HIDALGO2
CENTRE OF EXCELLENCE

Training 3

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Gwennolé Chappron, Philippe Pinçon,
Christophe Prud'homme, Vincent Chabannes, Javier Cladellas, Juliette Antonczak

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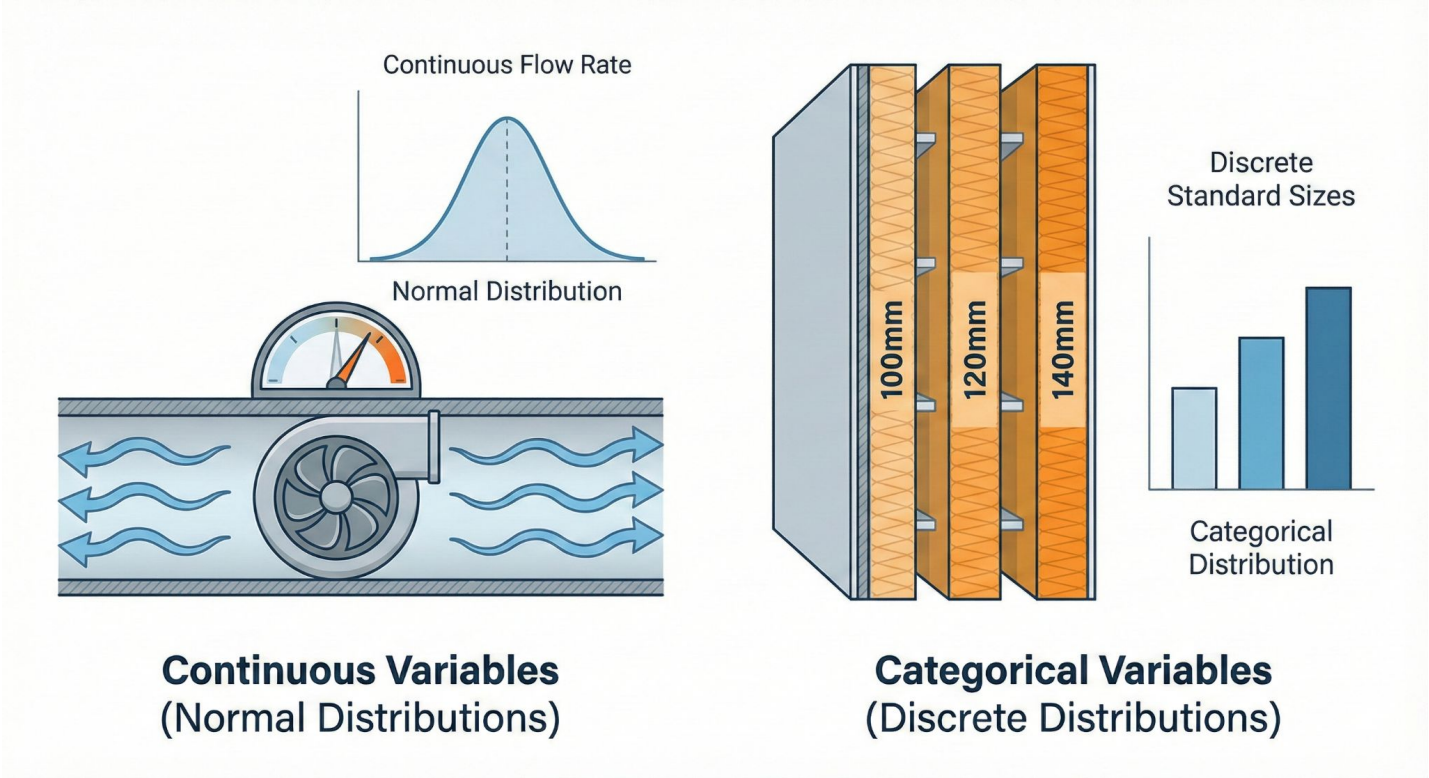
Summary Day 2: Application and Case Studies with Ktirio

Time	Activity
09:00 - 09:30	**Recap and Q&A from Day 2**
09:30 - 10:45	**Running Ktirio Simulation at District-Scale using HPC. Case study with simulation launch for a city district.**
10:45 - 11:00	☕ *Coffee Break*
11:00 - 12:00	**Ensemble runs analyzing results and open discussion on real-world applications.**
12:00 - 12:30	**Closing remark**

