Exploring Model Inputs with SimISR

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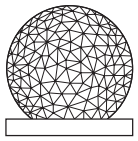

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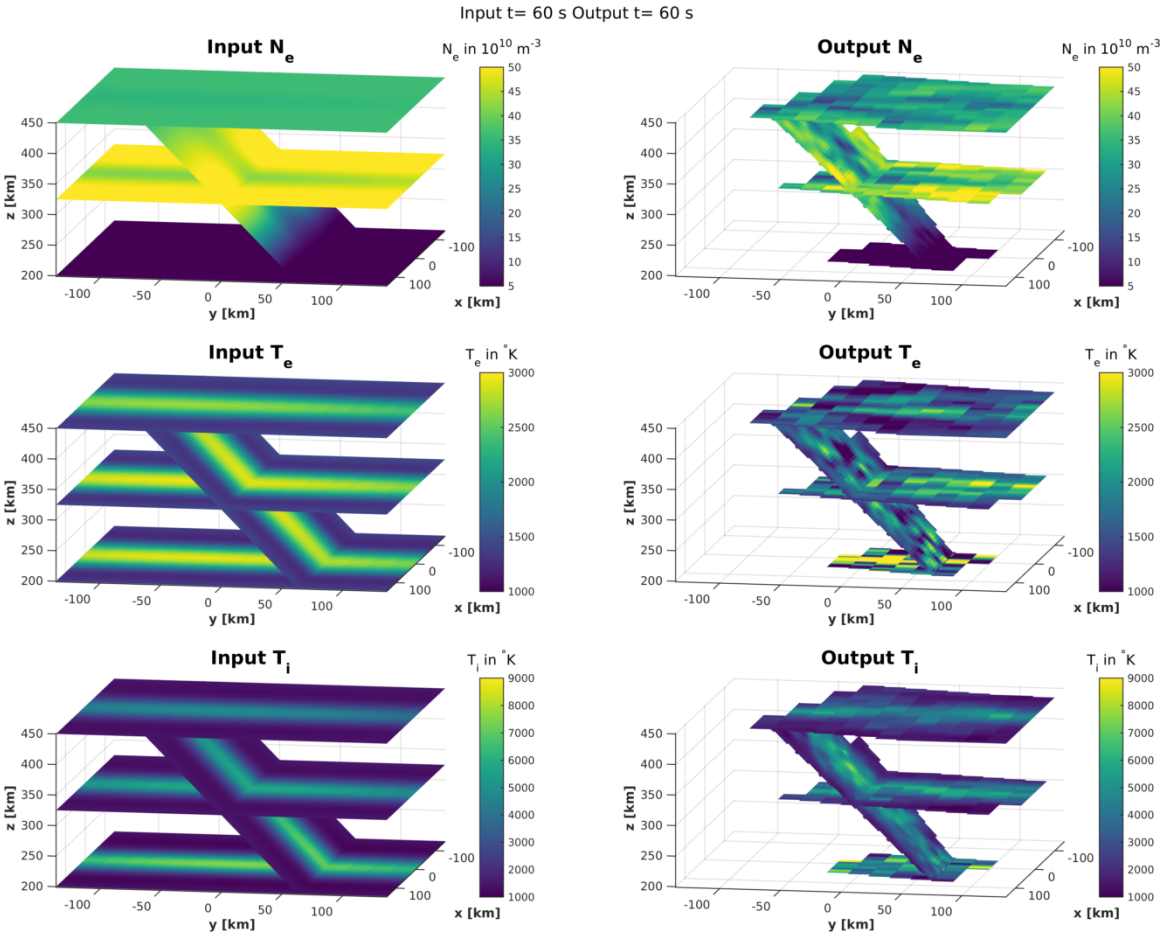
SimISR

- Creates simulated ISR data for a given set of plasma parameters along with processing & fitting
- Works in three spatial dimensions and time



[Swoboda et. al. 2017]

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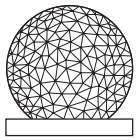
SimISR Example 1

- Explore the impact chemical content on ion temp measurement
  - Models for content can be imprecise
  - Causes positive bias in ion temperature
  - Methods have been proposed [Zettergren, 2011]
- Sensor parameters are taken from Millstone Hill System (zenith antenna)
- Plasma parameters are originally derived from ISR (pyglow)
- Make different scenarios
  - Adjust height of transition region in input
  - Adjust size of long pulse



