IEA Task 57

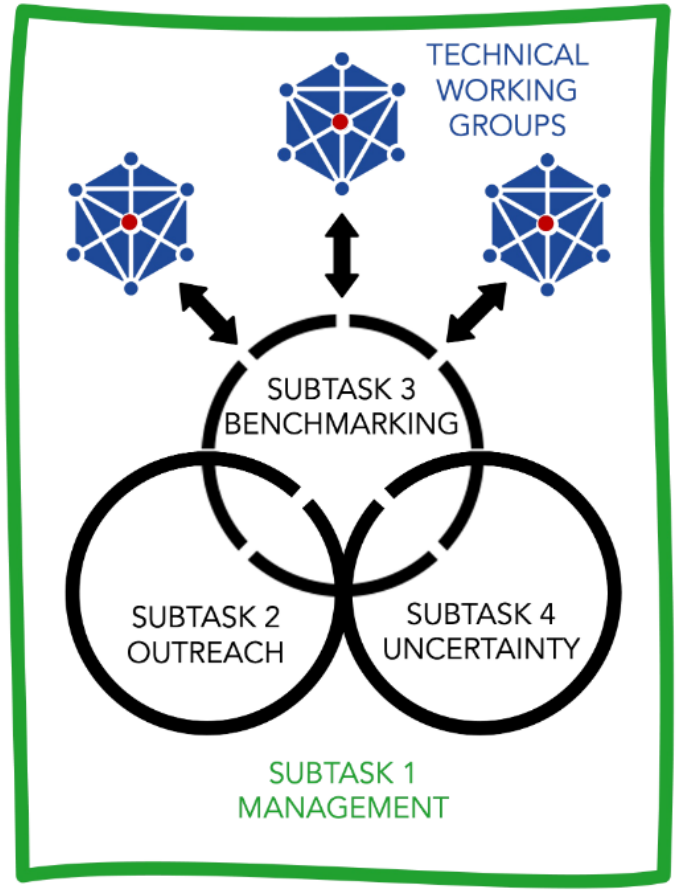
Joint Assessment of Wind Models (JAM)

JAM overview

- **Joint international collaboration:** bringing together experimentalists, computational modelers, and industry experts working with wind energy
- **Aim:** Align and integrate parallel efforts in assessing the accuracy and reliability of models used in wind energy systems, from turbine inflow to full wind farm operations
- **Duration:** February 2024 – January 2027
- **Participating countries**:
- Task 57 – JAM | IEA Wind TCP

Objectives

- **Increase and accelerate research** yield through coordination and collaboration of validation projects
- **Produce, disseminate, and execute benchmarks** that are long-lived democratic, and standardized
- **Maximize benchmark value** with stakeholder input before and after execution
- **Reduce uncertainty in model assessment** through emphasis on inflow and uncertainty quantification
- **Recommend best practices** on model use across application spaces

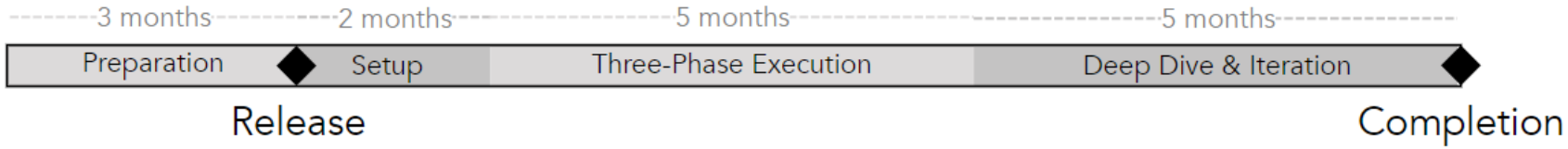


Adopted from JAM VIRTUAL KICKOFF

Benchmarking

JAM builds upon IEA Task 31 WakeBench (2011-2021) primarily by extending the scope and ambition of the benchmark cases:

