Improved Understanding of the Parameters Involved in Near-surface and Residual-layer NPF Events and Their Representations in Models

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Q1. What is the contribution of the near-surface and residual-layer NPF-derived particles to the boundary-layer aerosol and CCN number concentration in urban and rural regions of the Southeastern US?

Q2. Do particles produced through the near-surface and residual-layer NPFs have different chemical compositions and thus related water uptake properties?

Q3. What environmental parameters need to be improved in the models (like WRF-Chem APM) to capture the number, timing, nucleation height, seasonality, and modal growth rates of NPF-derived particles?

Q4. Are the gaseous precursor vapors involved in the residual-layer NPF events derived from the remnants of the previous day's local conditions?

Southeastern US is well suited for exploring NPFs

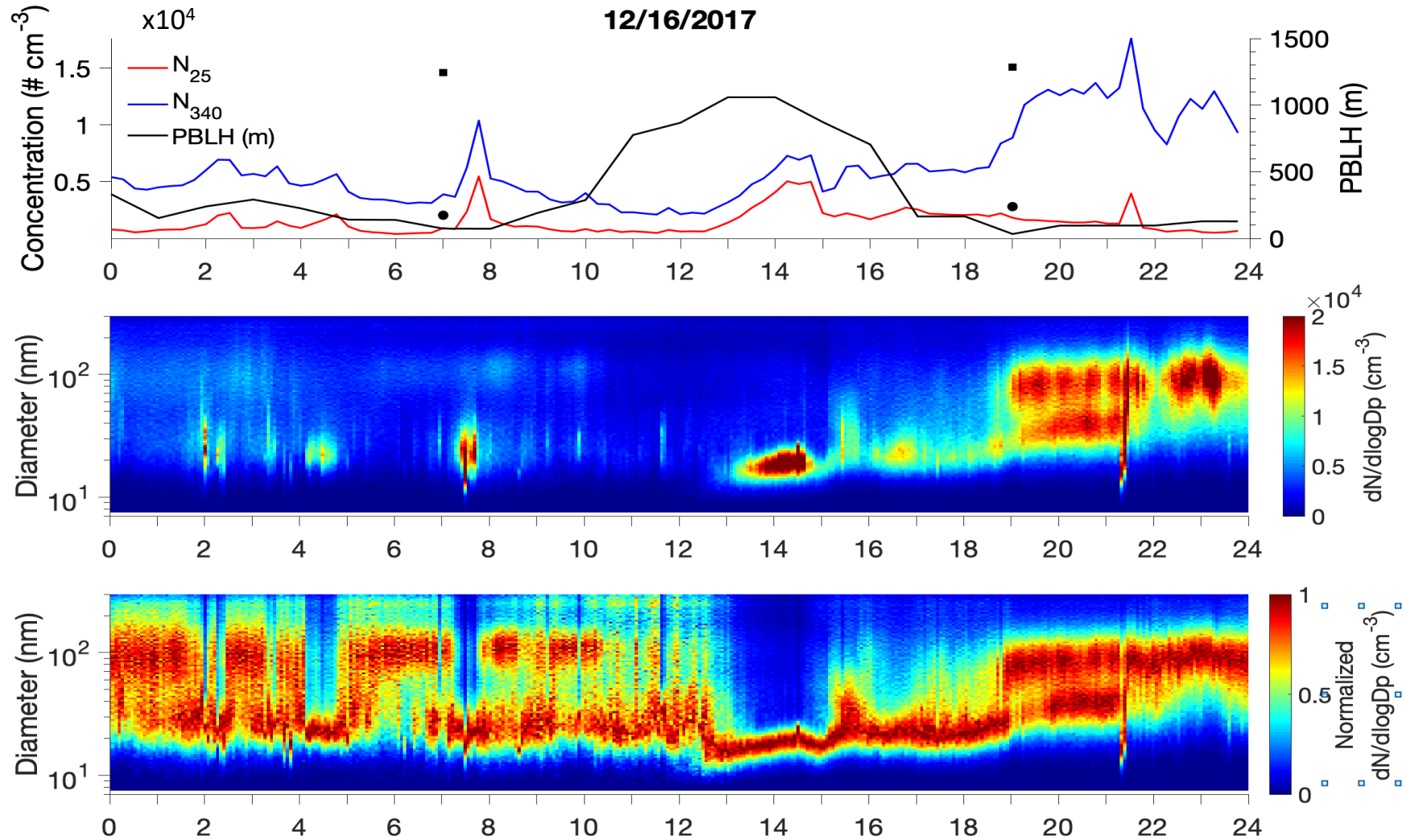- Persistent and "well behaved" NPFs in Research Triangle Area