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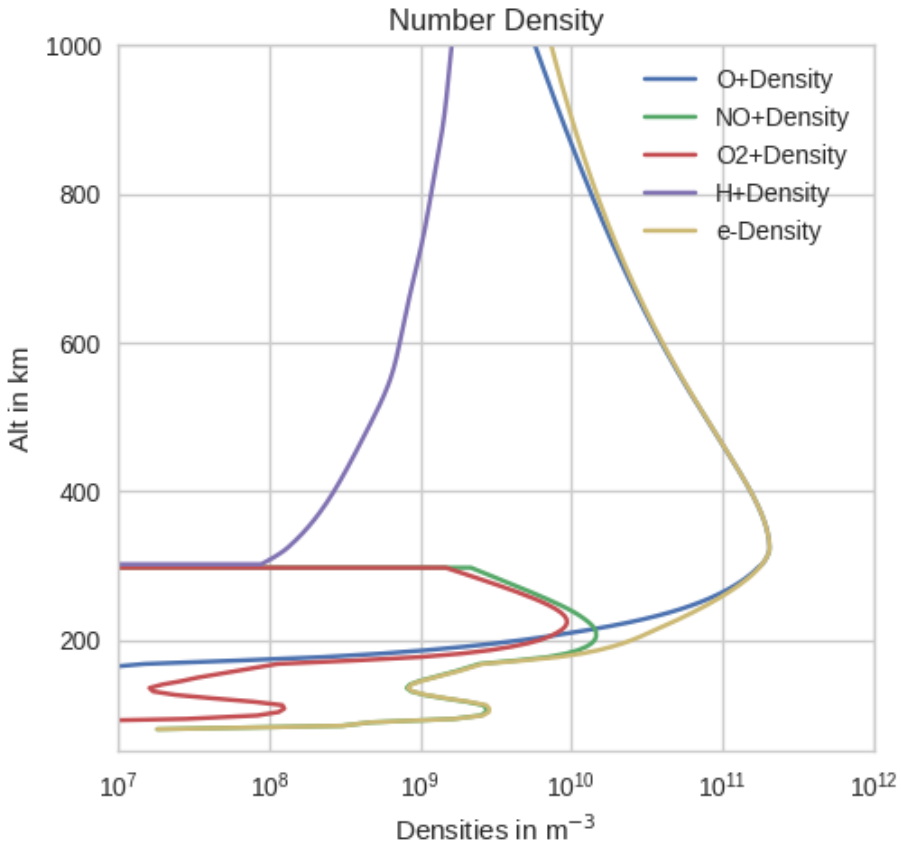
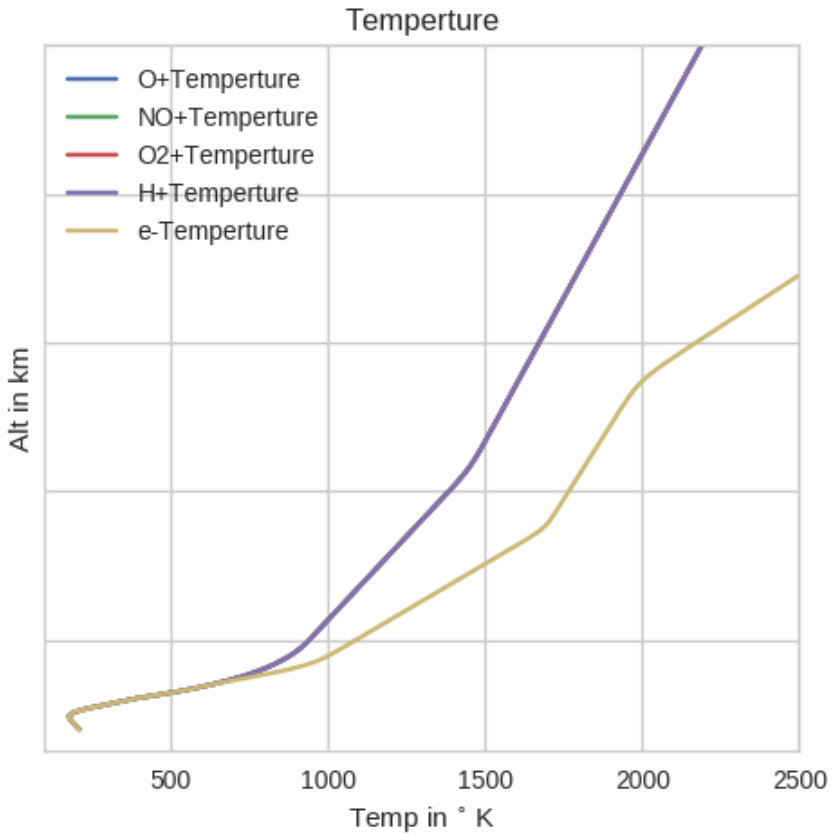
SimISR Example 1





