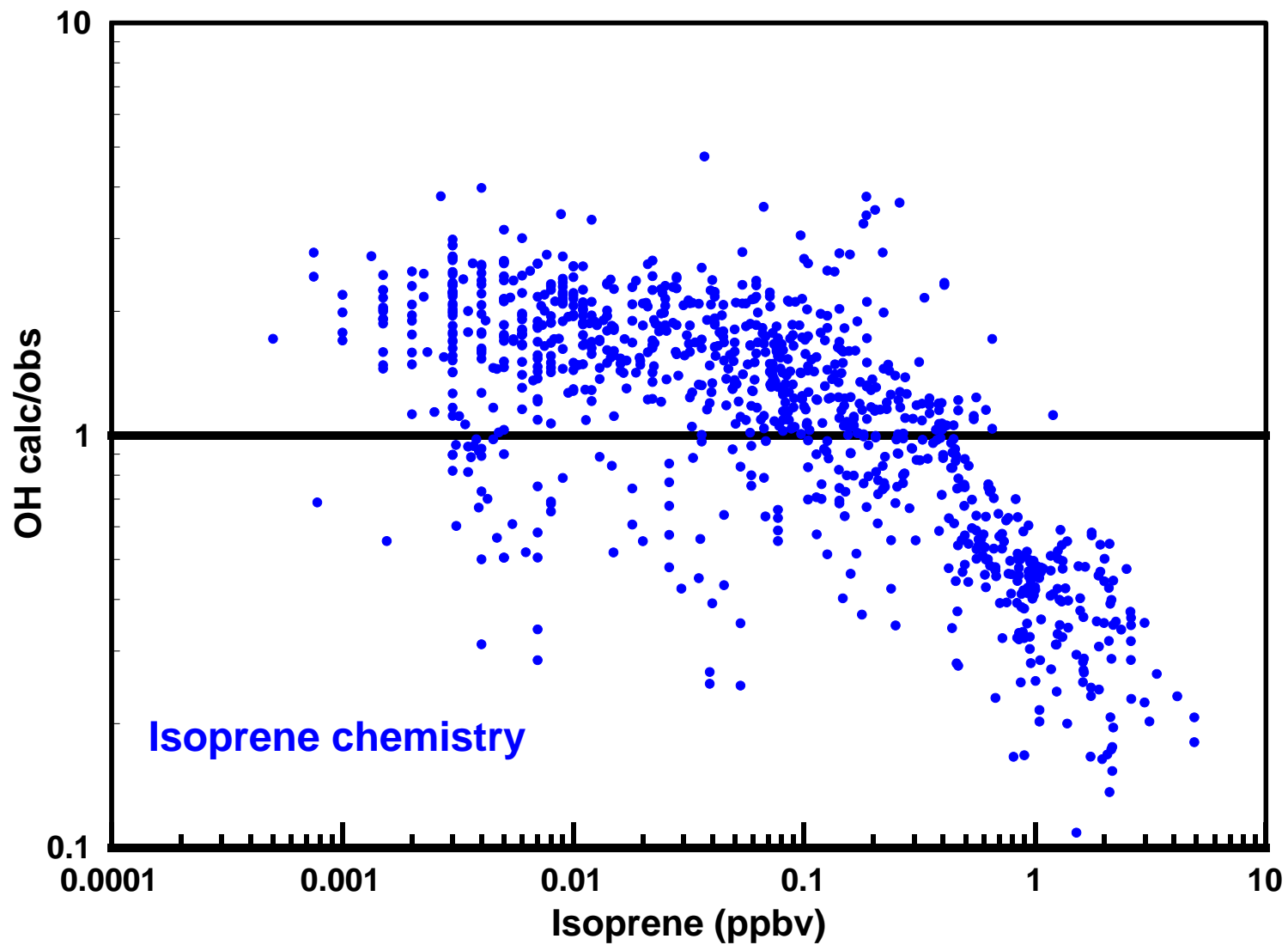
# Trends in Model-Measurement Agreement with NO