Weekdays
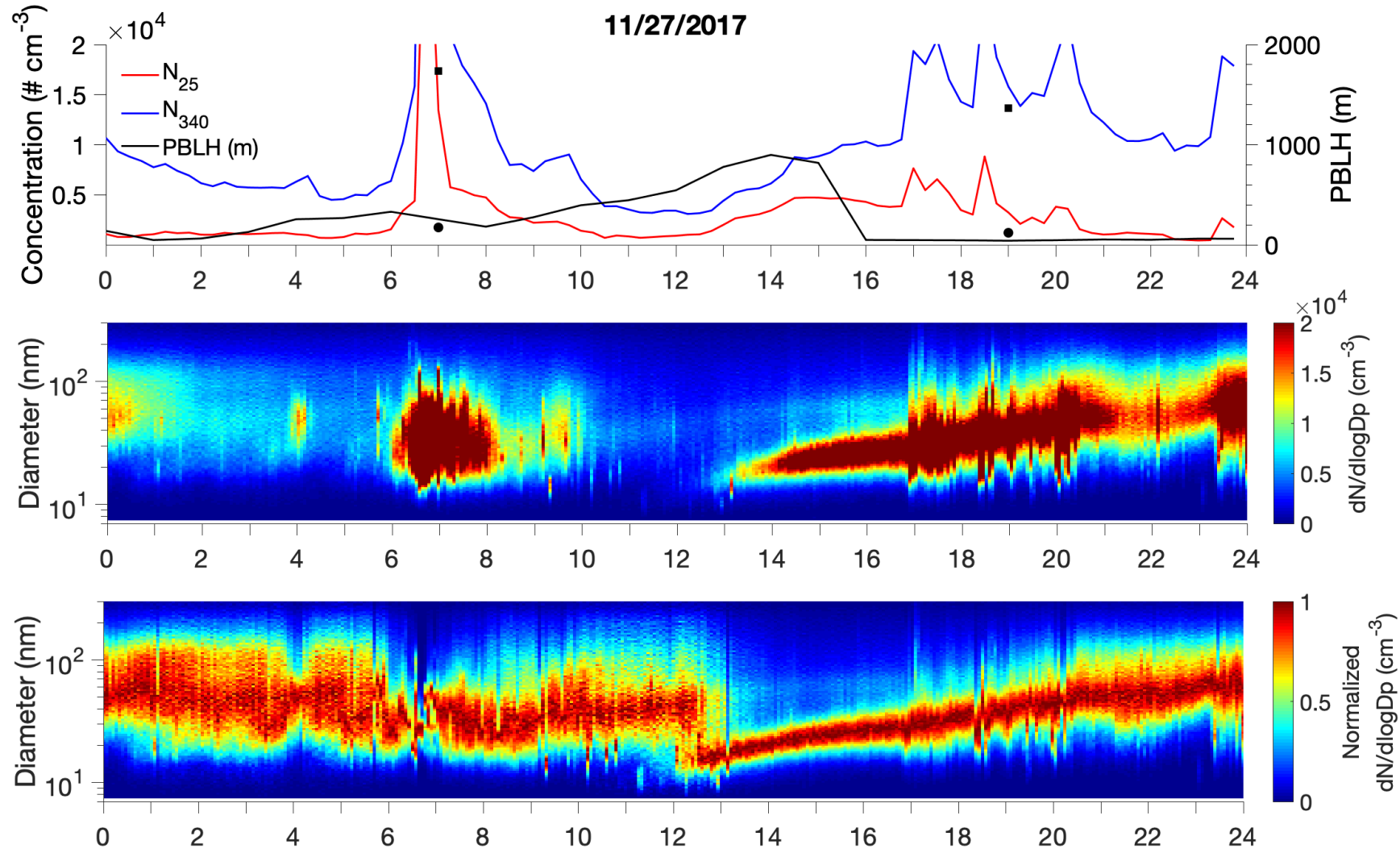
Southeastern US is well suited for exploring NPFs