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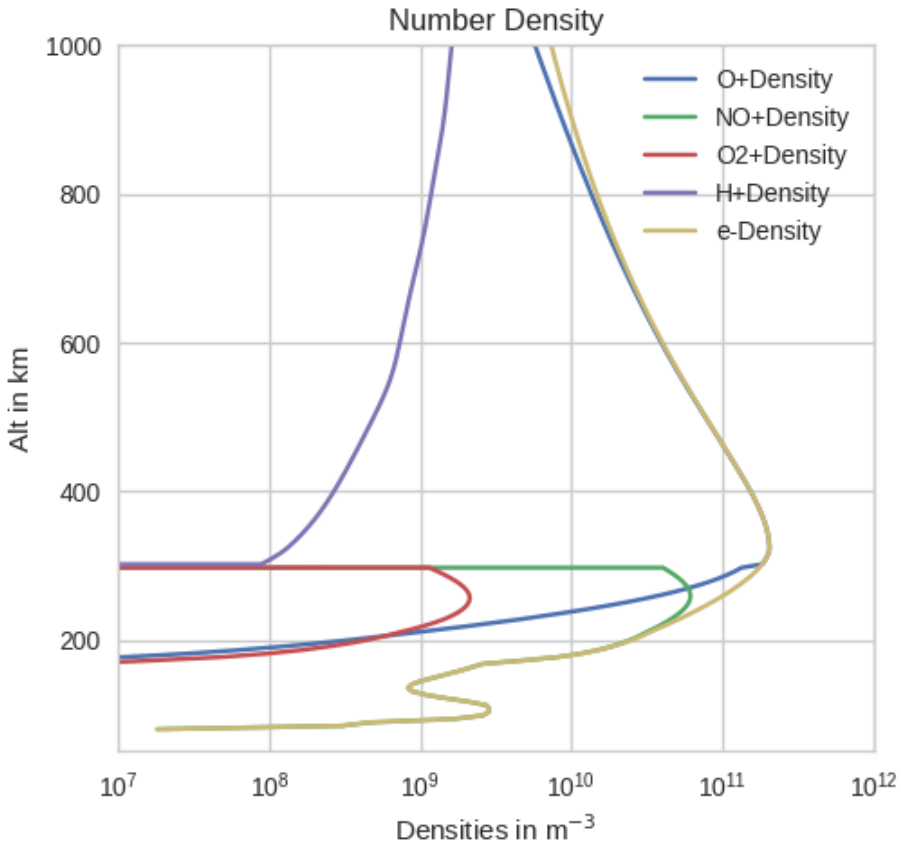
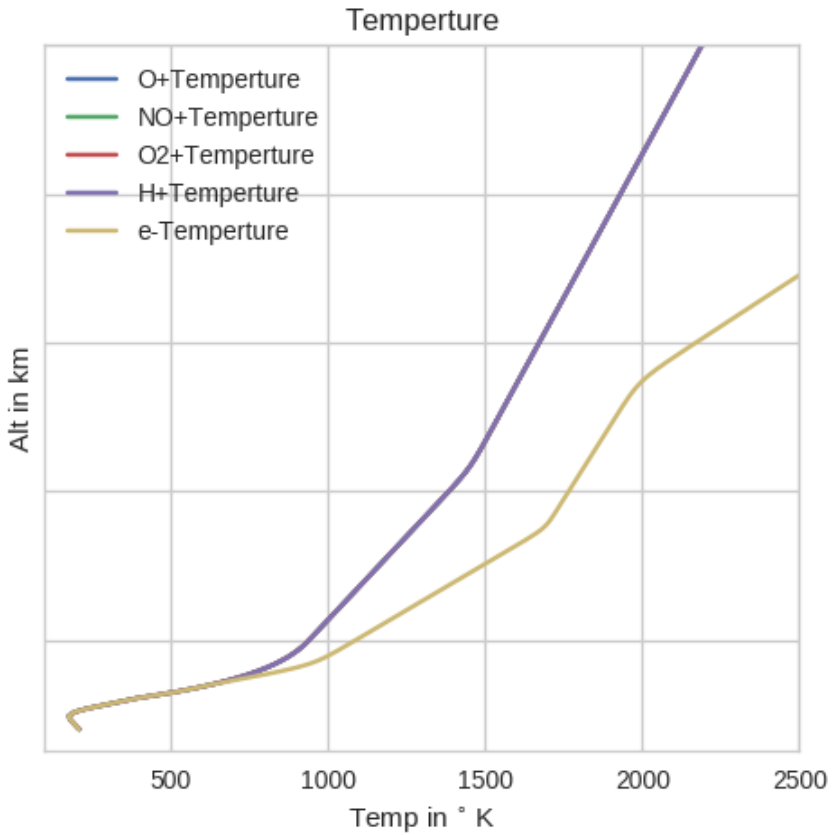
SimISR Example 1





