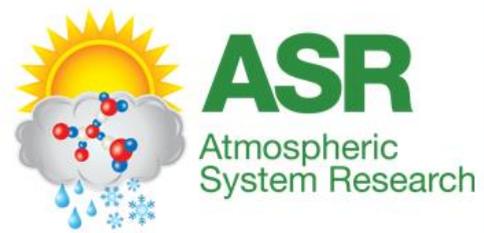




ARM



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Lagrangian vs Eulerian Perspectives of NPF events

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Jeffrey Pierce¹, Samuel O'Donnell¹,
Betty Croft², Bonne Ford¹, Shantanu Jathar³

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¹Department of Atmospheric Science, Colorado State University
²Department of Physics and Atmospheric Science, Dalhousie University
³Department of Mechanical Engineering, Colorado State University

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U.S. DEPARTMENT OF
ENERGY

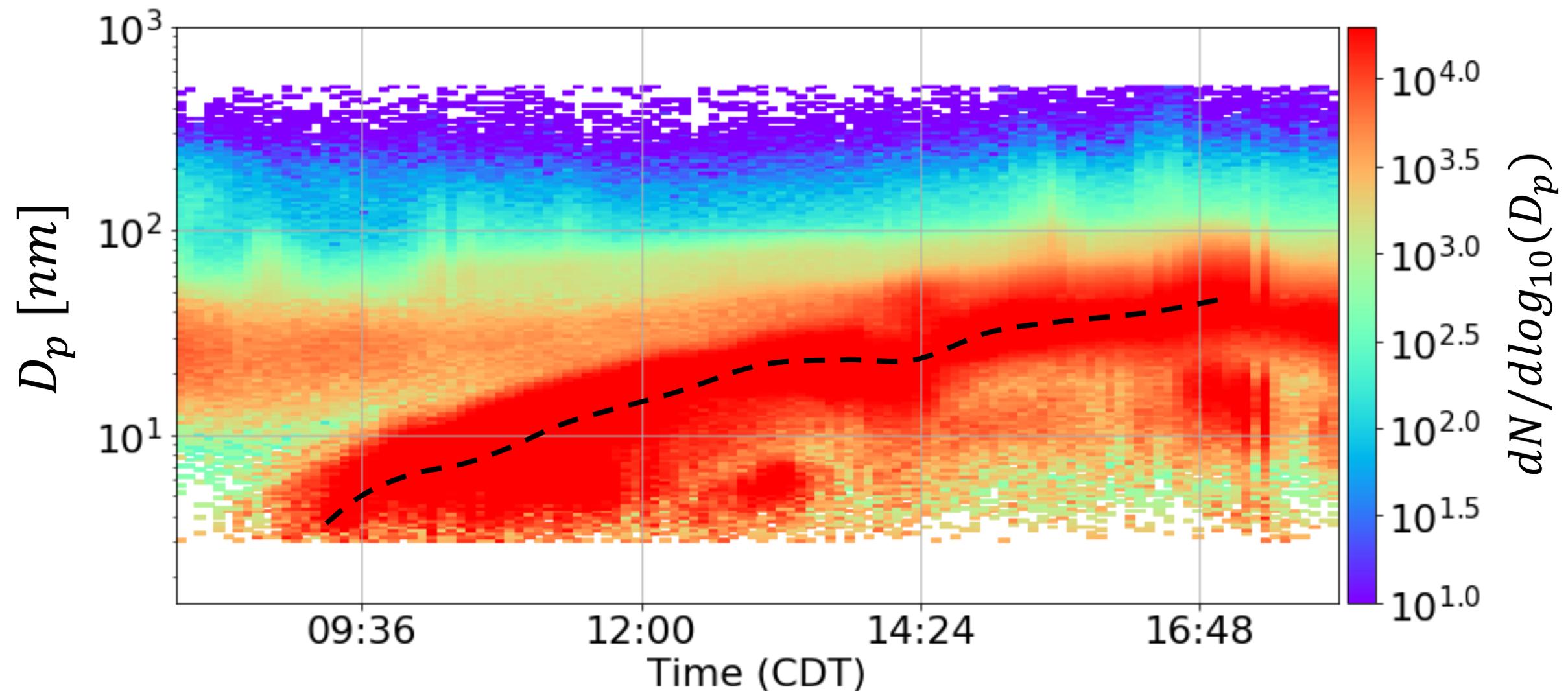
Key Points:

- Size distributions from a fixed site often may not tell the whole story
- Particles appearing grown can be from different air-mass origins
- “Apple” NPF events can be from nucleated particles advecting away



Background and Motivation

We often use observations of size distributions at stationary sites to gain knowledge of new-particle formation and growth.



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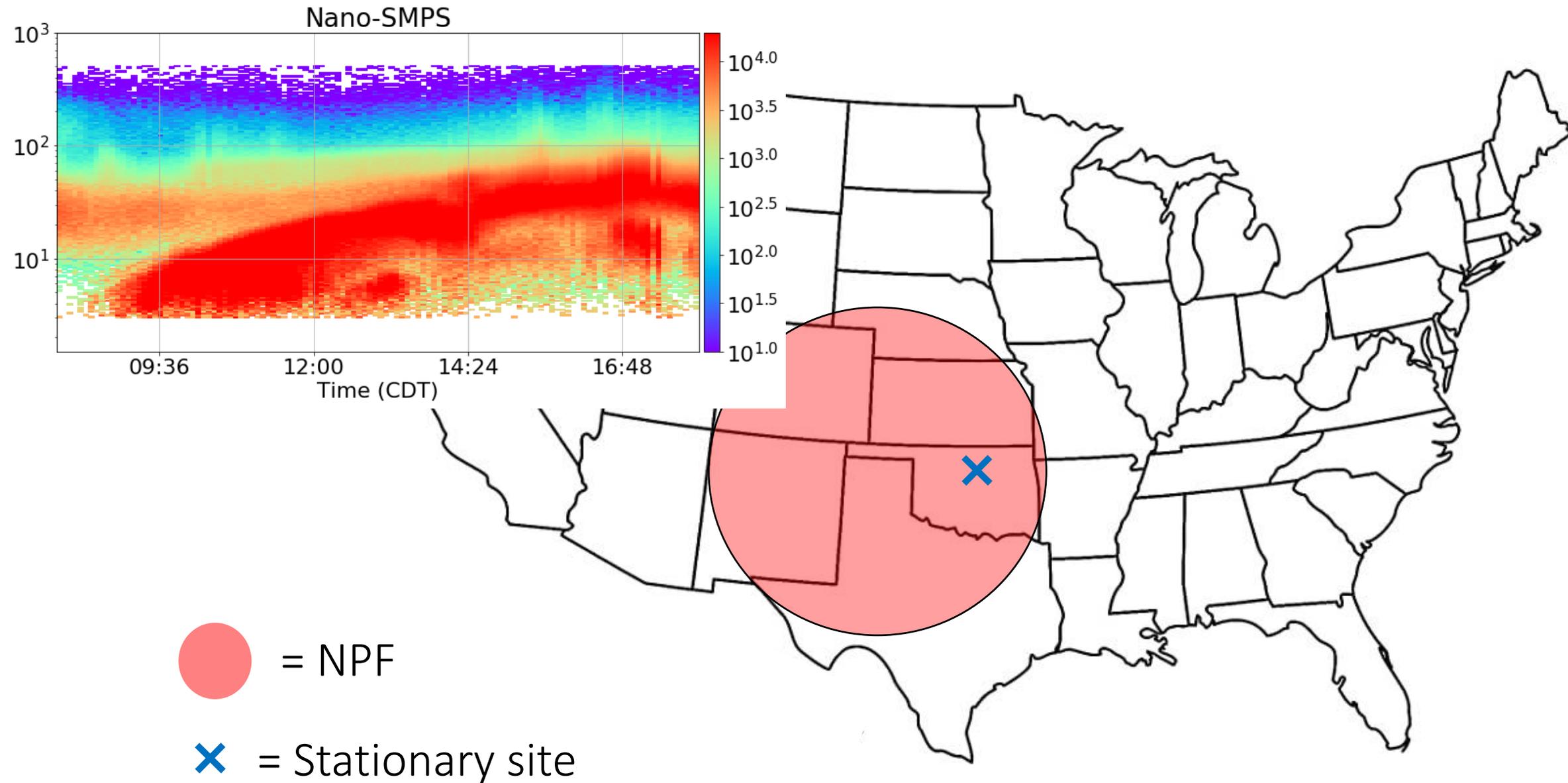
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Background and Motivation