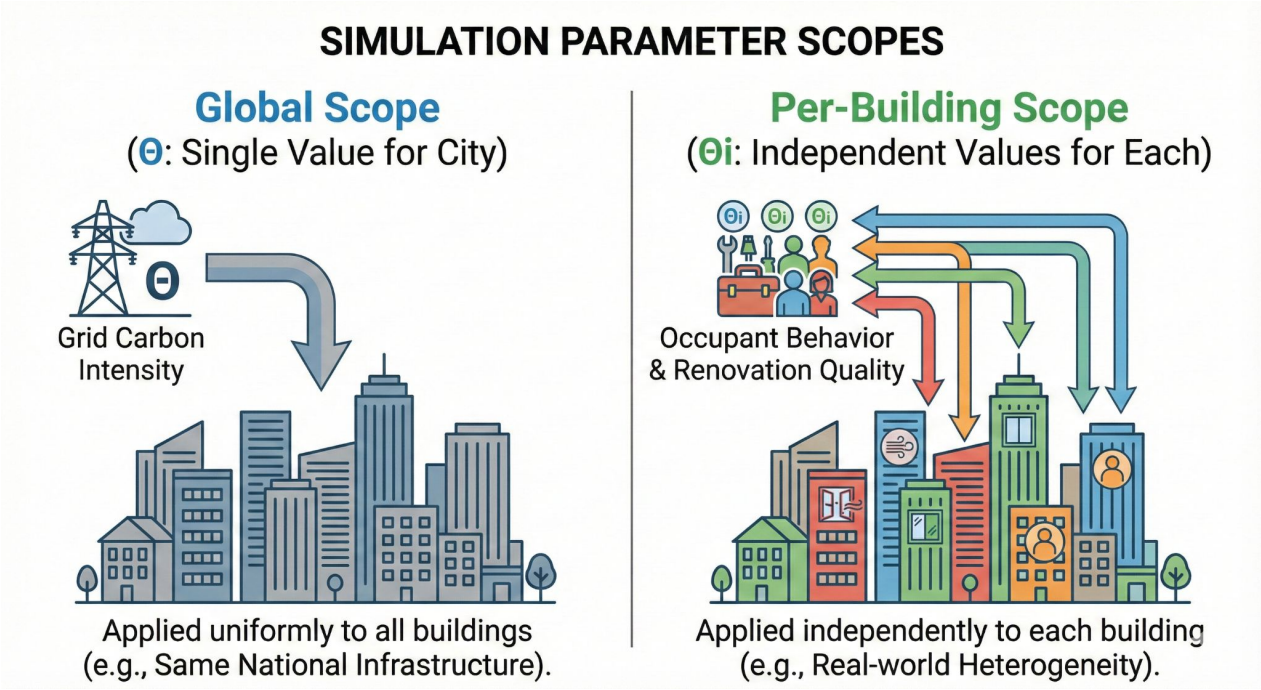
Presentation of Ensemble simulation

Modeling Uncertainty (Continuous vs. Discrete Distributions)



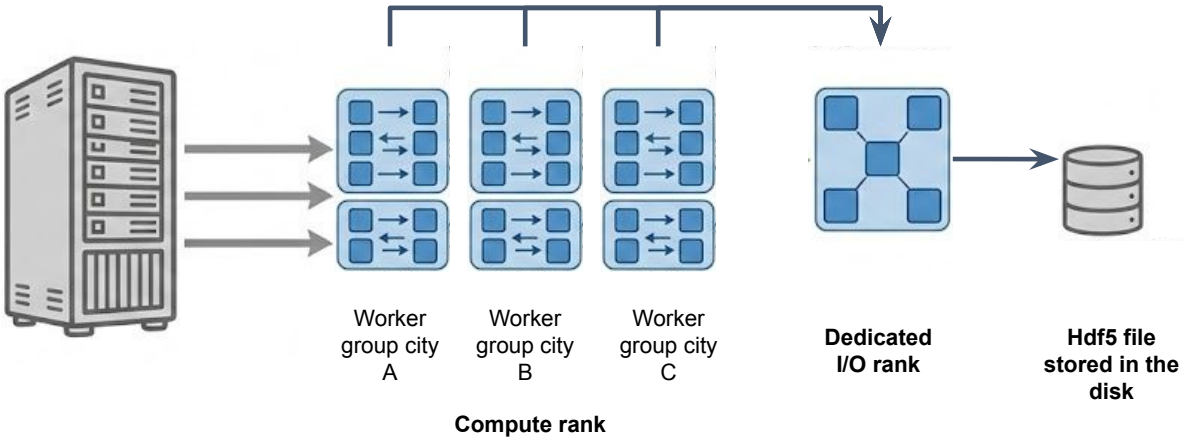
Distribution Strategies (Global vs. Per-Building)

Parameter application follows two distinct scopes. Global Scope applies a single random value across the entire city for shared infrastructure variables, such as grid carbon intensity. In contrast, Per-Building Scope assigns independent values to each structure, capturing the inherent heterogeneity of the stock through factors like occupant behavior and renovation quality.



HPC Architecture & Parallelism

To orchestrate large-scale simulations, we leverage the MPI standard to structure computation into hierarchical communicators, achieving near-linear scalability by assigning worker groups to specific city samples. To circumvent critical I/O bottlenecks, we utilize dedicated I/O ranks that aggregate data via high-speed networks before writing to disk, preventing file system contention. Simultaneously, we optimize computational resources by employing Welford's algorithm for on-the-fly statistical calculation without memory saturation, and Common Random Numbers (CRN) to synchronize scenarios and reduce background noise.



Multi-Scale Data Representation & Aggregation Strategies

To transform raw simulation output into actionable insights, we utilize a Multi-Scale Representation system that performs temporal and spatial aggregation across three levels: Building, District, and City. At the building level, temporal compression reduces hourly data to daily statistics for operational analysis, while district and city levels employ spatial binning and global summation to guide urban planning and climate policy. This hierarchical aggregation is a technical necessity; retaining full raw data for large-scale simulations would hit a "storage wall," making on-the-fly reduction essential to prevent I/O contention and manage petabytes of potential data.