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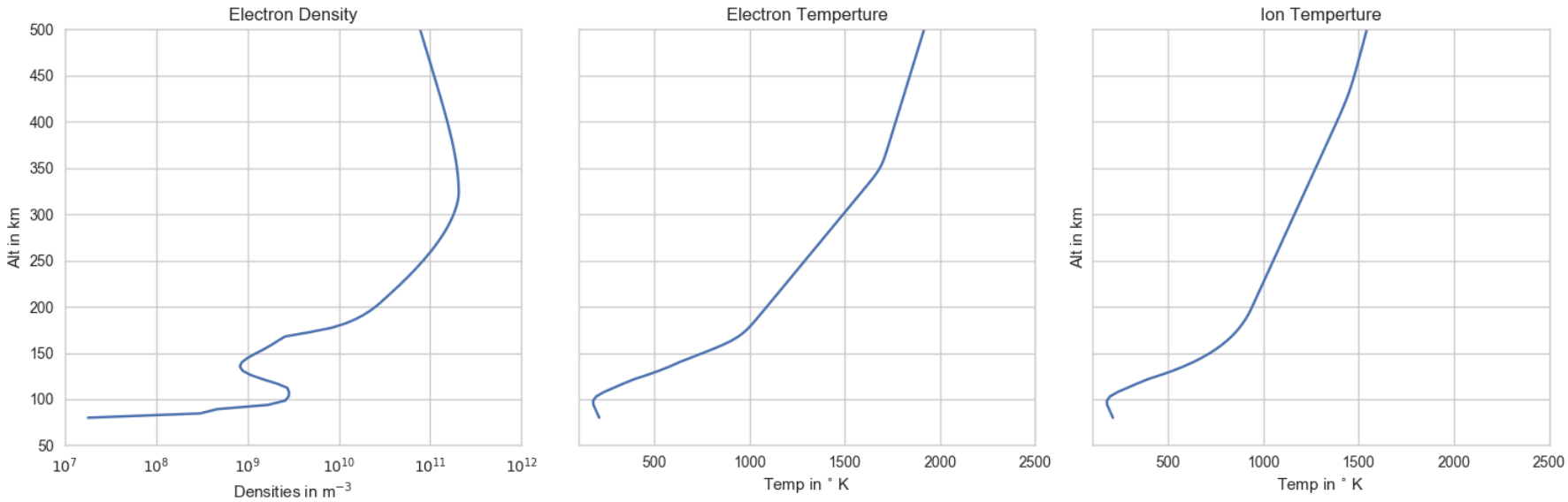
SimISR Example 1



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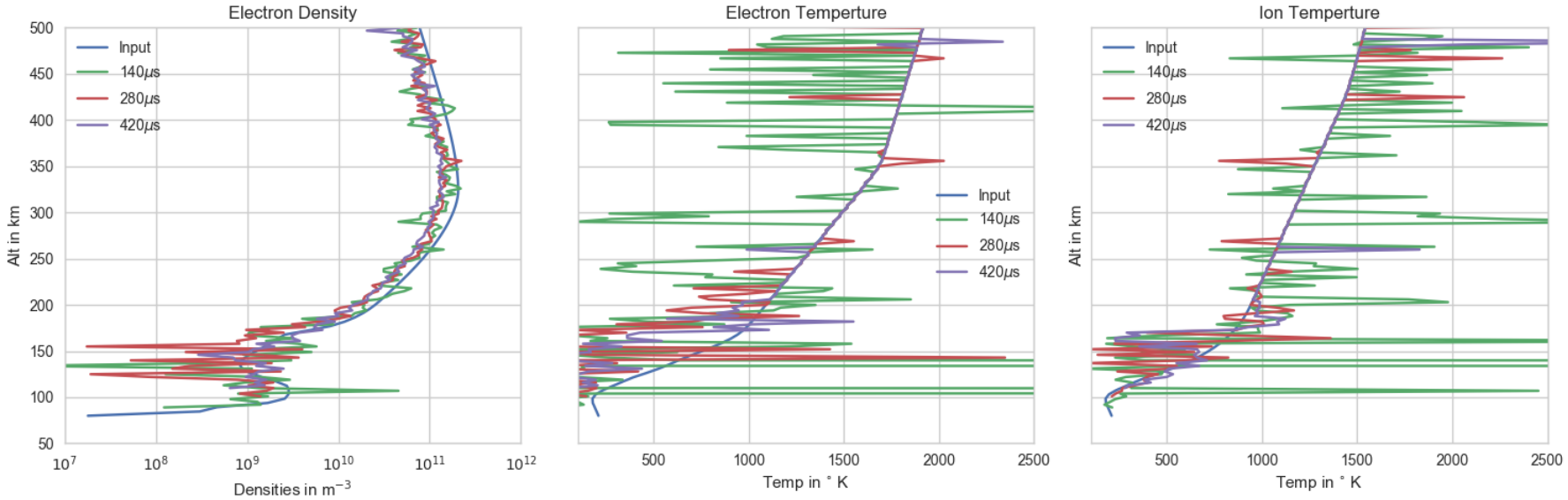
SimISR Example 1