This stationary-site analysis works best if the air in the region is homogeneous.



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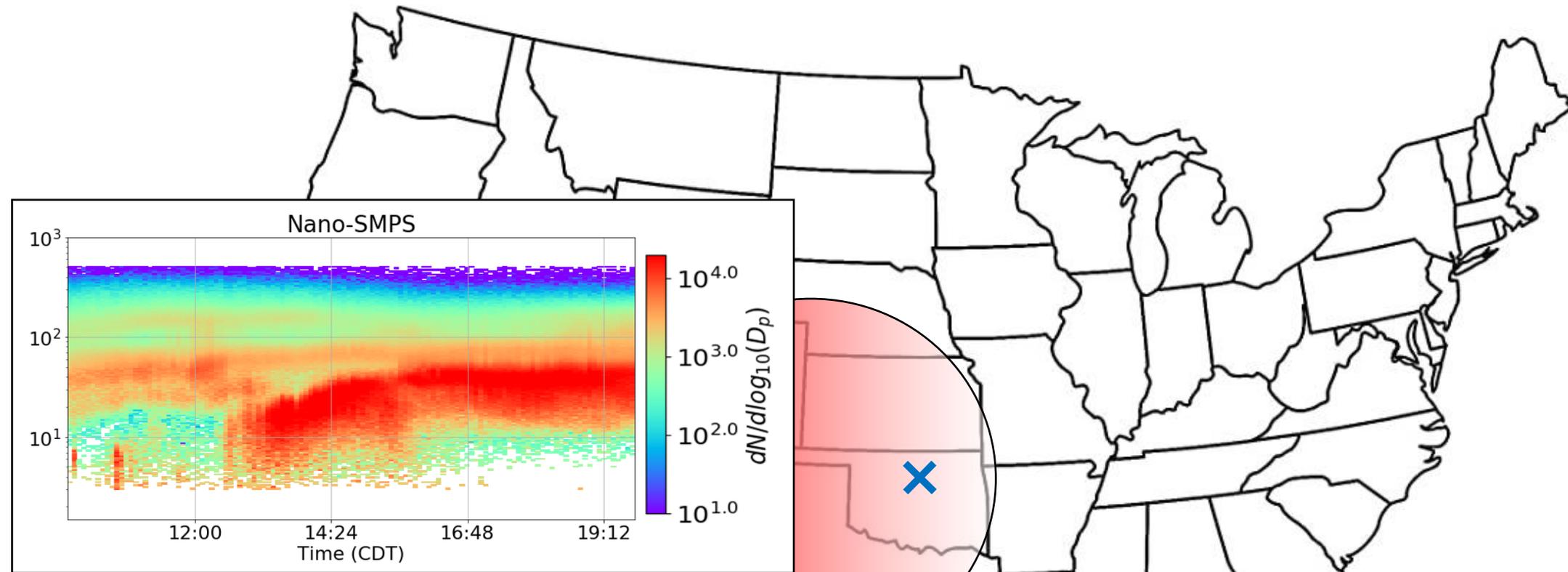
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Background and Motivation

But air is never homogeneous (gradual or sharp gradients)



