The Earth Model Column Collaboratory (EMC²) Ground-Based Lidar and Radar Simulator and Subcolumn Generator

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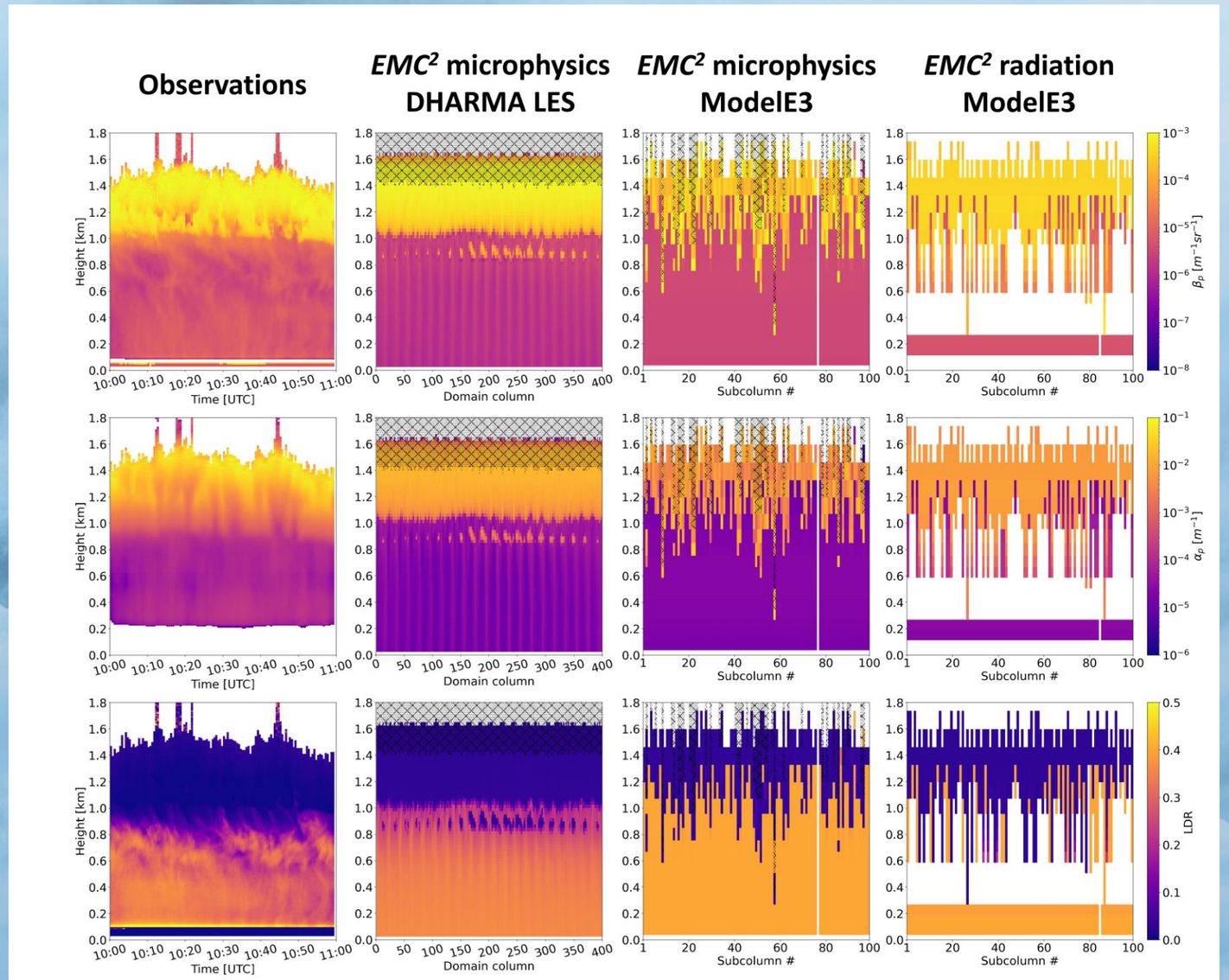