Transition Height: 210 km



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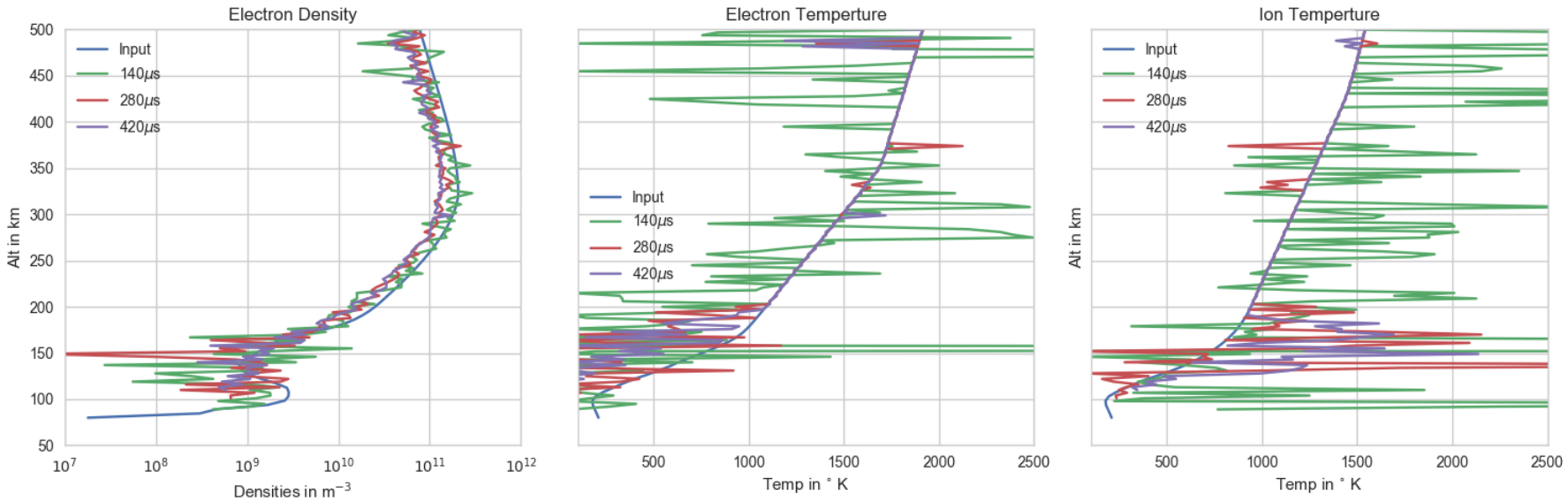
SimISR Example 1