● = NPF

✕ = Stationary site

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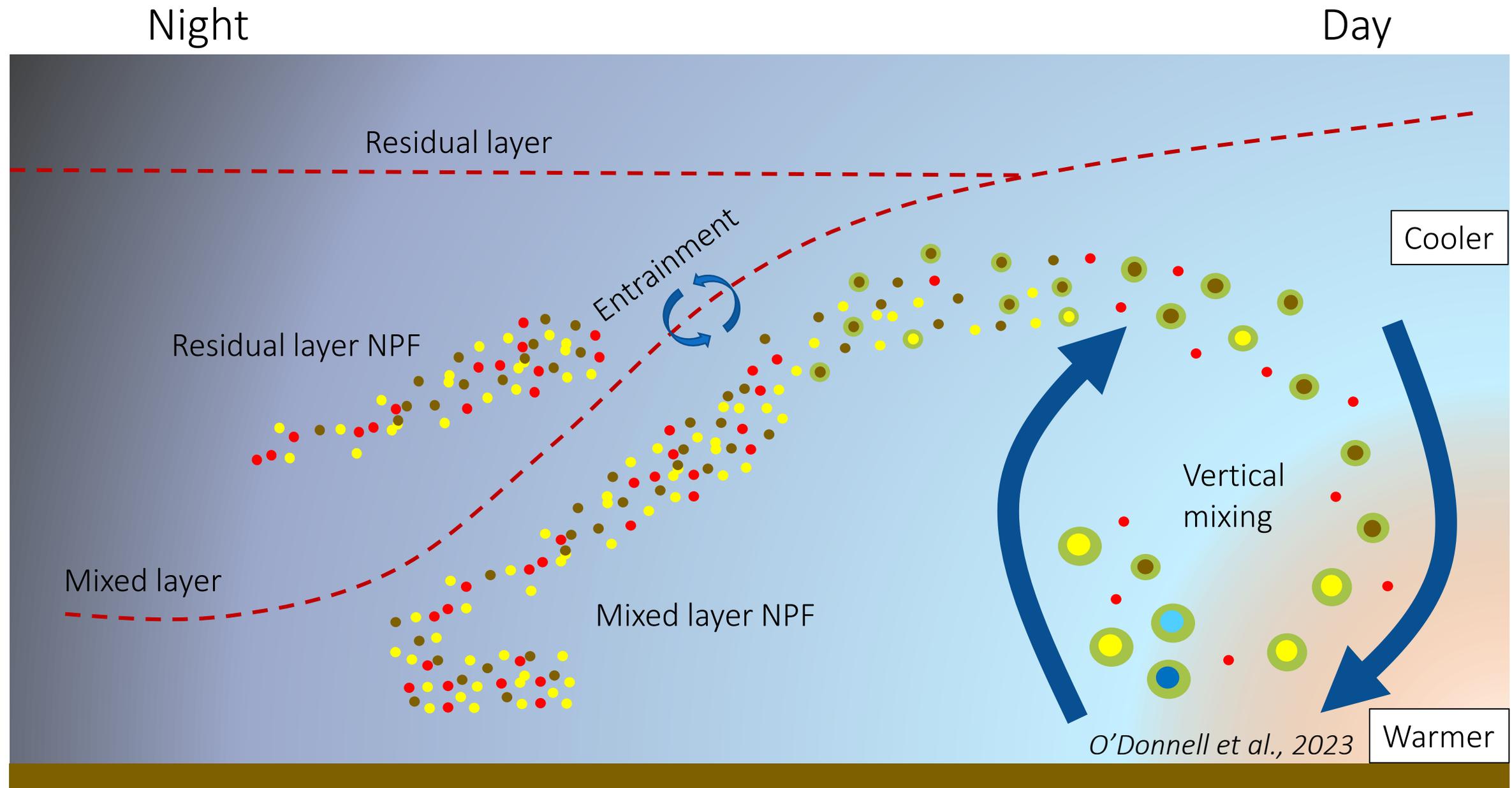
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Background and Motivation

NPF aloft can influence observations at the surface



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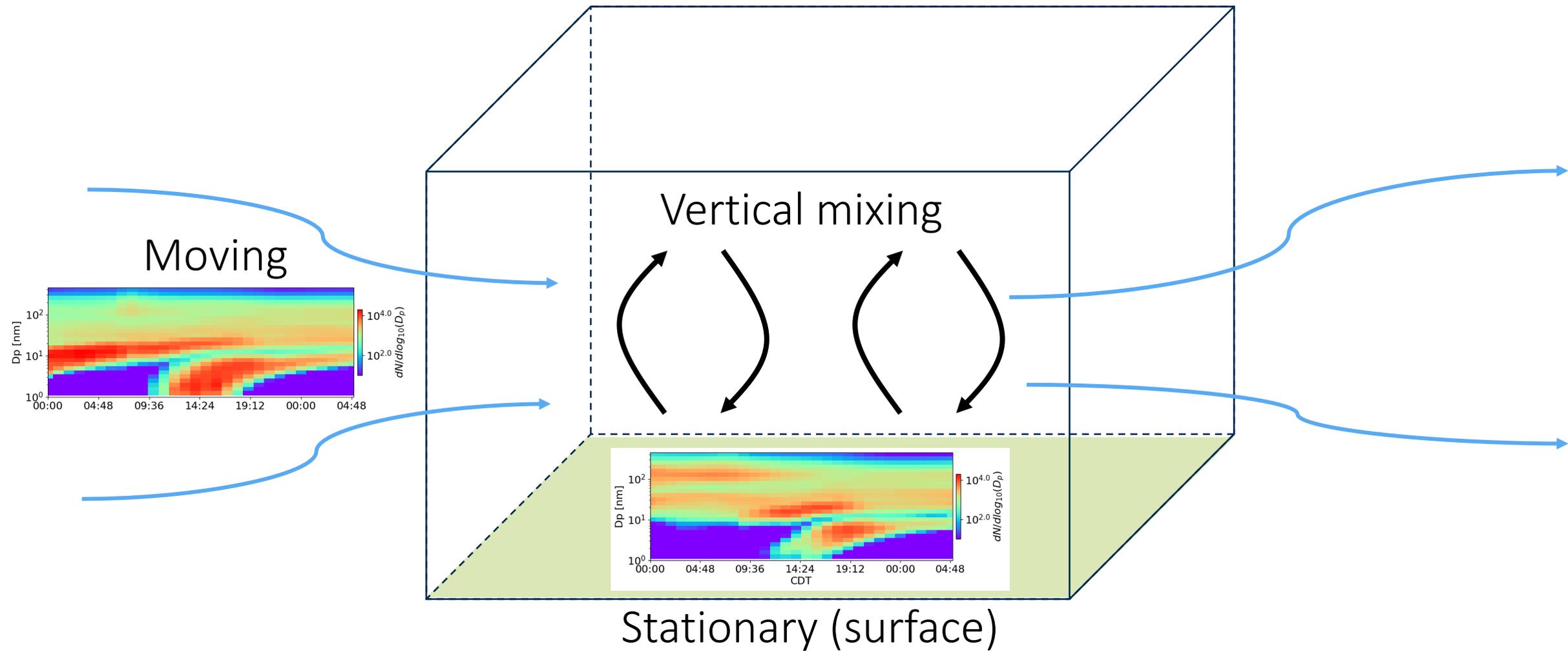
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Goals and Objectives

Determine differences in NPF events from stationary vs. moving perspectives



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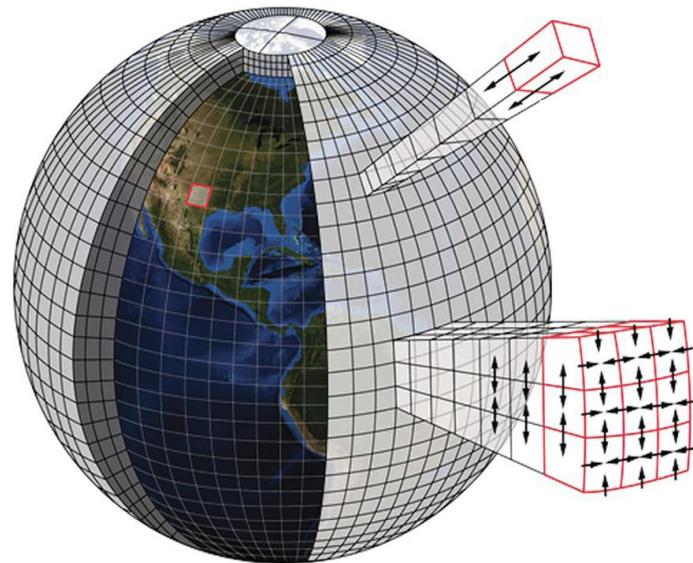
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Approach: modeling

