

PySDM: Pythonic particle-based cloud microphysics package

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PySDM

key features

- Monte-Carlo coalescence using SDM (Shima et al. 2009)
- Implicit-in-size condensation solver with adaptive timestep
- parallel implementation (per-grid-cell concurrency for condensation; domain-wide concurrency for coalescence and particles transport)
- zero- and two-dimensional examples

PySDM

technological stack and workflows

automated tests,
code coverage

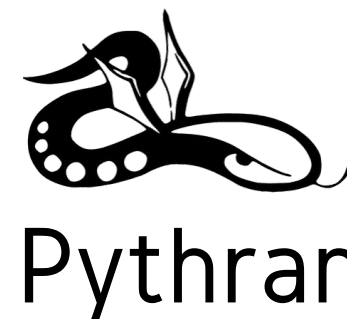
github.com/atmos-cloud-sim-uj/PySDM

README.md

build passing coverage 68%

Python acceleration,
multi-threading, GPU

```
29 @numba.njit(void(int64[:], int64
30                parallel=NUMBA_PARAL
31     ↓
32     def coalescence(n, idx, length,
33     ● for i in prange(length - 1):
34         if gamma[i] == 0:
35             continue
36         j = idx[i]
37         k = idx[i + 1]
38
```



interactive
examples & tutorials

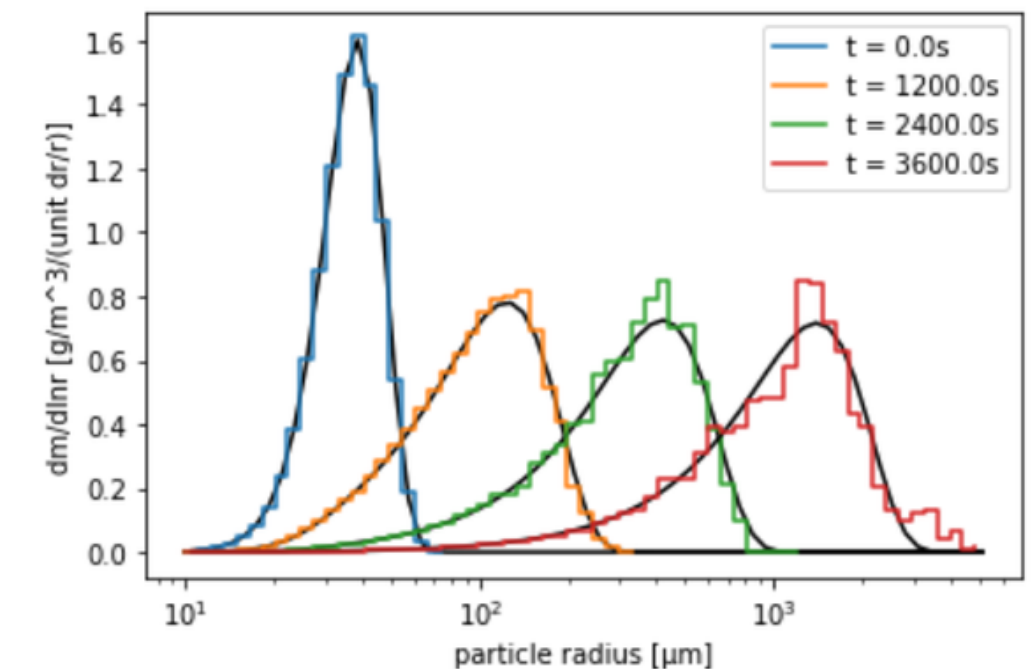
hub.gke.mybinder.org/user/atmos-cloud-sim-uj-pysdm-f3z5jupm/no...

Shima et al. 2009 Fig 2a



View Insert Cell Kernel Widgets Help

Run Code








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PySDM

portability

[Build jobs](#)

[View config](#)

✓ # 182.1	AMD64		Python 3.8 with newest packages on Linux	🕒 19 min 45 sec
✓ # 182.2	AMD64		Python 3.7 on Linux numba::parallel=False	🕒 21 min 10 sec
✓ # 182.3	AMD64		Python 3.7 on Linux numba::parallel=True	🕒 18 min 39 sec
✓ # 182.4	AMD64		Python 3.7 on OSX	🕒 30 min 11 sec
✓ # 182.5	AMD64		Python 3.7 on Windows	🕒 32 min 20 sec

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PySDM

PySDM simulates the dynamics of population of particles immersed in moist air using the particle-based (a.k.a. super-droplet) approach to represent aerosol/cloud/rain microphysics. The package features a Pythonic implementation of the Super-Droplet Method (SDM) Monte-Carlo algorithm for representing collisional growth (Shima et al. 2009), hence the name.

Demos:

- Shima et al. 2009 Fig. 2 [launch](#) [binder](#)
- Arabas & Shima 2017 Fig. 5 [launch](#) [binder](#)
- Yang et al. 2018 Fig. 2: [launch](#) [binder](#)
- ICMW 2012 case 1 (work in progress) [launch](#) [binder](#)

Tutorials:

- Introduction [launch](#) [binder](#)
- Coalescence [launch](#) [binder](#)

Credits:

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THANK YOU

[GITHUB.COM/ATMOS-CLOUD-SIM-UJ/PYSDEM](https://github.com/ATMOS-CLOUD-SIM-UJ/PYSDEM)