Silber et al., *GMD*, 2022

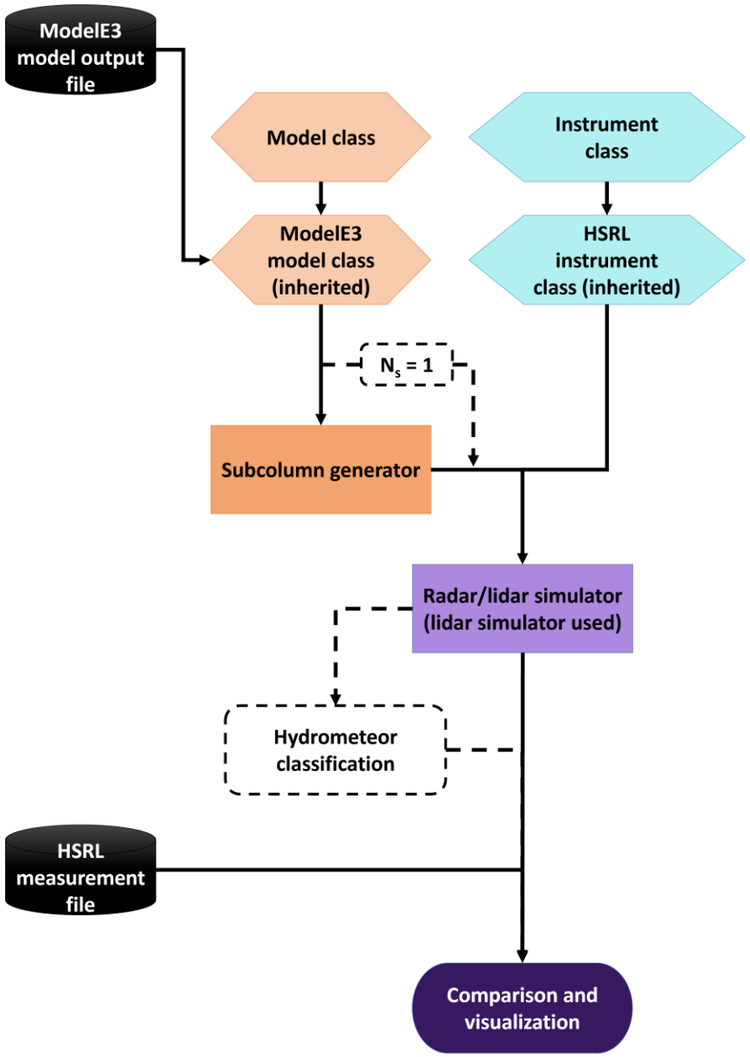
https://github.com/columncolab/EMC2

The Earth Model Column Collaboratory (EMC²)

- Instrument simulators can bridge between observations and models.
- *EMC²* is an open-source ground-based lidar and radar simulator and subcolumn generator, specifically designed for climate models but also applicable to high-resolution model output.
- *EMC²* provides a flexible framework enabling direct comparison of model output with ground-based radar and lidar observations.
- *EMC²* enables the emulation of ground-based (and air- or space-borne) measurements.
- The *EMC²* simulator uses either single particle or bulk particle size distribution lookup tables.
- The *EMC²* software is fully written in Python.