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GEOS-Chem-TOMAS

- Reanalysis meteorology
- Tracks both number and mass of aerosol populations
- Represents emissions, deposition, condensation, coagulation, and nucleation



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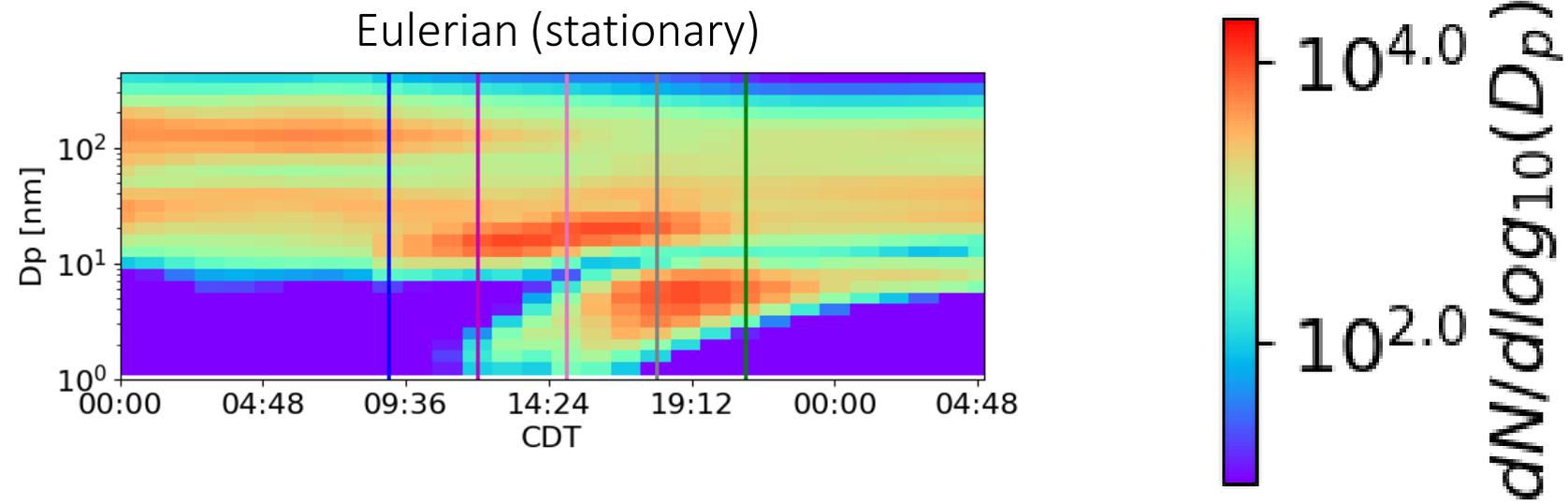
HYSPLIT

- Lagrangian parcel trajectory model
- Trajectories pass over stationary site every 3 hours
- Size distributions linearly interpolated between grid point centers



Results and Discussion

Example at SGP: Particles appearing grown are partially from NPF upwind



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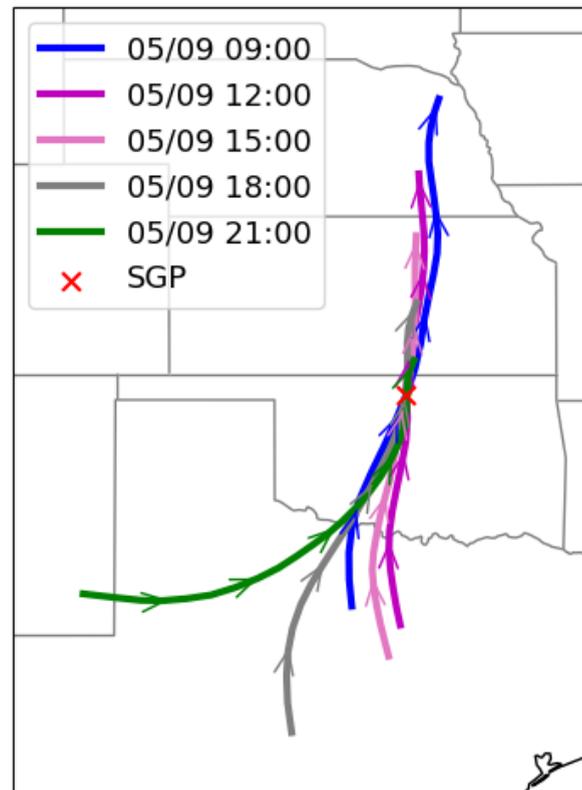
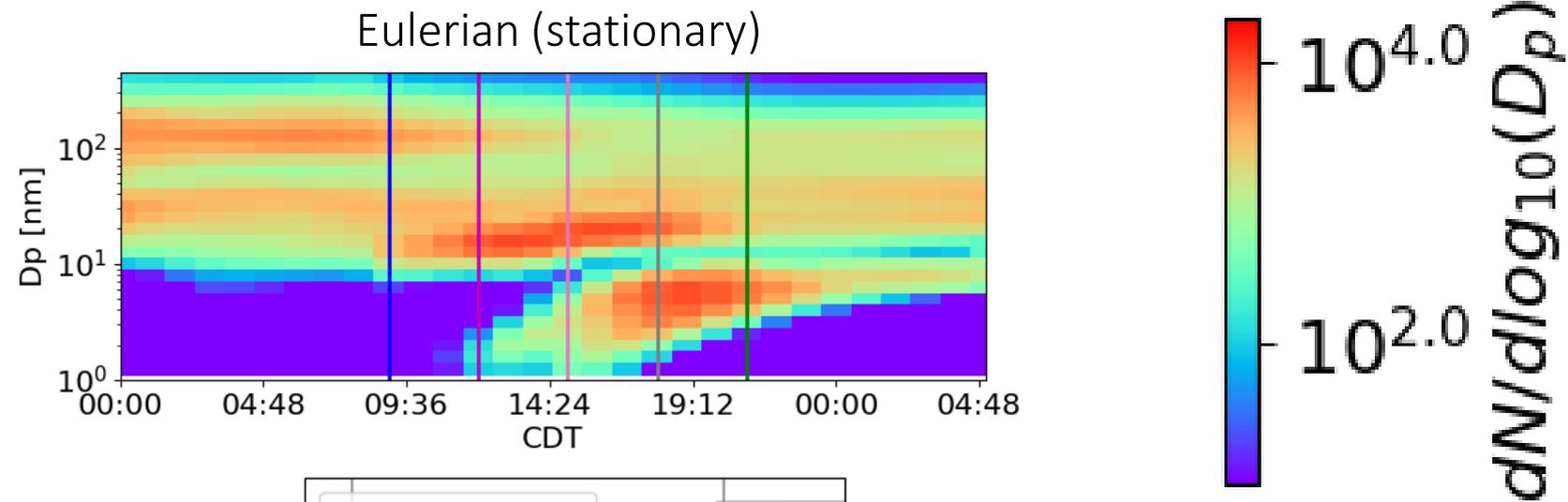
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Results and Discussion