Transition Height: 230 km



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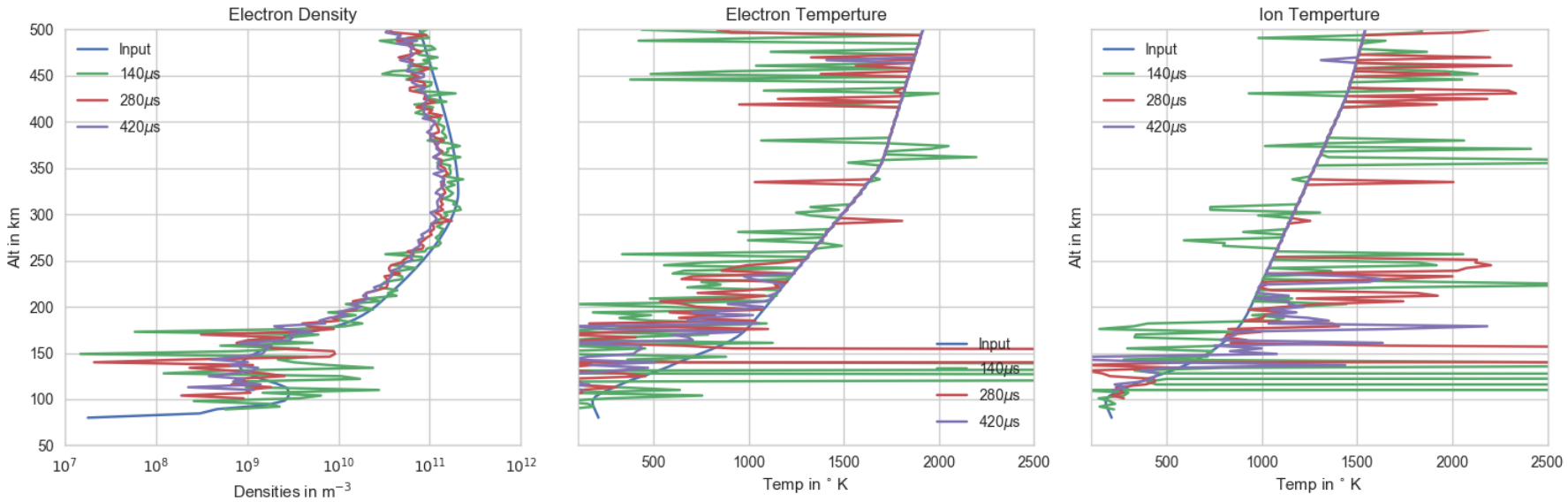
SimISR Example 1

Transition Height: 250 km



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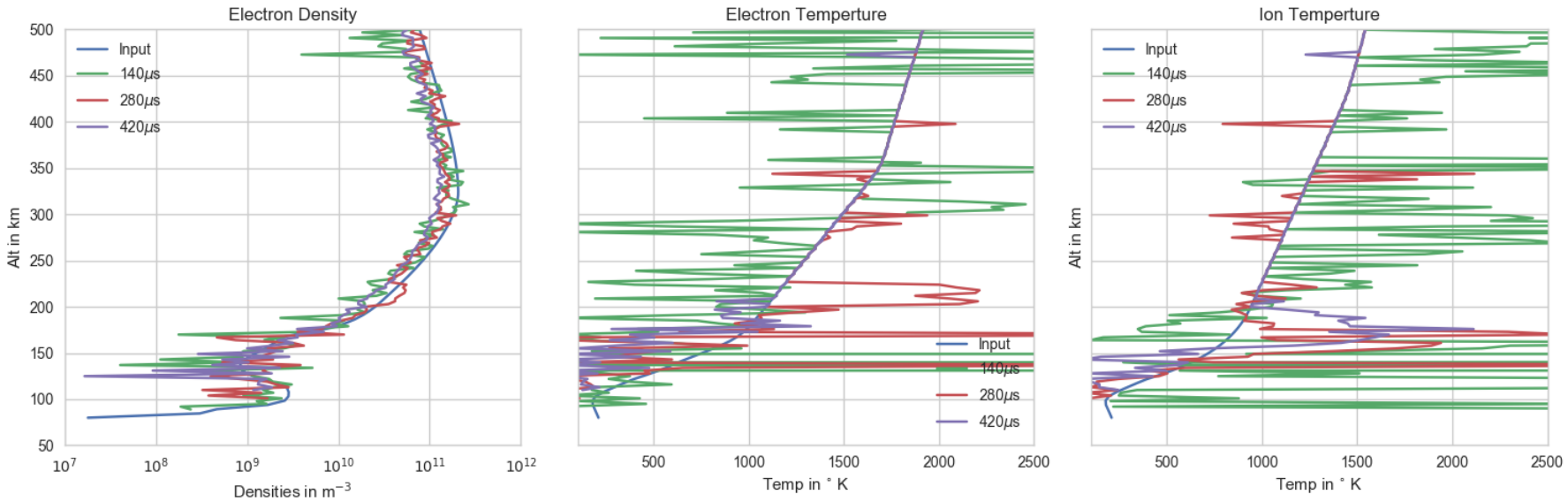
SimISR Example 1

Transition Height: 270 km



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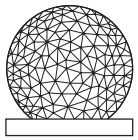
SimISR Example 2

