

# Workshop on Urban Scale Processes and their Representation in High Spatial Resolution Earth System Models

Argonne National Laboratory  
9700 S. Cass Avenue, Lemont, IL 60439  
Building 446 Auditorium  
Breakout rooms in building 435, 436 & 434

<b>Wednesday, May 22, 2019</b>	
<b>ESMs and Urban Representation: Needs and Challenges</b>	
08:30-09:00	<b>Registration</b> Light continental breakfast
09:00-09:30	Welcome Scope of the workshop; (Don Wuebbles (University of Illinois) Rao Kotamarthi (Argonne) – Logistics
09:30-10:00	Presentation: Urban treatment in ESMs: current capabilities and gaps Speaker: Elena Shevliakova (NOAA) Address: Why is urban representation in an ESM important? What is known? What is important to represent in EMSs – what is included now and what is not included? How does this picture change as ESMs go to higher resolution?
10:00-10:30	Presentation: Current capabilities and gaps in Urban modelling Speaker: Fei Chen (NCAR) Address state-of-the-art and where urban modelling needs to go
10:30-10:50	Break
10:50-12:00	Panel Discussion: Federal Agency and International Perspectives (Discussant: Don Wuebbles) Panel: Corrine Hartin (DOE), Robb Randall (DOD), NASA (Ken Jucks), NOAA (Jin Huang), WMO (Alexander Baklanov) – 5 minutes presentation by each of the panellists followed by discussion
12:00-01:00	Lunch – Box lunches provided to all participants  Working Lunch: Emerging Computational Platforms for HPC Speaker: Katharine Riley, Argonne (Rao Kotamarthi to introduce)
01:00-01:15	Introduction to Breakout Series 1 (Rao Kotamarthi)  3 Breakouts (Groups 1, 2, 3)

01:15-02:45	<p><b>Group 1 – Challenges for ESMs for Modeling Urban Systems</b></p> <p>(Lead: Kate Calvin (PNNL))</p> <p>Address: Enhancing the capabilities of global Earth System models (ESMs) in representing the atmospheric dynamics and chemistry, unique aspects of the biosphere and landuse, and human dimensions in the urban environment. Why is urban representation important? What is known? What is important to represent in EMSs– what is Included now and what is not included? How does this picture change as ESMs go to higher resolution?</p>
	<p><b>Group 2 –Modeling of urban processes and their treatment in ESMs</b></p> <p>(Lead: Ashish Sharma (University of Illinois))</p> <p>Address: the considerable gaps in the current available urban scale modeling capabilities and the requirements for a set of reduced parameterization/subgrid models necessary for representing urban processes in ESMs. How should we prioritize the urban processes that should be represented in ESMs?</p>
	<p><b>Group 3 – First principles modeling at urban scales</b></p> <p>(Lead: Rob Jacob (Argonne))</p> <p>Address: In building urban scale models from first principle based fluid dynamic models (CFD models) these models currently lack many of the atmospheric physical process representation to capture the atmospheric dynamics. What can we do to expand these surrogate models to more accurately capture urban systems? Transport and diffusion processes in street canyons are poorly parametrized. How can we better predict the occurrence of different flow patterns (e.g., channelling, vortex flow) as a function of ambient wind conditions? How can slope (upslope and downslope) flows in an urban environment improve our understanding for air quality, visibility, and biochemical hazards?</p>
02:45-03:10	Break
03:10-04:30	<p>Talk on the need for a hierarchy of urban models</p> <p>Speaker: Alberto Martilli (CIEMAT Madrid) -30 minutes</p> <p>Group discussion for 50 minutes led by Luis Bettencourt (University of Chicago).</p> <p>There is a need for a hierarchy of models than span the time and spatial scales for representing urban microclimates. The CFD scale models will be expensive for performing simulations over climate time scales as standalone models or as sub-models within an ESM. Have regional scale models (WRF-Urban) been adequately tested and/or what is needed to do so? How can we couple the different types of urban models to establish a robust, yet computationally efficient model of urban climate? How can future exascale computational platforms be leveraged?</p>