- Persistent and "well behaved" NPFs in Research Triangle Area

Weekend

Southeastern US is well suited for exploring NPFs

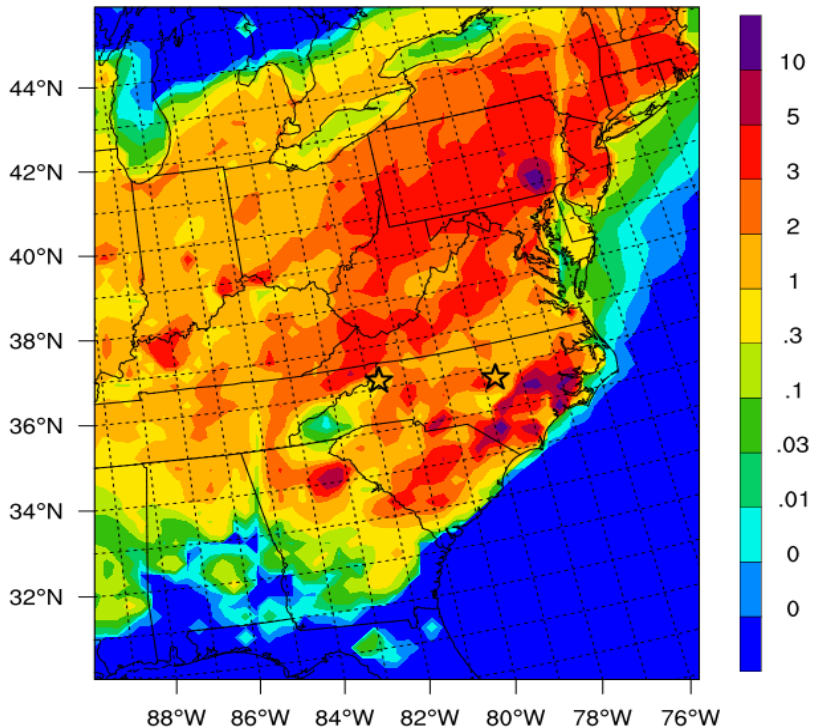- Particle concentrations and growth rates are comparable to other sites

Date	Detection time (LT)	Particle concentration (cm^{-3})		Growth rate (nm h^{-1})
		10 to 25 nm	26 to 40 nm	10 to 25 nm
11/24/2017	13:00	1.6 ×10^3	1.1×10^3	2.8 [± 0.95]
11/26/2017	12:00	2.3 ×10^3	1.2 ×10^3	2.0 [± 0.92)]
11/27/2017	13:00	2.7 ×10^3	1.0 ×10^3	3.2 [± 0.73]
12/11/2017	13:30	2.4 ×10^3	1.5 ×10^3	3.9 [± 0.67]
12/13/2017	14:00	4.4 ×10^3	4.1 ×10^3	2.8 [± 0.95]
12/16/2017	12:00	1.3 ×10^3	9.4 ×10^3	1.6 [± 1.19]