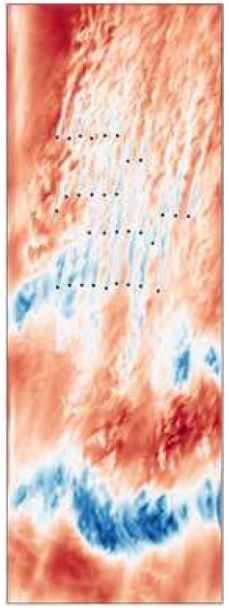
- **More comprehensive experimental data:** concurrent inflow, wake and performance data at full scale
- **Few high-quality benchmarks:** many participants, iterative execution
- **Benchmark standardization:** universal blueprint, stakeholder-driven metrics
- **Focus on inflow:** Lesson learned from previous work
- **Model assessment deep dives:** workshops with modelers to pin-point model issues

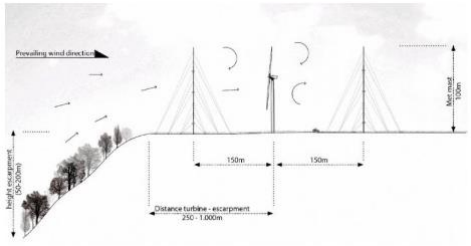


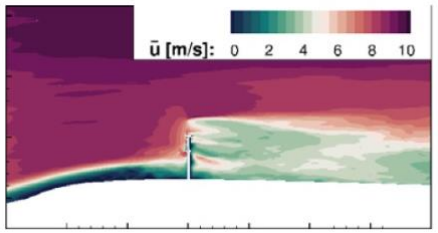
Content from JAM In-Person Kickoff Meeting

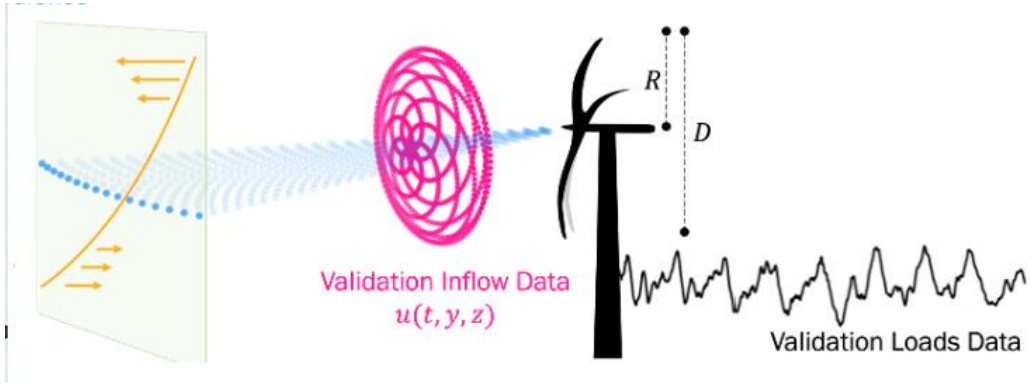
Benchmarks

- Spring 2024 - AWAKEN (diurnal cycle, two land-based wind plants)
- Fall 2024 - RAAW (turbulent inflow generation, land-based, flat terrain)
- Spring 2025 – WINSENT (complex terrain, two turbines)
- Spring 2026 - WiValdi (near shore, two turbines)