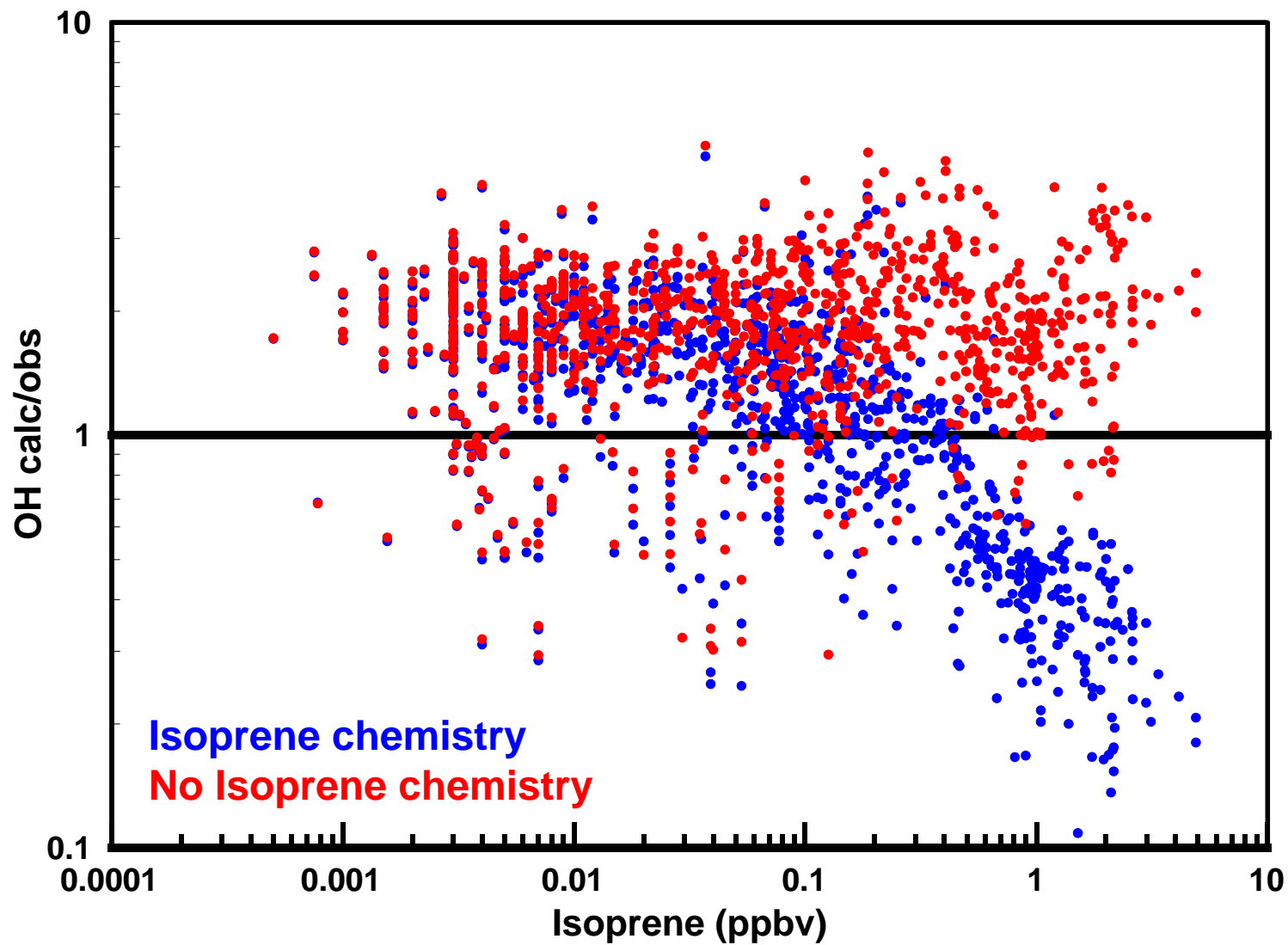
# Trends in Model-Measurement Agreement with NO