- Plasma parameters come from multi-fluid ionosphere model (Zettergren 2012)
  - Parameters from Perry et al. 2015
  - Arc tied to a field align current moving through field of view

- Simulate the measurement with the SimISR with parameters similar to PFISR
  - Antenna beamwidth ~1deg
  - Frequency 440MHz
  - Sampling frequency 50 kHz
  - Uncoded Long Pulse 280 us
  - Integrate 255 pulses per position
  - Integration period of 1 min



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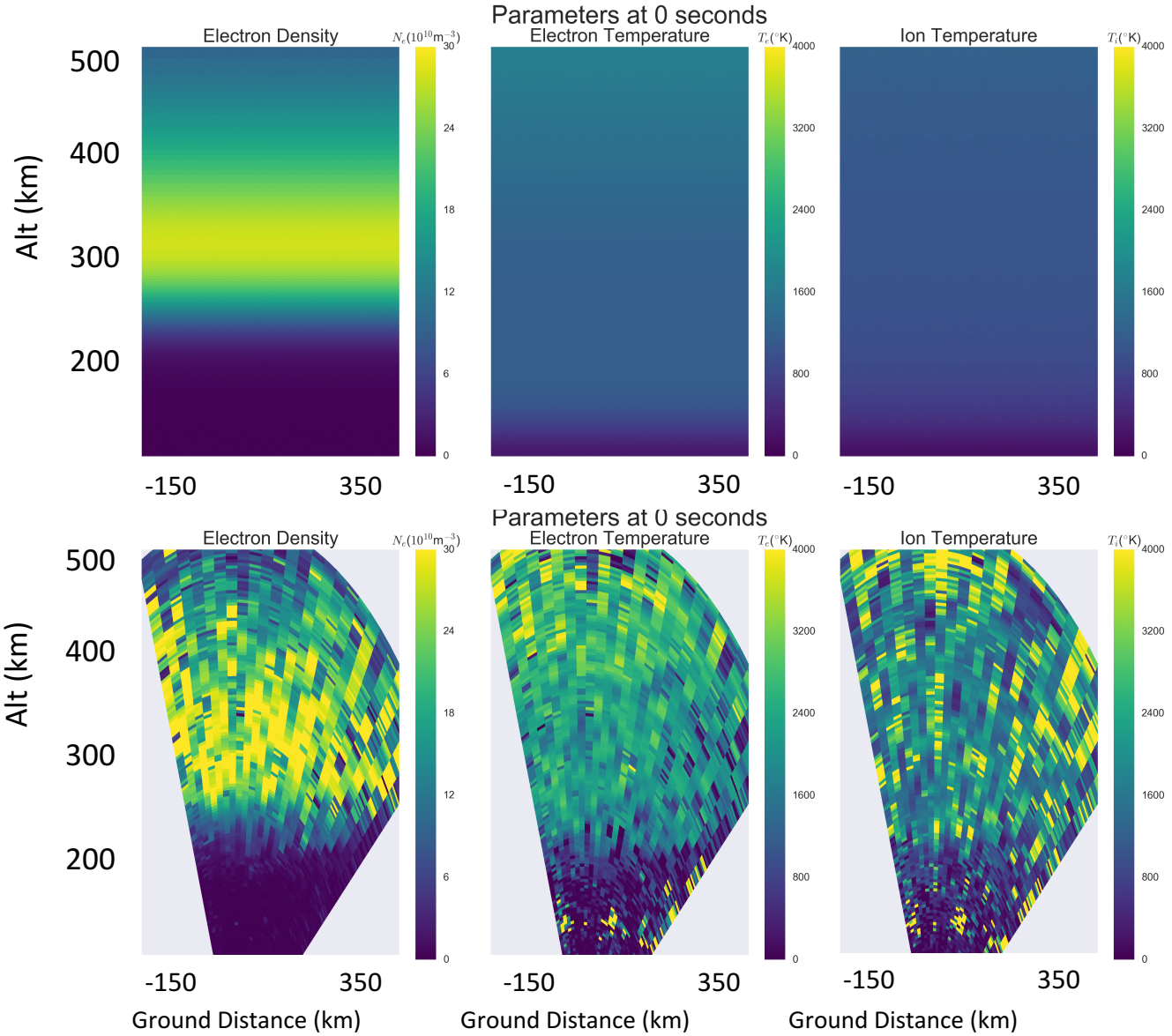
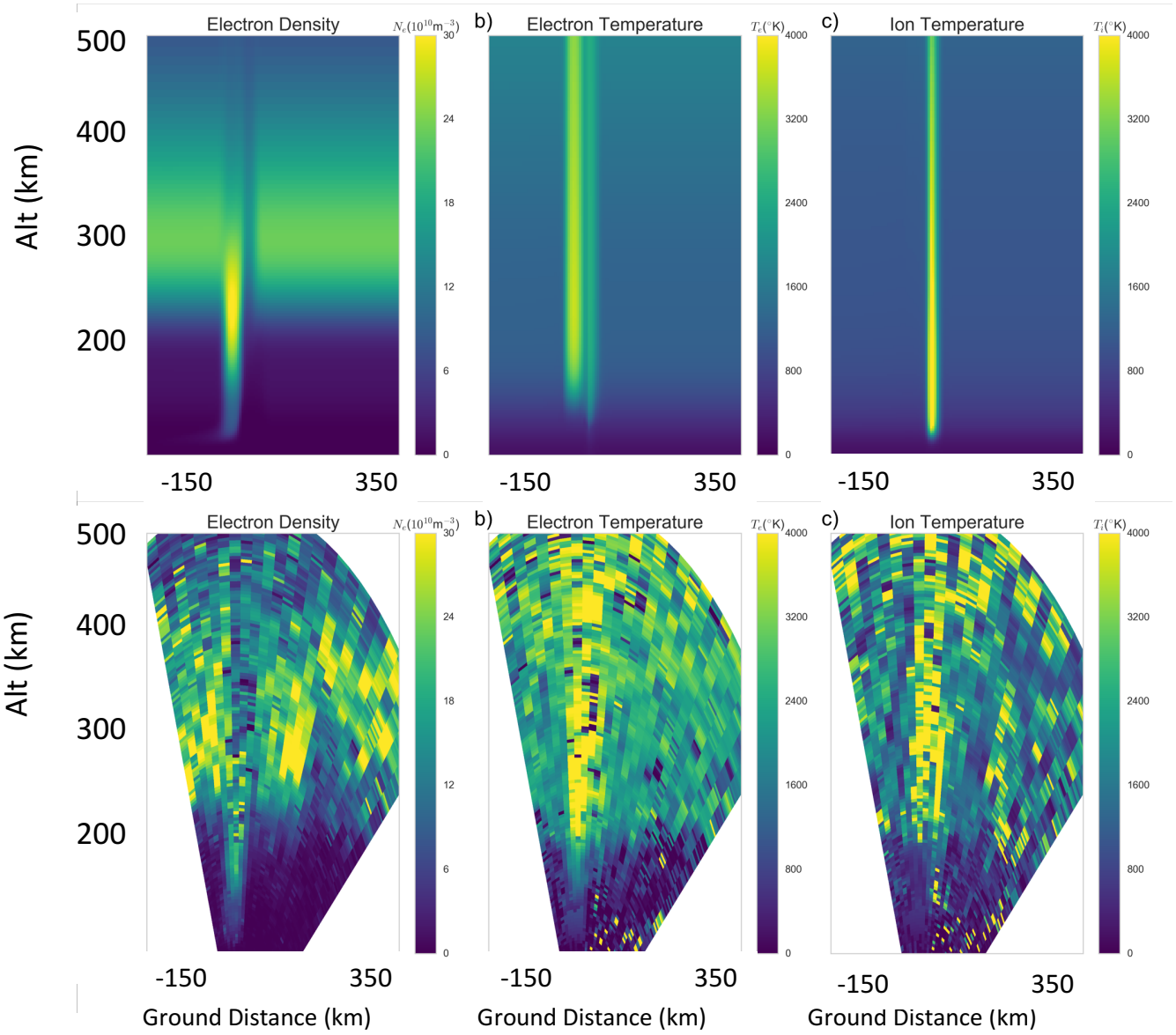
SimISR Example 2



SimISR Example 2



- Evacuation in electron density is visible.
- Enhancements in electron and ion temperature are noticeable.

References

- M. Zettergren, J. Semeter, C. Heinselman, and M. Diaz, “Incoherent scatter radar estimation of Fregion ionospheric composition during frictional heating events,” *J. Geophys. Res. Space Physics*, vol. 116, no. 1, pp. n/a–n/a, Jan. 2011.
- Oliver, W. L., J. M. Holt, S.-R. Zhang, and L. P. Goncharenko, “Long-term trends in thermospheric neutral temperature and density above Millstone Hill,” pp. 1–7, Oct. 2014.
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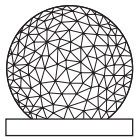

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