Example at SGP: Particles appearing grown are partially from NPF upwind



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Results and Discussion

Example at SGP: Particles appearing grown are partially from NPF upwind

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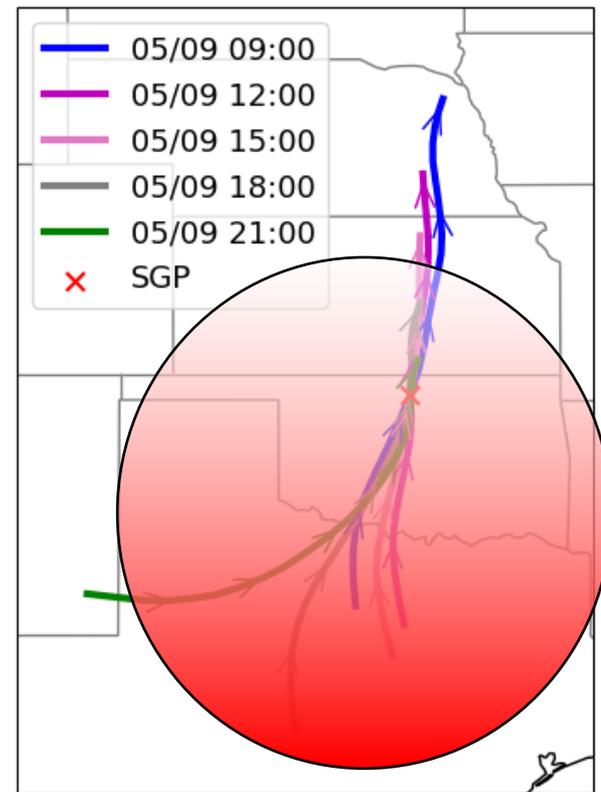
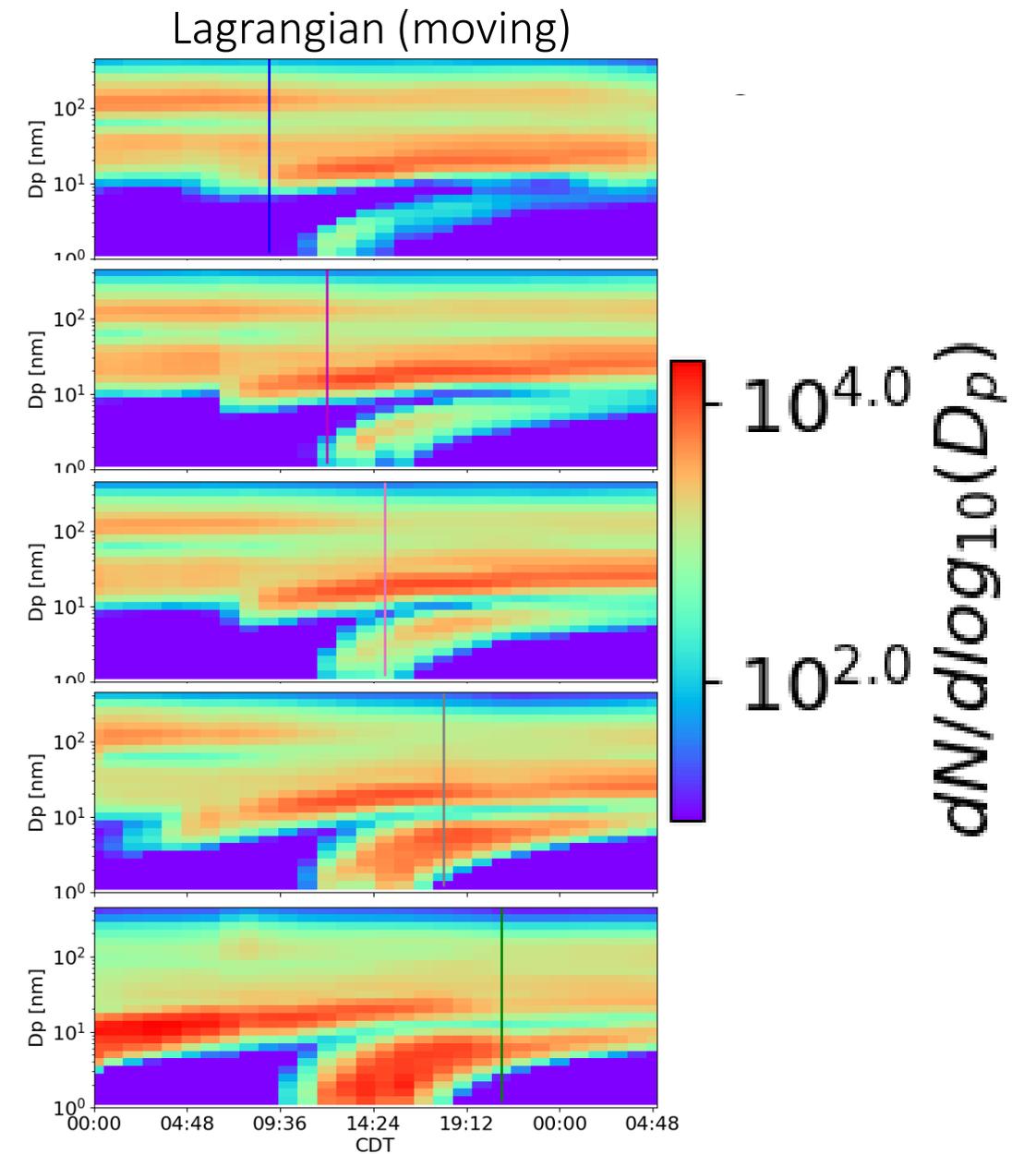
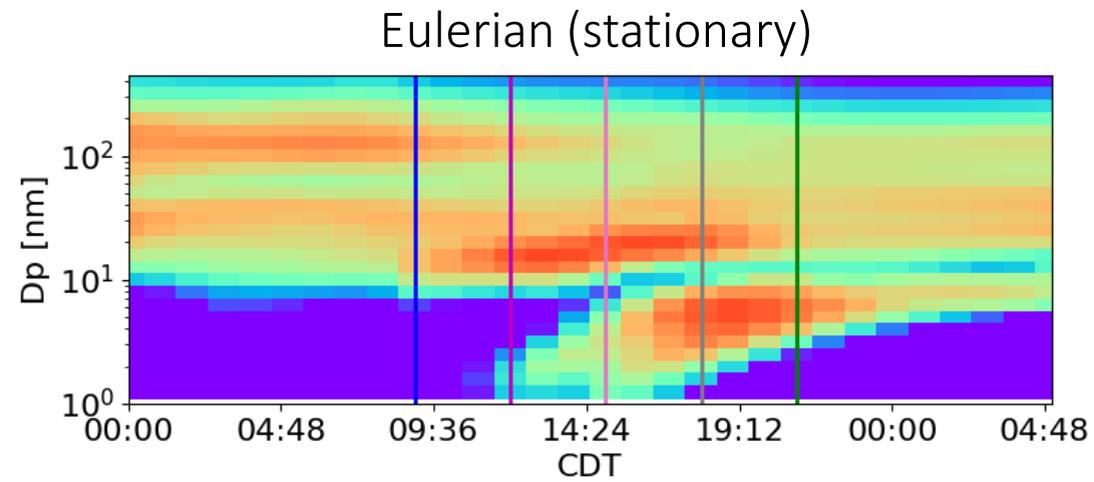
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Results and Discussion