https://github.com/columncolab/EMC2

EMC² Standard Workflow



Silber et al., *GMD*, 2022

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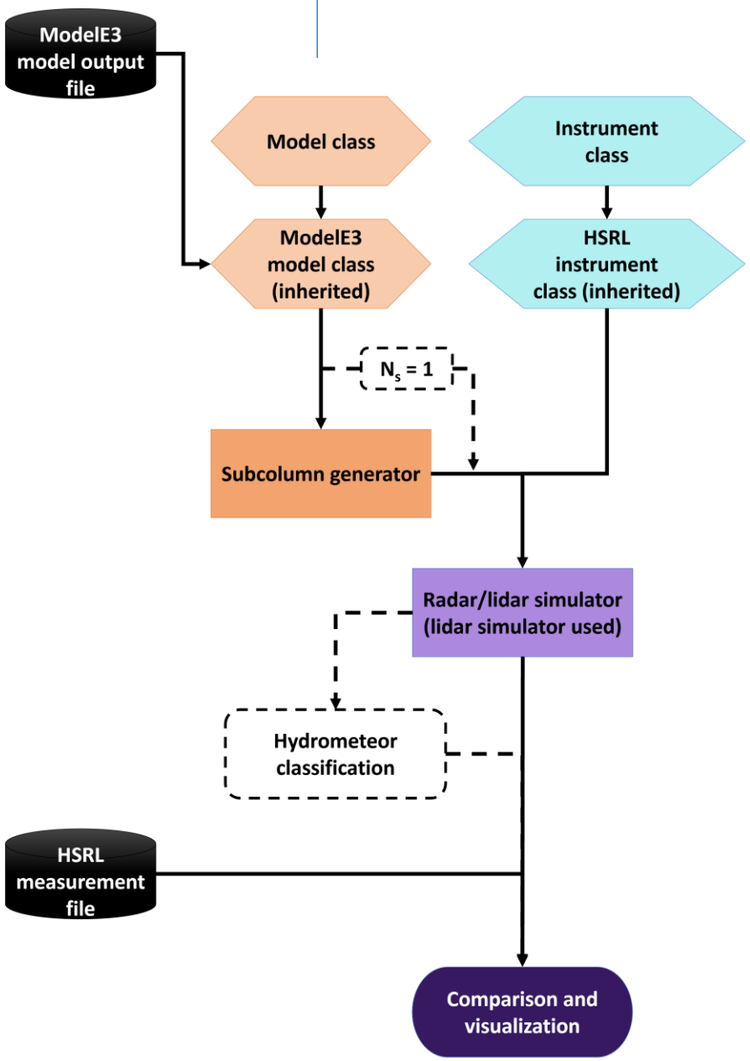
EMC² Standard Workflow



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Model sub-classes:

- E3SM (EAM)
- CESM2 (CAM6)
- ModelE3
- WRF

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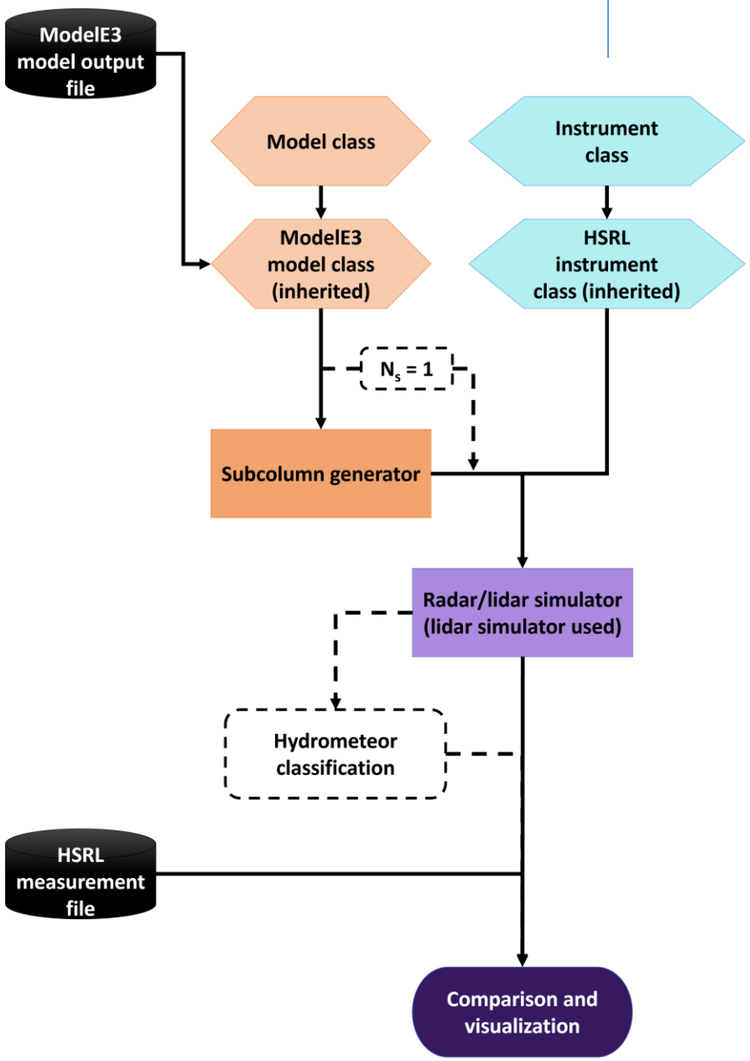
EMC² Standard Workflow



