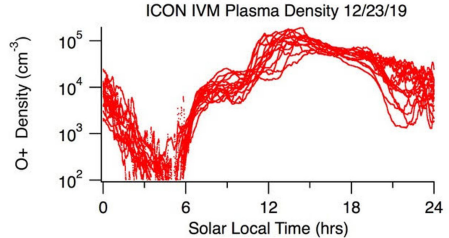
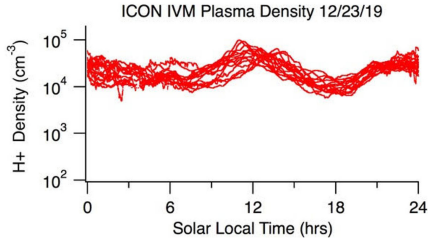


ICON IVM DATA/MODEL COMPARISON (SAMI3/TIEGCM/WACCM-X): DEC 23, 2019

J.D. Huba
Syntek Technologies
Fairfax, VA

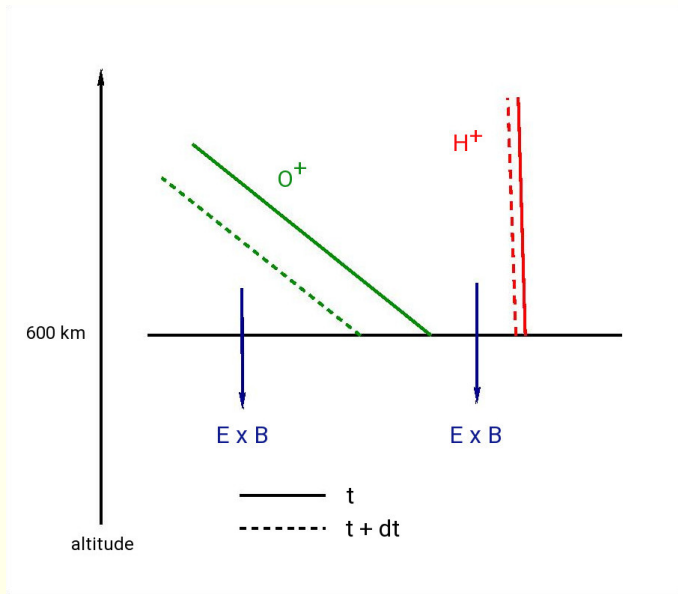
CEDAR
June 2020

with R. Heelis (UT Dallas) and A. Maute (HAO/NCAR)

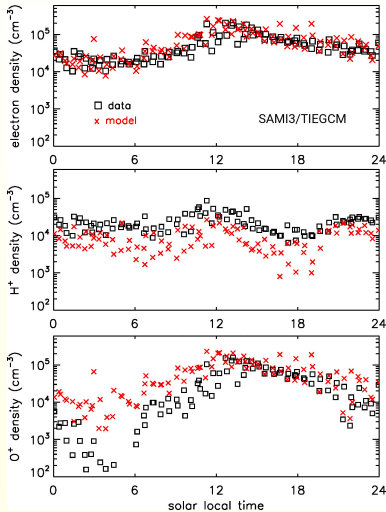


- H⁺ density relatively uniform
- O⁺ density large depletion post-midnight/pre-sunrise

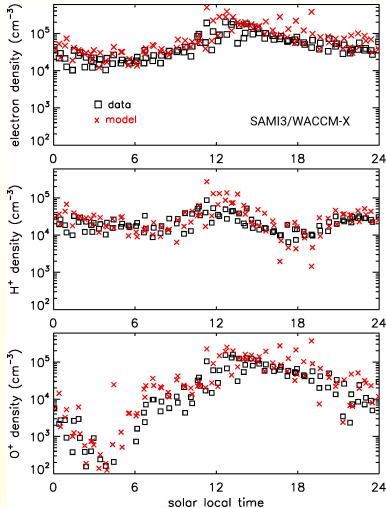
CARTOON EXPLANATION



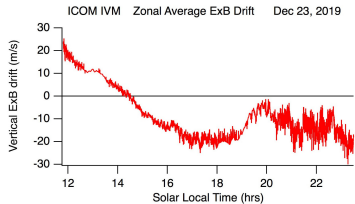
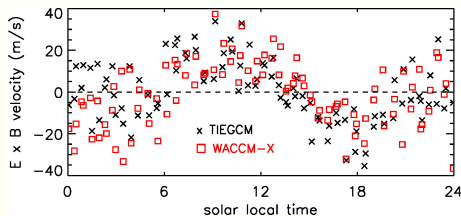
- SAMI3/TIEGCM (resolution 2.50°)
- SAMI3/WACCM-X (resolution 1.25°)
- codes are one-way coupled: thermospheric variables (i.e., density, temperature, winds) are inputs to SAMI3 but the SAMI3 ionosphere variables are not used in TIEGCM/WACCM-X
- map simulation data to ICON orbit
- note: H density not included in TIEGCM so MSIS used



- electron density: reasonable agreement with data
- but H^+ is low
- and O^+ is high - especially in post-midnight/pre-sunrise sector



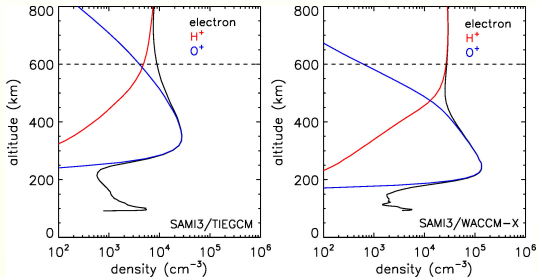
- electron density: reasonable agreement with data
- but now H^+ is in better agreement with data
- as well as O^+ - especially in post-midnight/pre-sunrise sector
- large dropout in O^+ captured



- considerable longitudinal variability in E \times B drift
- upward in daytime \sim 06 : 00 – 15 : 00
- downward in late afternoon \sim 15 : 00 – 19 : 00
- WACCM-X drift 'more' downward in post-midnight/pre-sunrise sector than TIEGCM

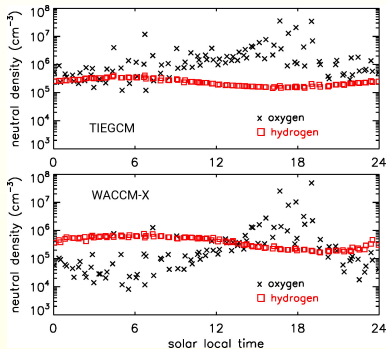
DENSITY PROFILES VS ALTITUDE

vertical profile at magnetic equator: 03:36 LT at longitude 54°



- H⁺/O⁺ transition altitude lower for WACCM-X
- at ICON orbit (~ 600 km)
 - H⁺ larger for WACCM-X
 - O⁺ larger for TIEGCM
- note: large 'reservoir' of H⁺ above ICON orbit

NEUTRAL DENSITIES: O AND H



- biggest differences for 00:00 LT - 12:00 LT
- H density slightly larger for WACCM-X
- O density much larger for TIEGCM

- post-midnight / pre-sunrise IVM observations
 - large dropout in O^+ ($\lesssim 10^2 \text{ cm}^{-3}$)
 - but not in H^+
- result is captured with SAMI3/WACCM-X simulation
 - (but not SAMI3/TIEGCM simulation)
 - primary difference: O density
- caused by downward drift
 - 'low' reservoir of O^+ above ICON orbit
 - 'large' reservoir of H^+ above ICON orbit