Example at SGP: Particles appearing grown are partially from NPF upwind

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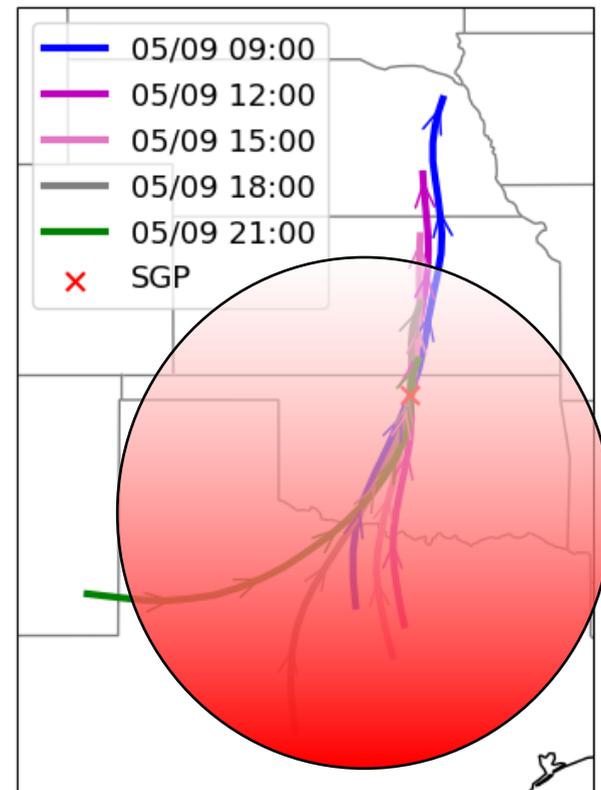
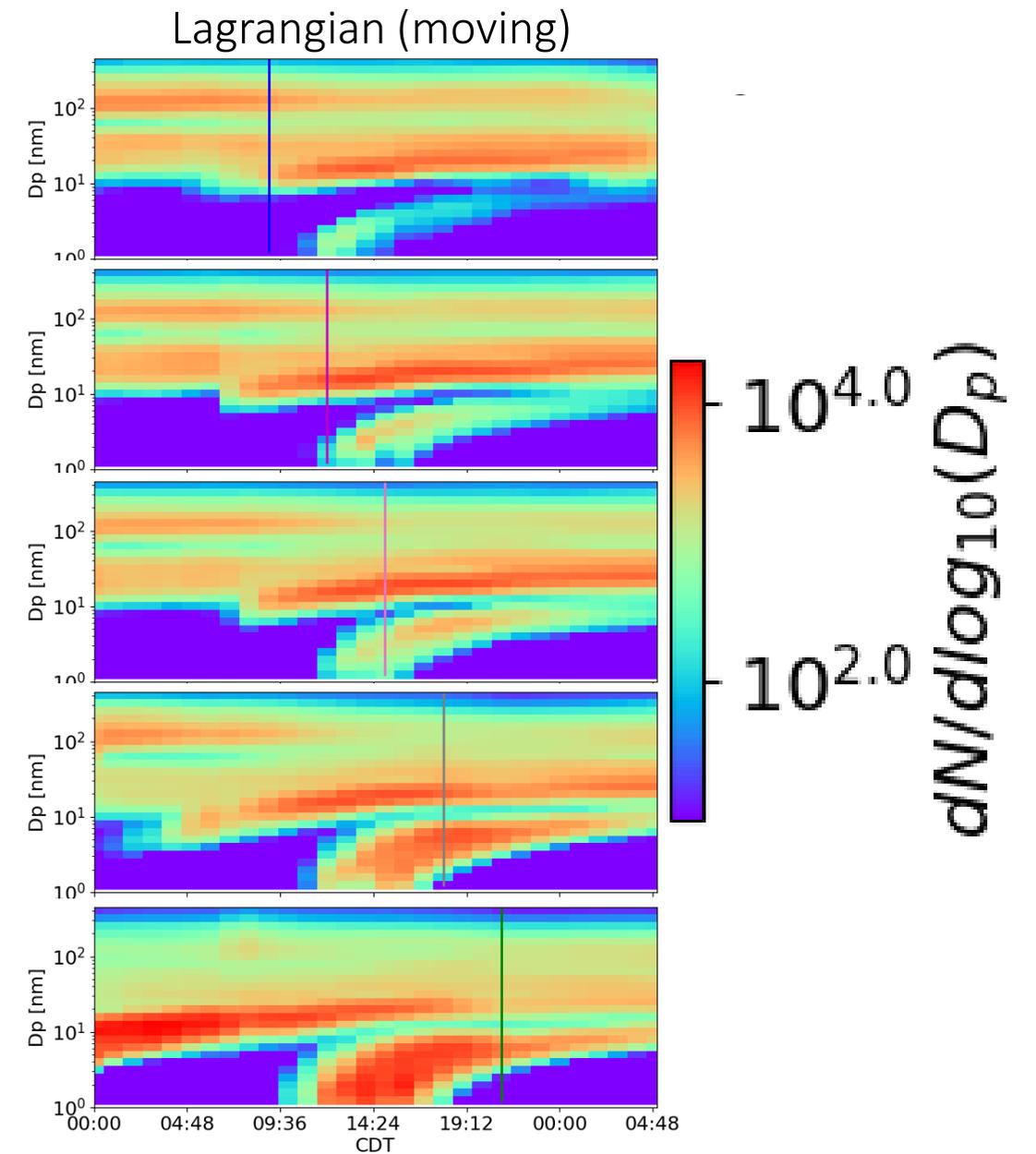
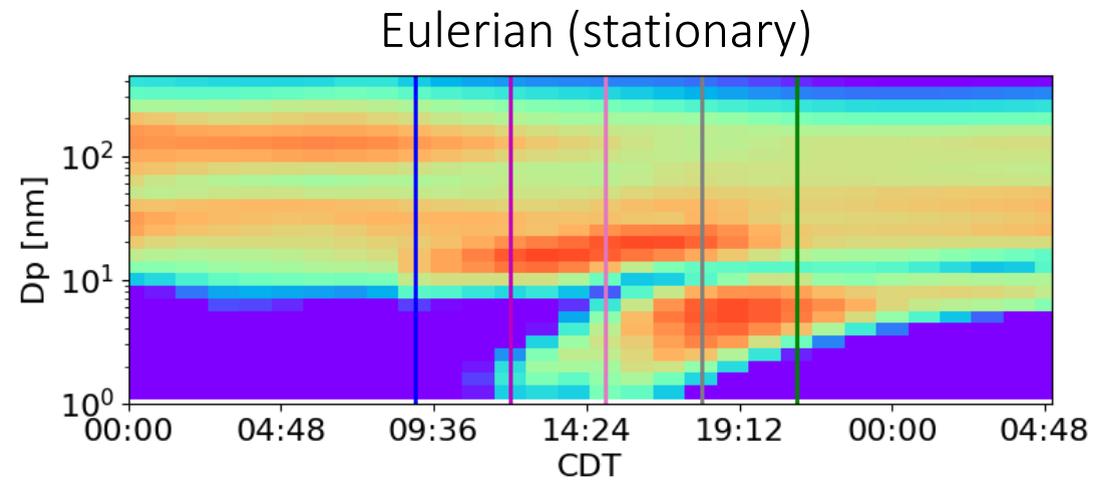
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Results and Discussion