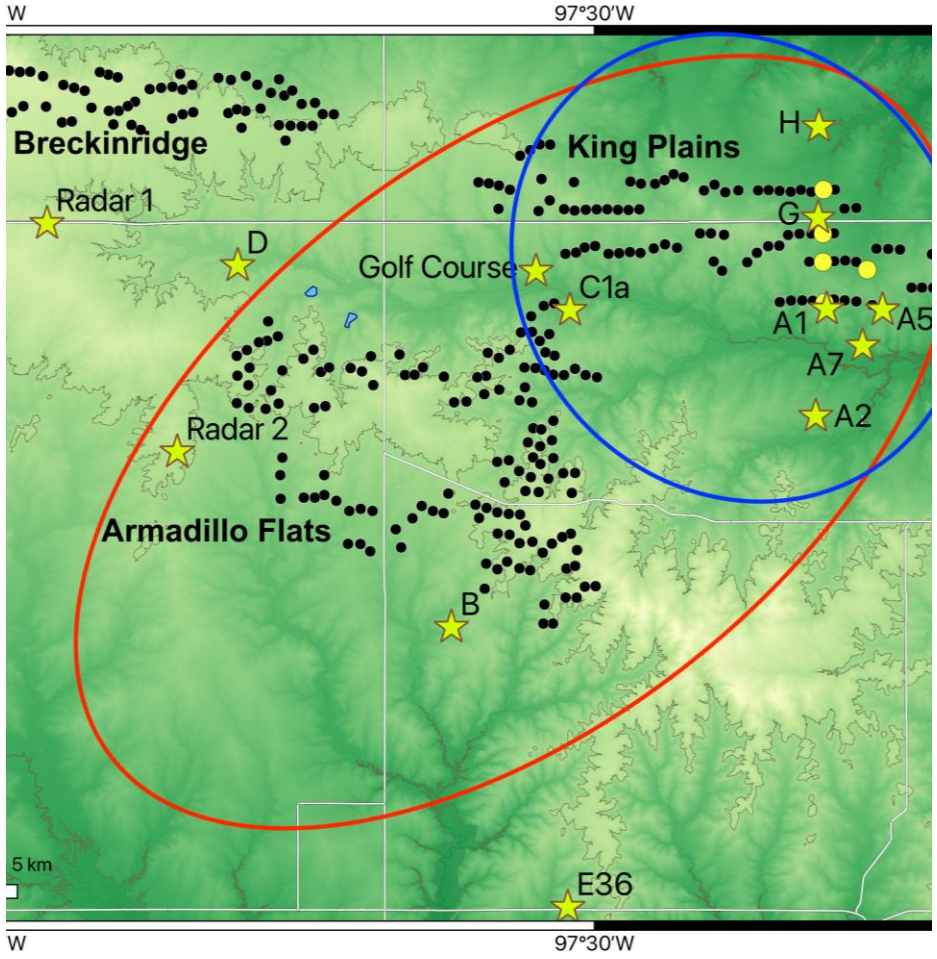








AWAKEN: The American WAKE ExperimeNt



Multi-institutional field-campaign on wind farm–atmosphere interactions:

- Northern Oklahoma, U.S.
- 2022-2024
- 13 ground sites with numerous instruments (met masts, lidars, sonics, radars ..)
- 5 instrumented wind turbines (yellow circles)
- Multiple wind farms
- Leverage existing observational facilities (Southern Great Plains) operated by ARM

AWAKEN: A benchmark in 3 phases

Phase 1 Kick-off
28 May 2024 → Phase 2 Kick-off
12 Nov 2024 → Phase 3 Kick-off
Jan 2025

PHASE 1: THE BASELINE

Summer 2024

- The benchmark team releases LIMITED inflow observations at AWAKEN for 24 August 2023 and NREL's open-source wind turbine model to the benchmark participants.
- The participants leverage the limited inputs and their own best practices to simulate the wakes from the King Plains and Armadillo Flats wind plants.
- The benchmark team compares the simulated results with the observed values.

PHASE 2: MODEL IMPROVEMENT WITH INFLOW OBSERVATIONS

Fall 2024

- The team releases ALL the inflow observations and SOME SCADA to the benchmark participants.
- The participants leverage the additional inputs and what learnt in Phase 1 to simulate the wakes from the King Plains and Armadillo Flats wind plants.
- The benchmark team compares the simulated results with the observed values.