04:30-05:00	Workshop summary: Urban scale models and observations Speaker: Beth Drewniak (Argonne)
05:00-05:30	Daily summary, feedback and discussion – led by Beth Drewniak (Argonne) Note: Breakout summaries to be prepared overnight
06:00-07:30	Reception at Argonne Guest House
<b>Thursday, May 23, 2019</b>	
08:30-09:00	Light continental breakfast
09:00-09:15	Setting up the 2 <sup>nd</sup> day (Lead: Rao Kotamarthi)
09:15-10:20	Summaries from Breakout Groups 1, 2 and 3
10:20-10:45	Break
10:45-12:15	Presentation: Observations in Urban Environs such as The Array of Things Talk by Charlie Catlett – 30 minutes Group discussion for 60 minutes led by Charlie Catlett (Argonne) and Petra Klein (Univ. Oklahoma) and Pavlos Kollias (SUNY Stonybrook) on new sensing technologies and their use in urban model development
12:15-01:15	Lunch – Box lunches provided to all participants (two short talks 15 minutes each) 12:30-12:45: The IITM Earth System Model for studying climate change and the Indian Monsoon: R. Krishnan, Indian Institute of Tropical Meteorology, Pune, India 12:45-01:00: Urban observations and modelling in eastern China: Current results and Challenges: Ning Zhang, Nanjing University, China
1:15-02:45	Presentation: Satellite datasets for Urban Model development and Model Evaluation Speaker: Eric Kort (University of Michigan) – 30 minutes Group discussion for 60 minutes led Johannes Feddema (University of Victoria, Canada)
02:45-03:10	Break

03:10-04:40	<p>3 Breakouts (Groups 4, 5, and 6)</p> <p><b>Group 4</b> – Urban scale datasets including ecological and other datasets (besides land-use)</p> <p>(Lead: Dan Horton, Northwestern University)</p> <p>Address: There is no set of standard/accepted urban scale datasets that could be used to evaluate the high-end CFD models for acceptable performance in producing urban micro-climates. How do we build upon current urban research activities to collect and archive data for model validation? Are there nontraditional data sources that can also be used to build this dataset? Can we create an observational data testbed to test models?</p>
	<p><b>Group 5</b> – Emerging sensing technologies and their use</p> <p>(Lead: Mark Potosnak, DePaul University)</p> <p>Address: Emerging smart city sensing technologies and their possible use in model development. How can observational studies of urban regions be used to aid the modeling community? Generally, observational sites and sensors in cities are poorly placed and likely are non-representative of their neighborhoods. The development of dense cheap sensor networks provides an opportunity to bridge this gap. However, using these datasets for evaluating models or process-scale model development will be a challenge due to data quality and consistency issues. Is there a pathway for using these datasets for rigorous scientific model evaluation and model development? Does the concept of an Integrated Field Laboratory (based on the earlier workshop mentioned above) bridge the gap between the cheap/dense networked datasets and research quality data needs?</p>
	<p><b>Group 6</b> – The need for ultra-high-resolution land use datasets (Lead: Jason Ching, UNC)</p> <p>Address: For this we introduce and discuss the follow-on to NUDAPT, or WUDAPT (World urban Database and Access Portal Tool, a world community based Initiative currently underway that is (a) worldwide coverage, (b) generates urban canopy form, fabric and function data, (c) implemented via various methodologies and community collaborations and testbeds. We explore WUDAPT's infrastructure and implications for a suite of variety of 'Fit-for Purpose' ESM model applications, and other issues and implications</p>
04:40-5:10	<p>Presentation: Urban, energy, exascale Earth system modeling: a perspective from E3SM Kate Calvin, PNNL)</p>
05:10-5:30	<p>Daily summary, feedback and discussion – led by Don Wuebbles</p> <p>Note: Breakout summaries to be prepared overnight</p>

## Friday, May 24, 2019

08:30-09:00	Light continental breakfast
09:00-09:10	Setting up the 3 <sup>rd</sup> day (Lead: Beth Drewniak)
09:05-10:15	Summaries from Breakout Groups 4, 5 and 6
10:15-10:30	Break
10:00-11:30	<p>Panel discussion – Revisiting Urban in ESMs – How do we get to where we need to get to?</p> <p>Panel: Venkatachalam Ramaswamy (NOAA GFDL), Jean-Francois Lamarque (NCAR), Fei Chen (NCAR), Dev Niyogi (Purdue University); each will give a 7 minute talk followed by 60 minute discussion)</p> <p>(Discussant: Rao Kotamarthi)</p>
11:30-12:00	Next steps, writing assignments, etc. (Lead: Don Wuebbles)
12:00	Meeting Adjourned
12:00 – 3:00	<p>Write document immediately afterward (all organizers, discussant leads and breakout leads) write at least a few paragraphs on their topic area; stay afterwards if needed to write up a section for the report – provide to Don Wuebbles)</p> <p>Leave by 3 pm</p>