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Same day at SGP: Vertical look

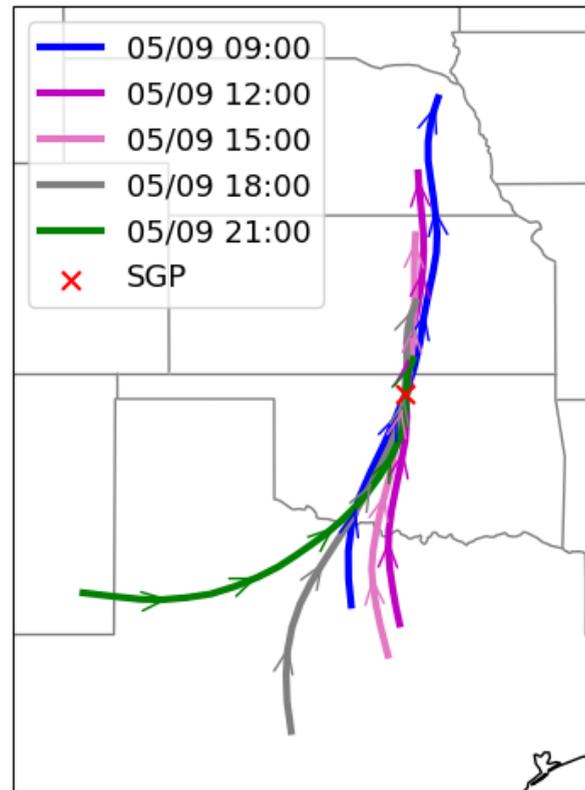
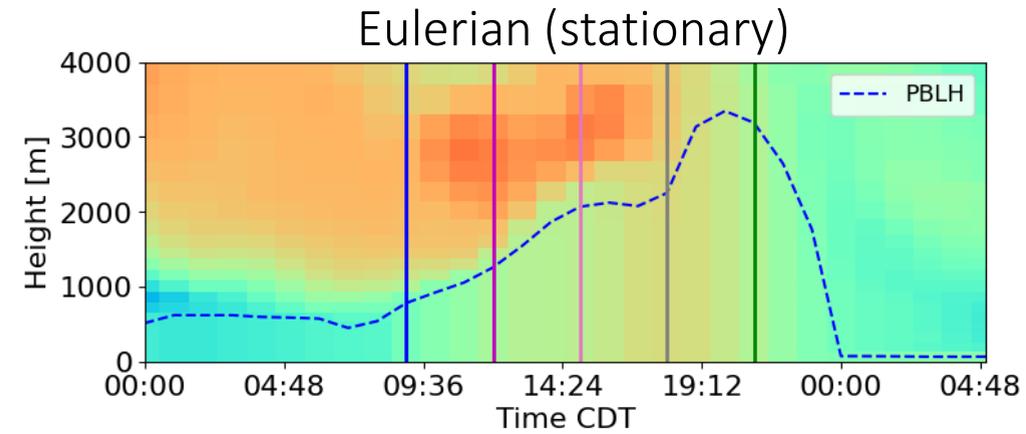
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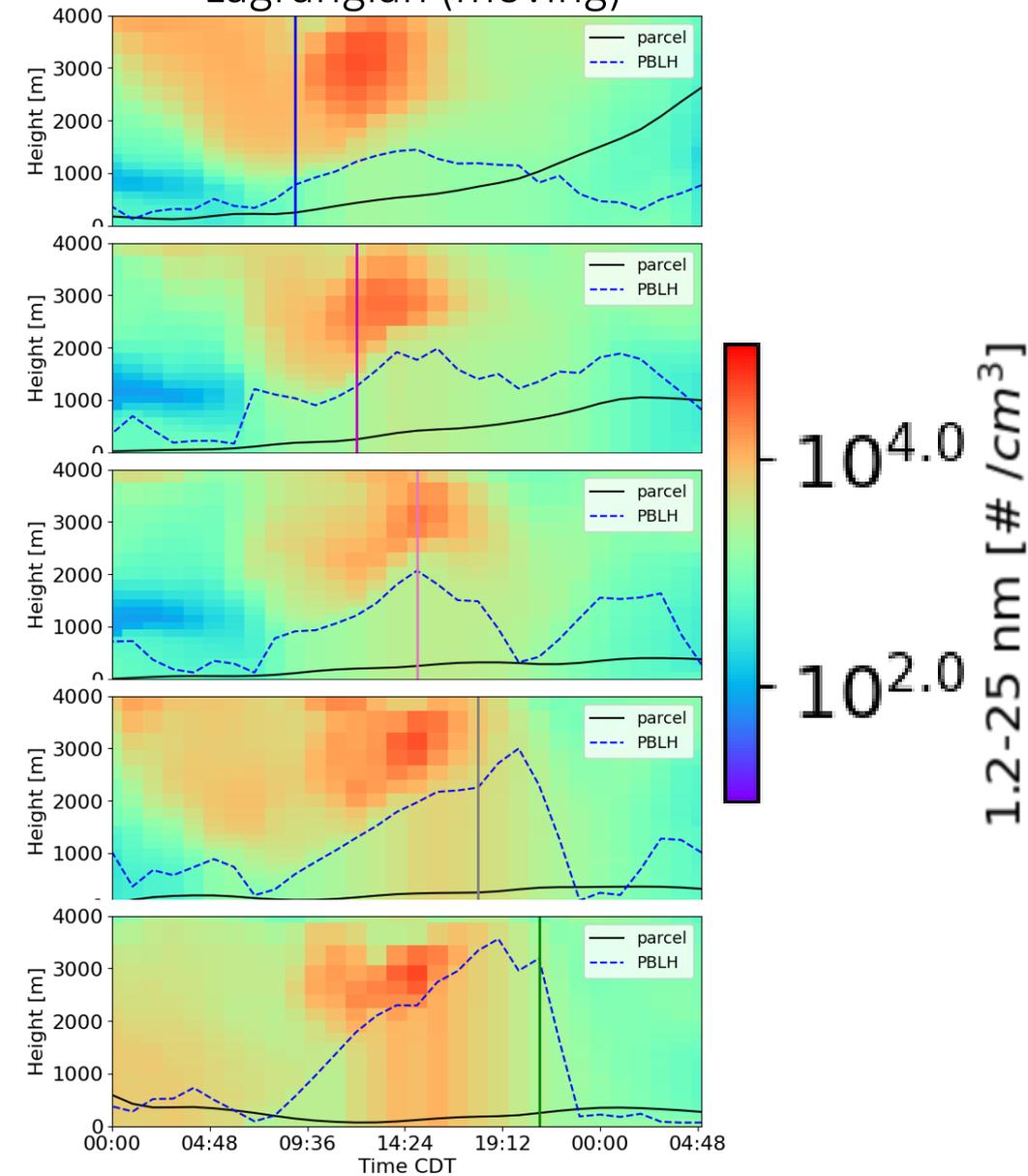
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Lagrangian (moving)