PHASE 3: MODEL IMPROVEMENT WITH INFLOW AND WAKE OBSERVATIONS

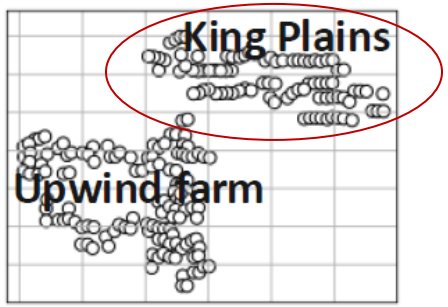
Winter 2024/25

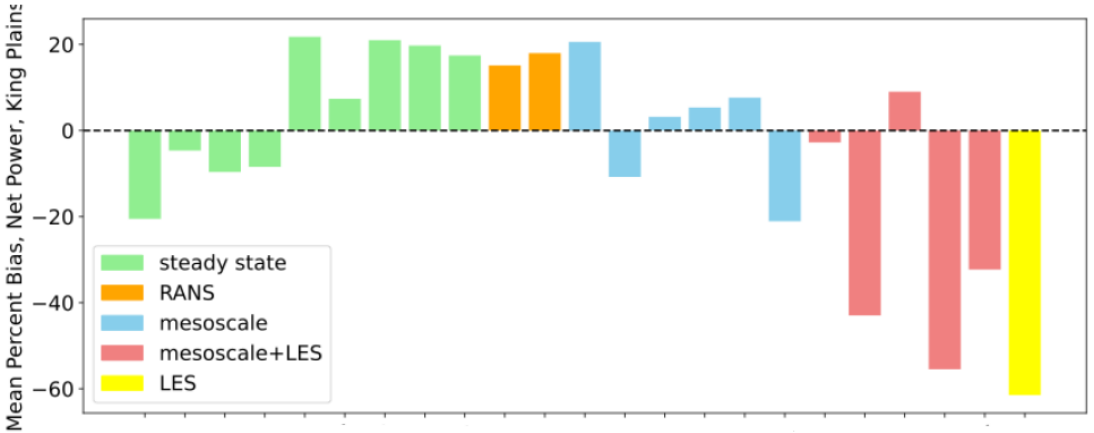
- The team releases ALL the wake observations and ALL SCADA to the benchmark participants.
- The participants leverage the additional inputs and what learnt in Phase 2 to simulate the wakes from the King Plains and Armadillo Flats wind plants.
- The benchmark team compares the simulated results with the observed values and summarizes results in a journal article.

AWAKEN: Selected results from phase 1

Simulation of results for August 24 2023

Power bias: $\frac{P_{simulated} - P_{observed}}{P_{observed}}$





Bias in predicted power of King Plains

AWAKEN: Selected results from phase 1

Simulation results for August 24 2023

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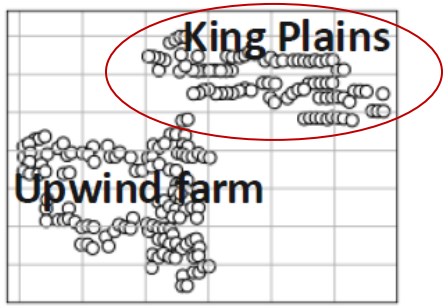

