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(LS)²D:
Python package for real-life large-eddy simulations

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Motivation

- Last ±decade: shift LES from idealised/academic → realistic/real-life cases
  - Validation parameterisations (*land surface, radiation, microphysics,* …) with observations
  - Study of atmospheric processes (*e.g. convection, cloud-radiation interactions,* …)
- LES as real-life weather testbed not new *(e.g. Neggers et al., 2012, BAMS)*, but:
  - Often based on regional models → limited geographical extend + data not openly available
  - Closed source methods/code → limits reproducibility / reusability

(LS)²D: **L**arge-eddy simulation and **S**ingle column model - **L**arge **S**cale **D**ynamics

Open source Python package to generate real-life LES experiments

Based on ERA5: global, ±70 year archive (*NRT*), accessible through CDS

Simplified (LS)²D example

```
import ls2d

settings = {
    'central_lat' : 51.97,
    'central_lon' : 4.93,
    'start_date'  : datetime(year=2016, month=8, day=15, hour=6),
    'end_date'    : datetime(year=2016, month=8, day=15, hour=20)}

era = ls2d.download_era5(settings)
era.calculate_forcings(n_av=1, method='2nd')
les_input = era.get_les_input(z_array_les)
```

- `les_input` = dictionary with required LES input:
  - Initial conditions *(atmosphere and land-surface)* and radiation background profiles
  - Large-scale advective tendencies, subsidence velocity, geostrophic winds speeds, …
- Final step: write in specific input format of your LES code

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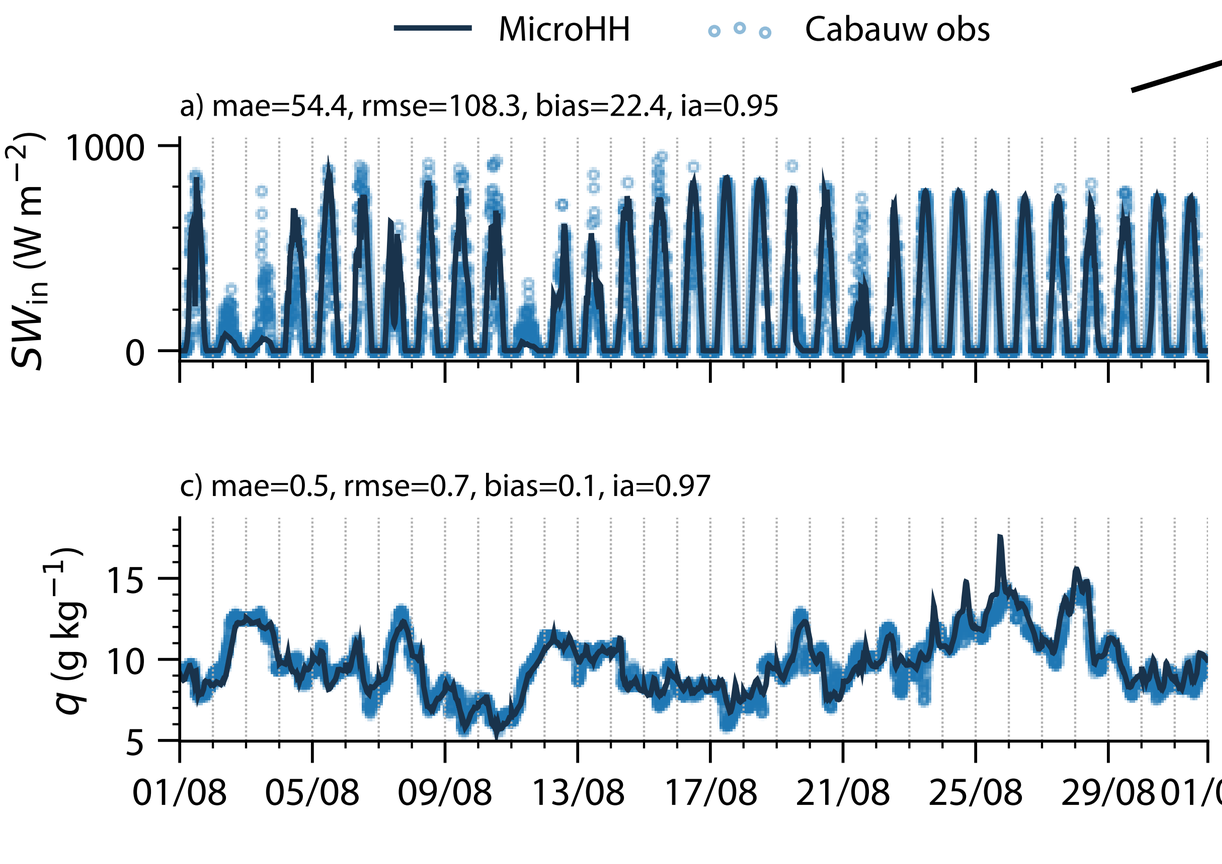
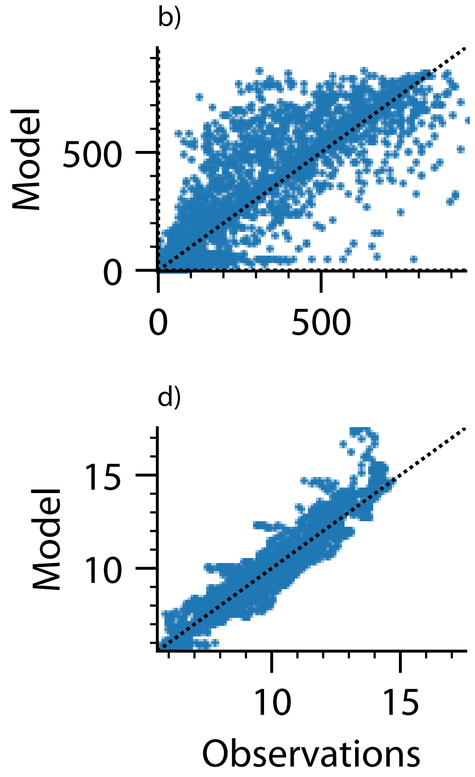
Results and outlook

(MicroHH → RRTMGP + HTESSEL + 1-mom ice micro)





- Ongoing validation for:
  - Cabauw (Ruisdael)
  - Barbados
  - Amazon (ATTO)

- Reference publication in preparation (*JAMES*) → release (LS)²D afterwards (*Github/PyPI*)
- Final aim project: MicroHH + (LS)²D as fast GPU based LES testbed (*microhh.org*)

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