Summary, References, and Acknowledgements

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Size distributions from a fixed site often may not tell the whole story

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Particles appearing grown can be from different air-mass origins

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“Apple” NPF events can be from nucleated particles advecting away

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Further analysis will help constrain and understand underlying processes

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Extras



Results and Discussion

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“Apple” type NPF events are likely local NPF advecting away

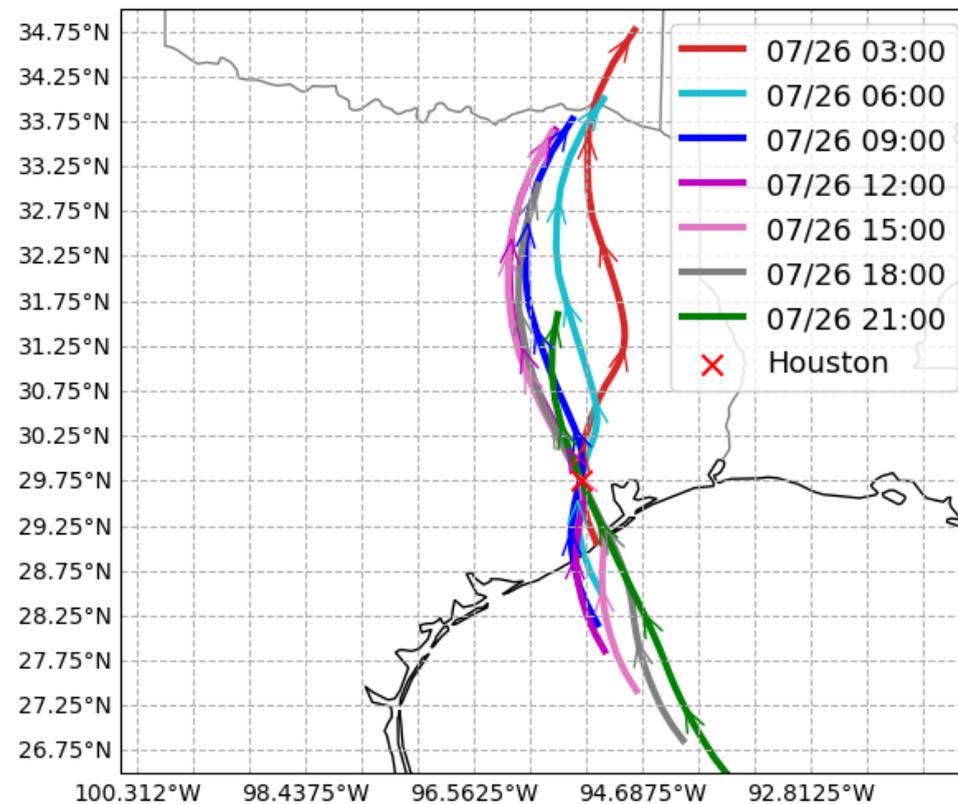
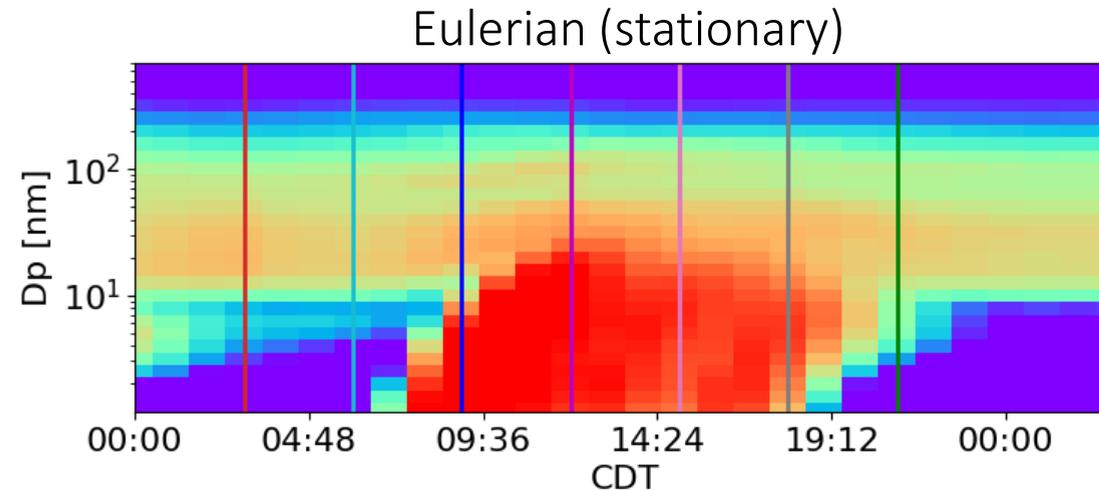
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Lagrangian (moving)