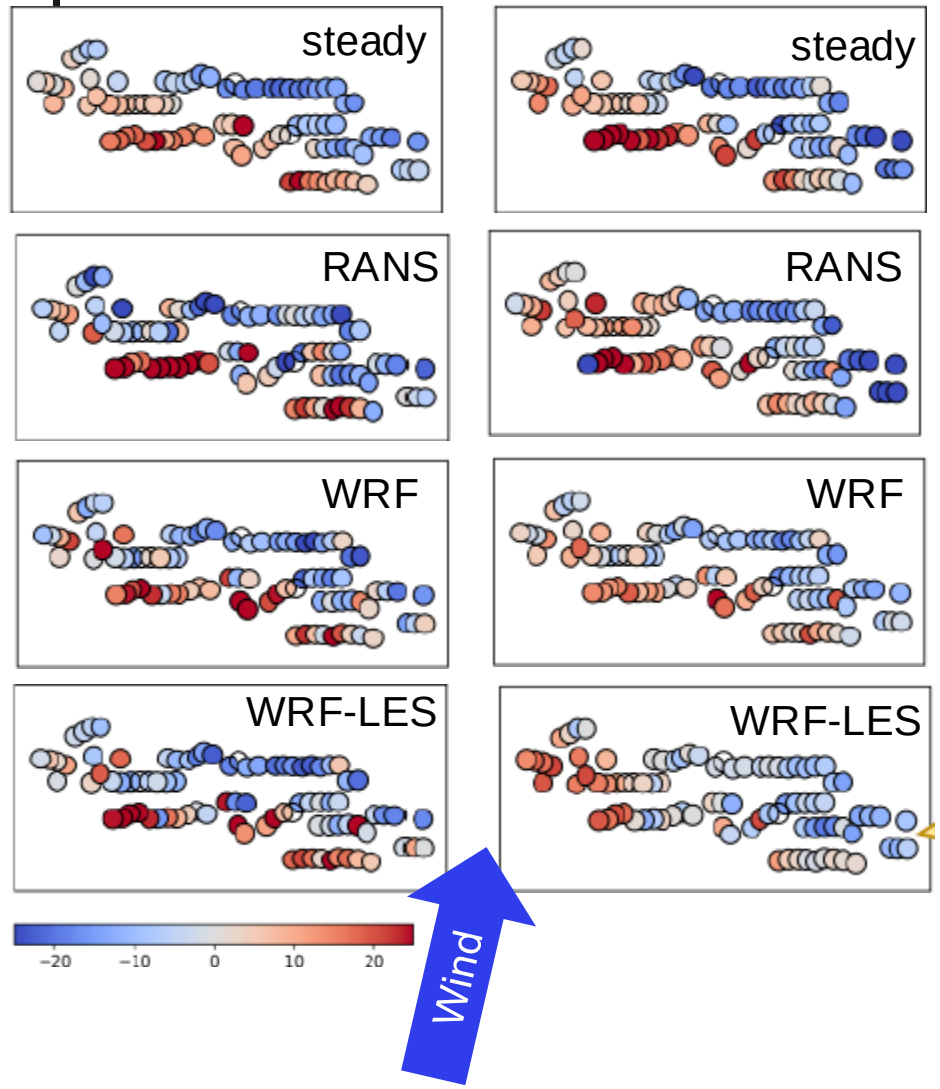

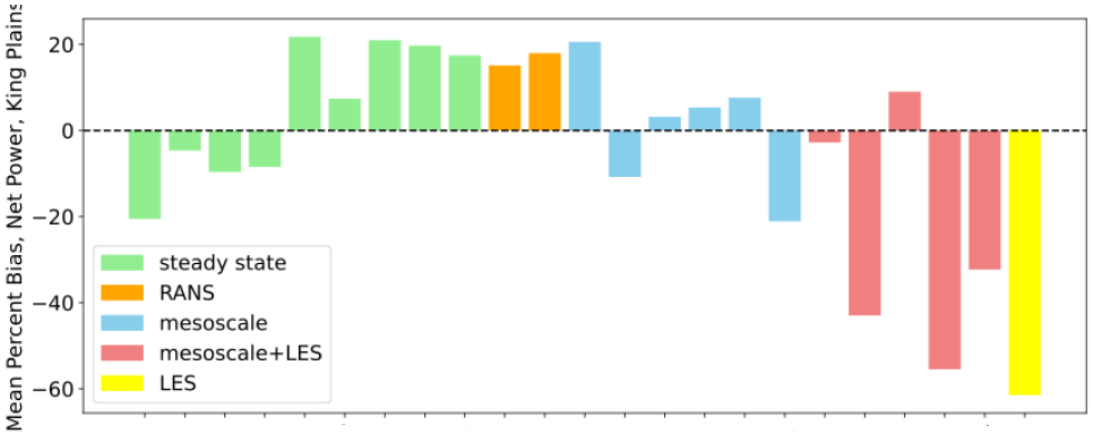

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