Southeastern US is well suited for exploring NPFs

- Frequent NPFs in the Piedmont and few in the Coastal Plane and in the Mountains
- Relatively high highly oxidized organic compounds (BioOxOrg) together with H_2SO_4 & ammonia
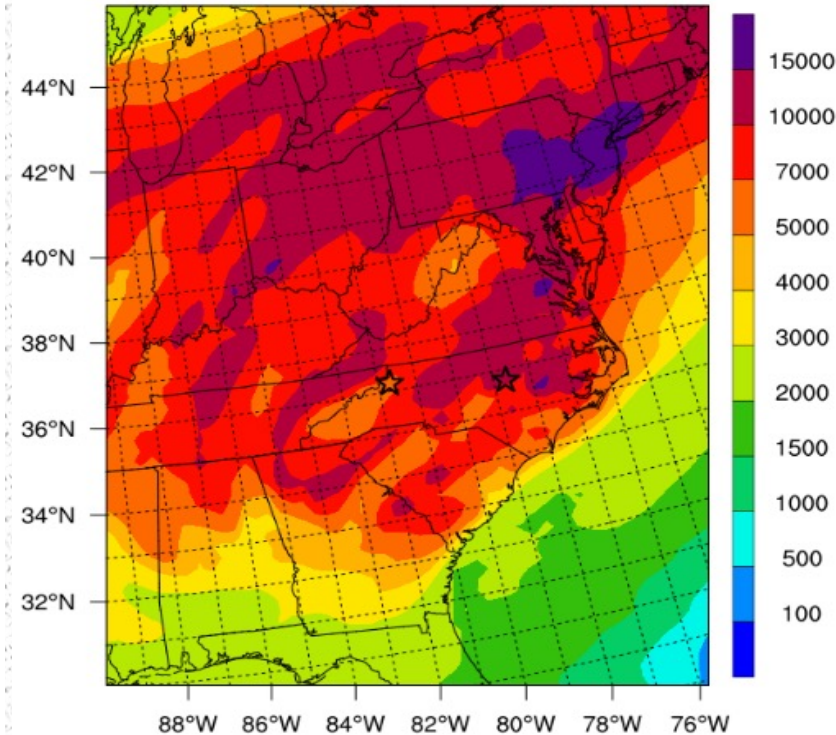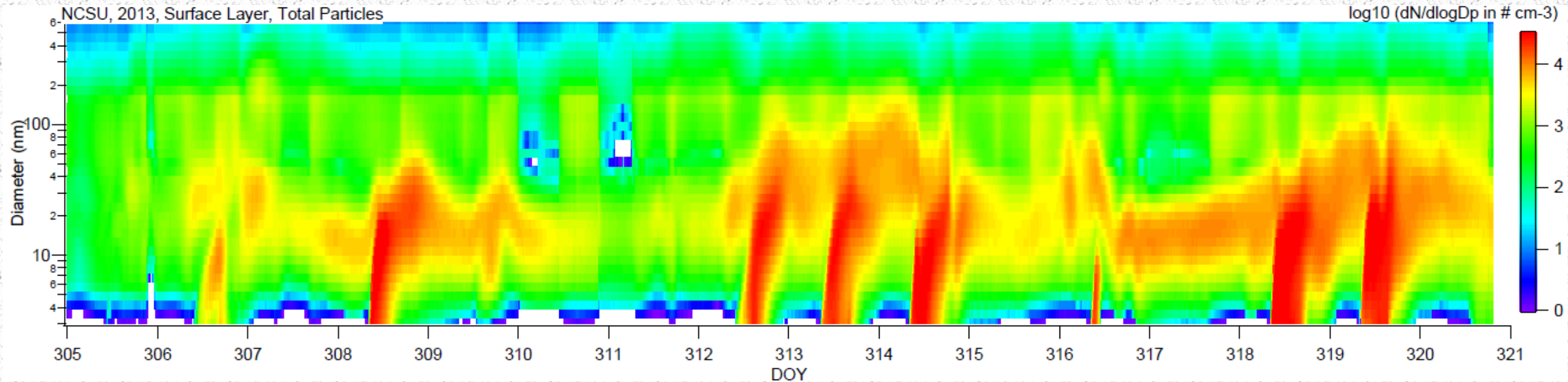
Nucleation rate (J, # cm^{-3} s^{-1})   CN10 (# cm^{-3})   CCN (# cm^{-3})
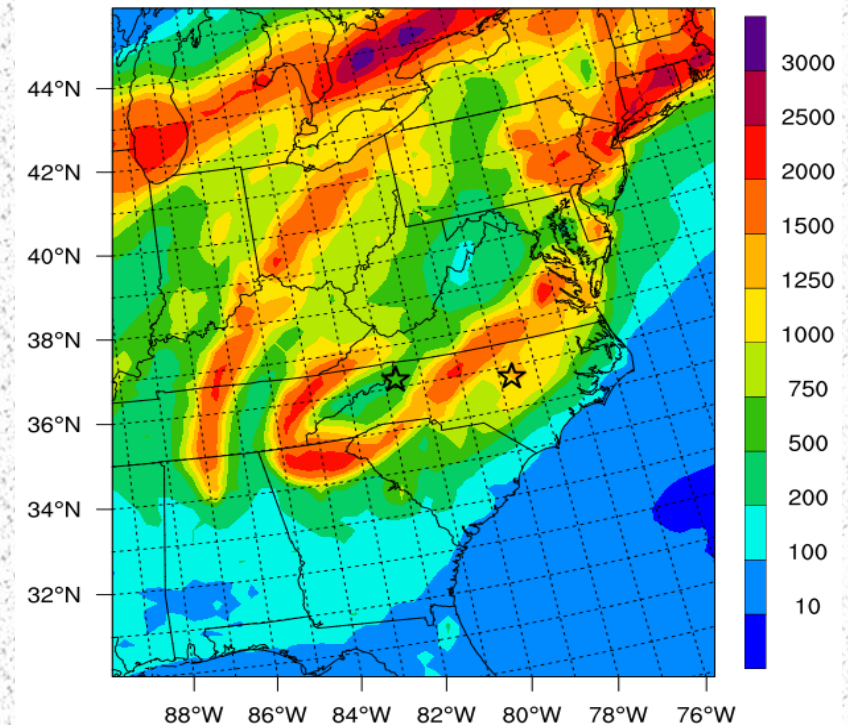
Southeastern US is well suited for exploring NPFs

- Parameters needed for better capturing residual layer nucleation events

Surface-level particle number size distribution for the model grid centered in Raleigh

Discussion Points

- Residual-layer NPFs are real and require more attention

- Southeastern US is well suited for exploring both near-surface and residual-layer NPFs

- Multi-instrumentation and multi-PI campaign could help making considerable improvements to the models