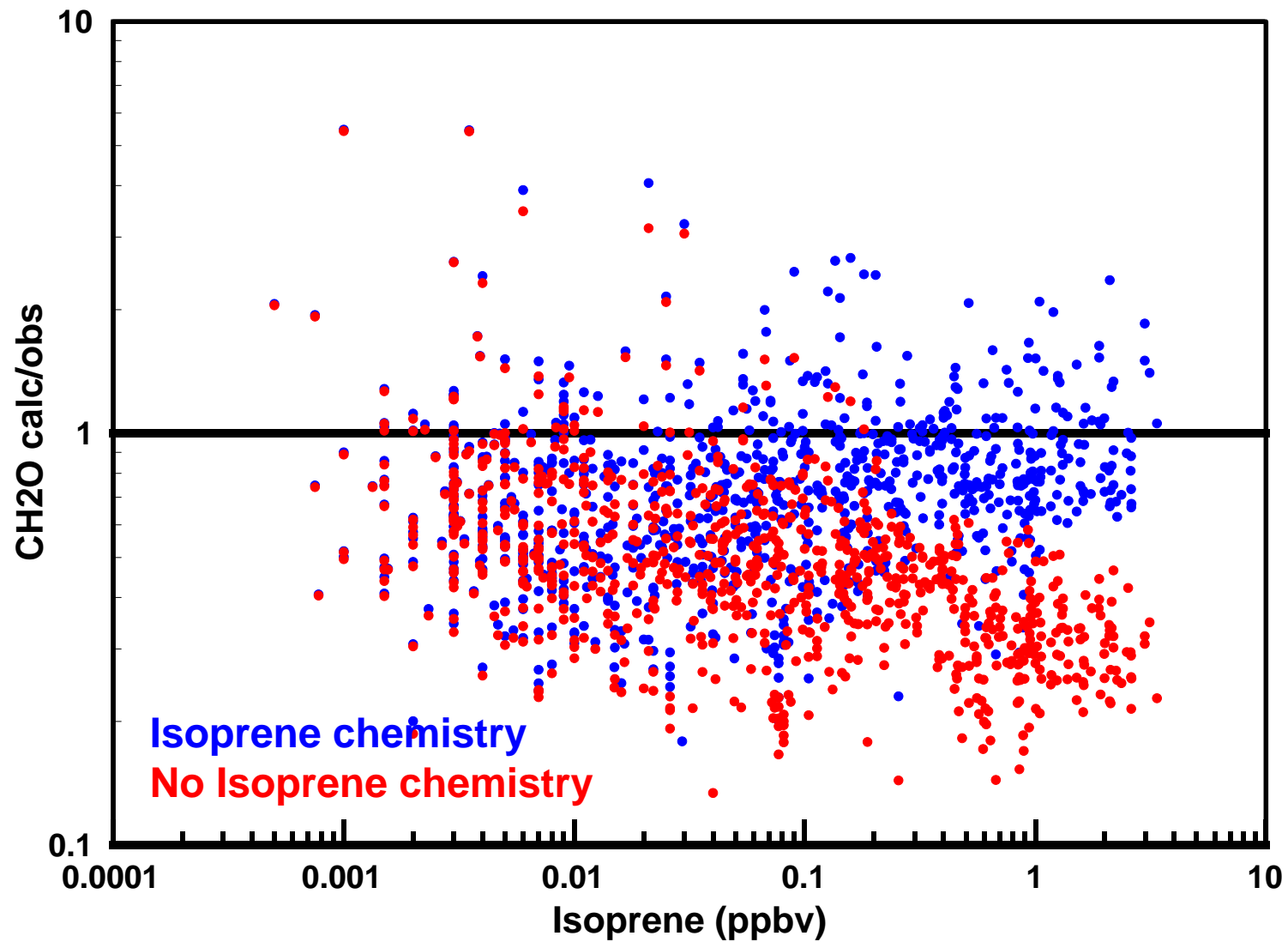
# Trends in Model-Measurement Agreement with Isoprene



# Trends in Model-Measurement Agreement with Isoprene



# Trends in Model-Measurement Agreement with NO





# Summary

**INTEX offers an unprecedented number of measurements suitable for testing photochemical theory.**

**Comparisons are somewhat paradoxical**

**Current estimated ozone production rates for the upper troposphere are 4-5 ppbv/day (could it be closer to 10 ppbv/day!?)**

**Input from the Science Team regarding these and other applications of the model are welcomed.**