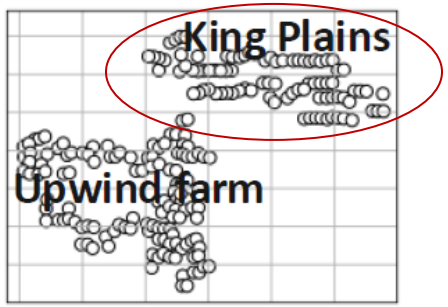
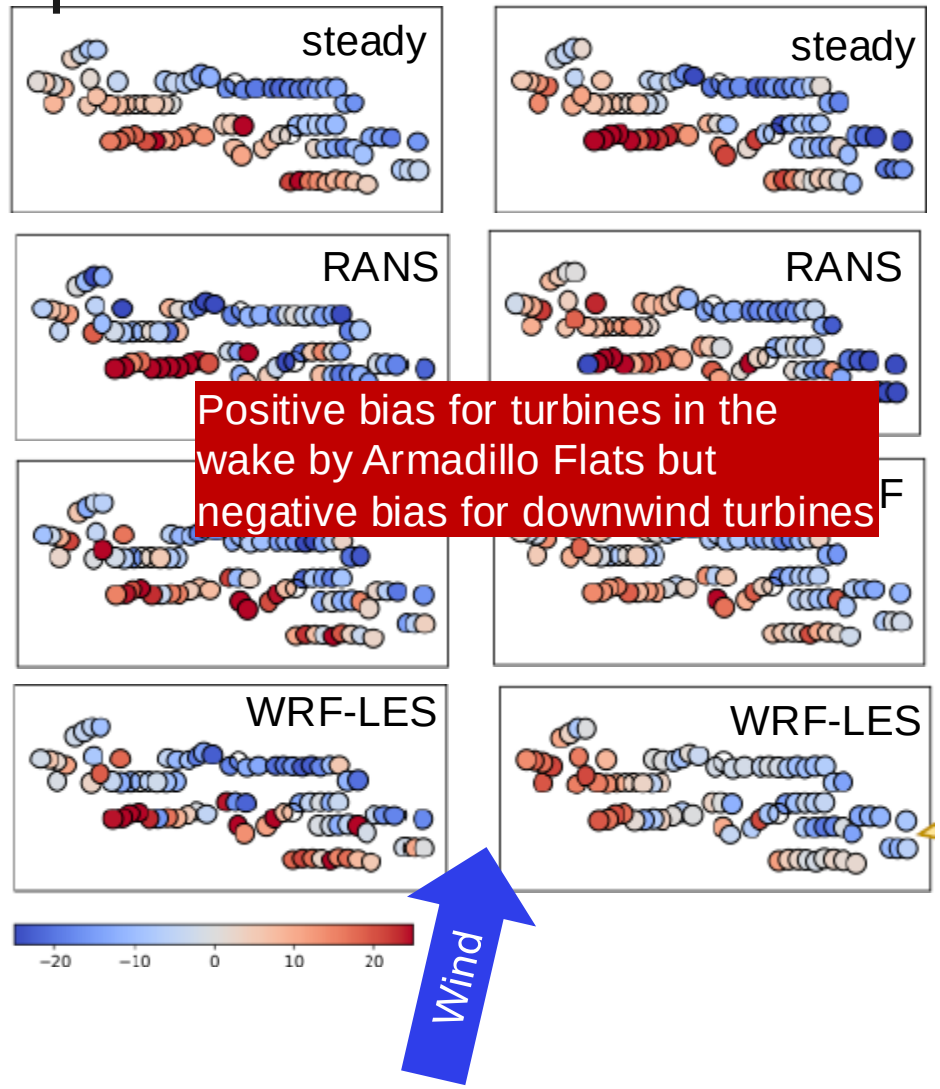
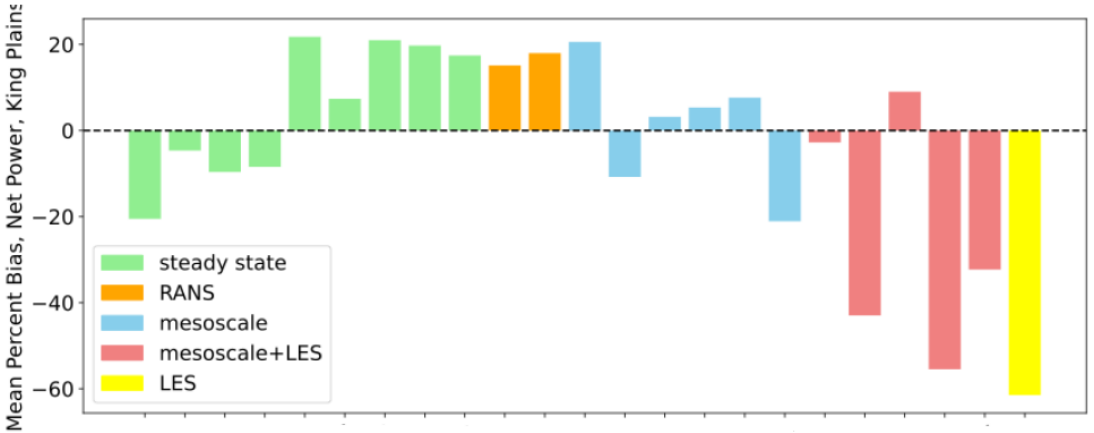




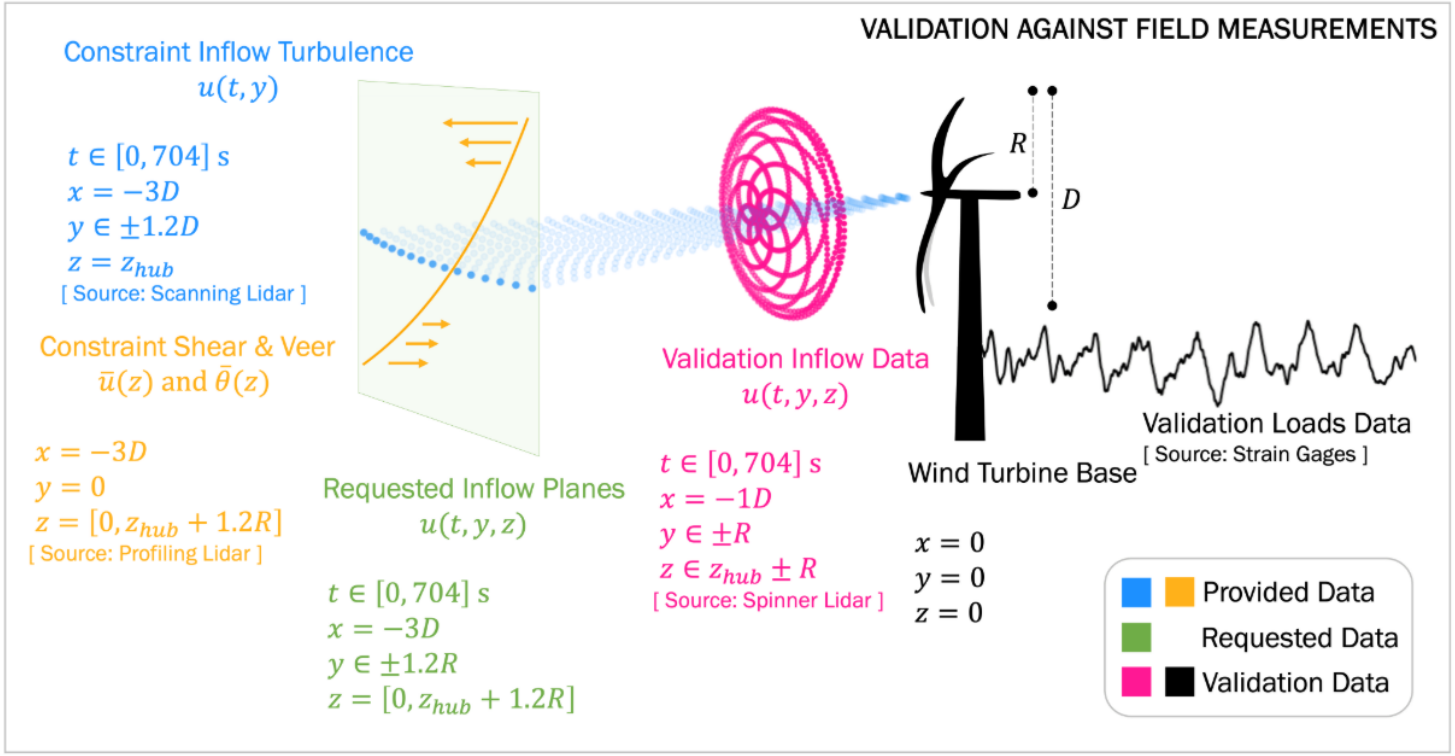
Positive bias for turbines in the wake by Armadillo Flats but negative bias for downwind turbines



Bias in predicted power of King Plains

RAAW: Rotor inflow

- Validate methods for simulating turbulent inflows to aeroelastic wind turbine simulations.
- Quantify the effect of inflow accuracy on simulated structural loads
- Models extrapolate above and below the constraint.
- Duration: October 2024-April 2025
- [Rotor Inflow Benchmarks — rotor inflow benchmark documentation]



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