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Instrument sub-classes:

- Radars:
  - C-SAPR
  - X-SACR
  - Ka-SACR
  - KAZR
  - WACR
  - BASTA
  - NEXRAD
- Lidars:
  - Raman
  - Micropulse lidar (MPL)
  - HSRL
  - Ceilometer
  - 1064 nm (NIR) lidars
  - CALIOP (CALIPSO)

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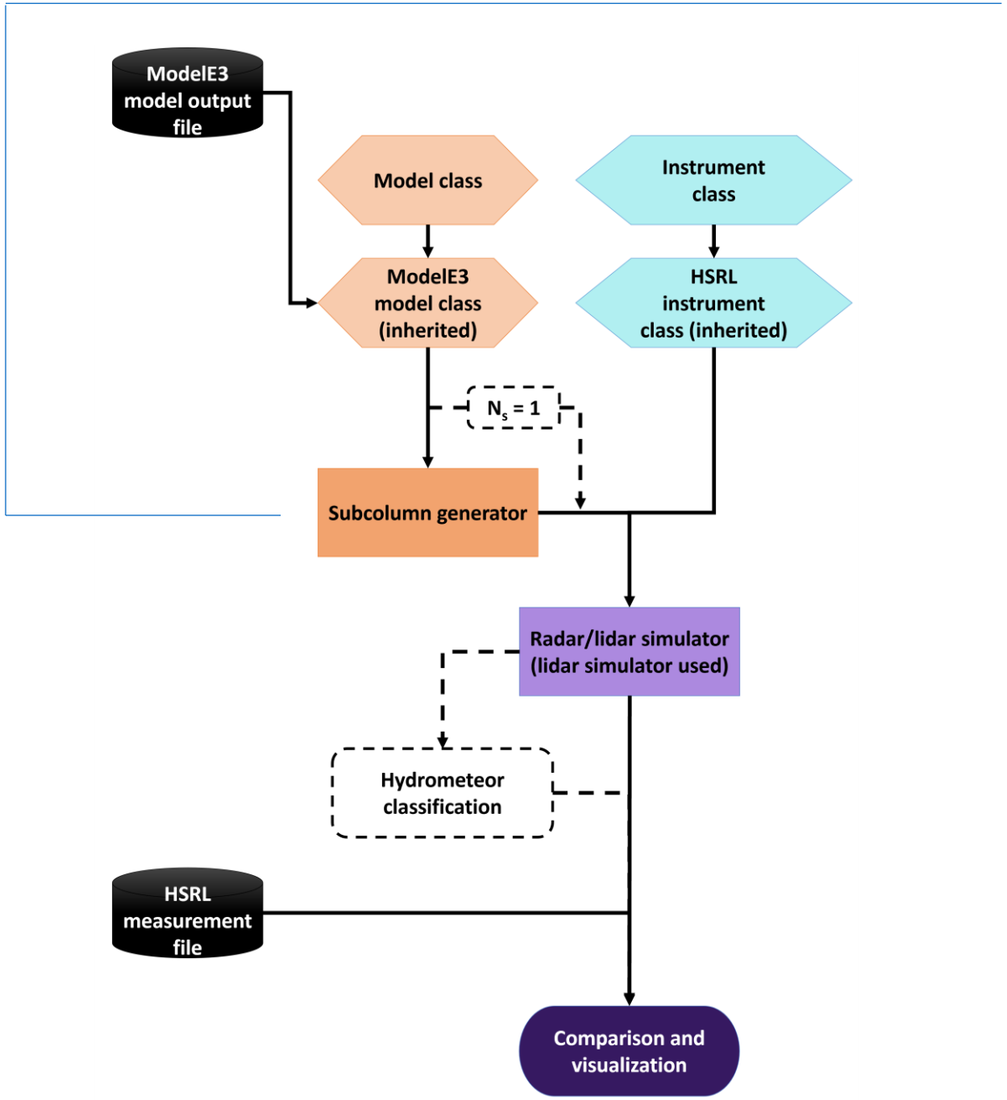
EMC² Standard Workflow



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Subcolumn generator:

- Emulating higher resolution
- Can be turned off (e.g., when processing LES output)
- Hydrometeor allocation consistent with model overlap assumptions
- Parallel processing

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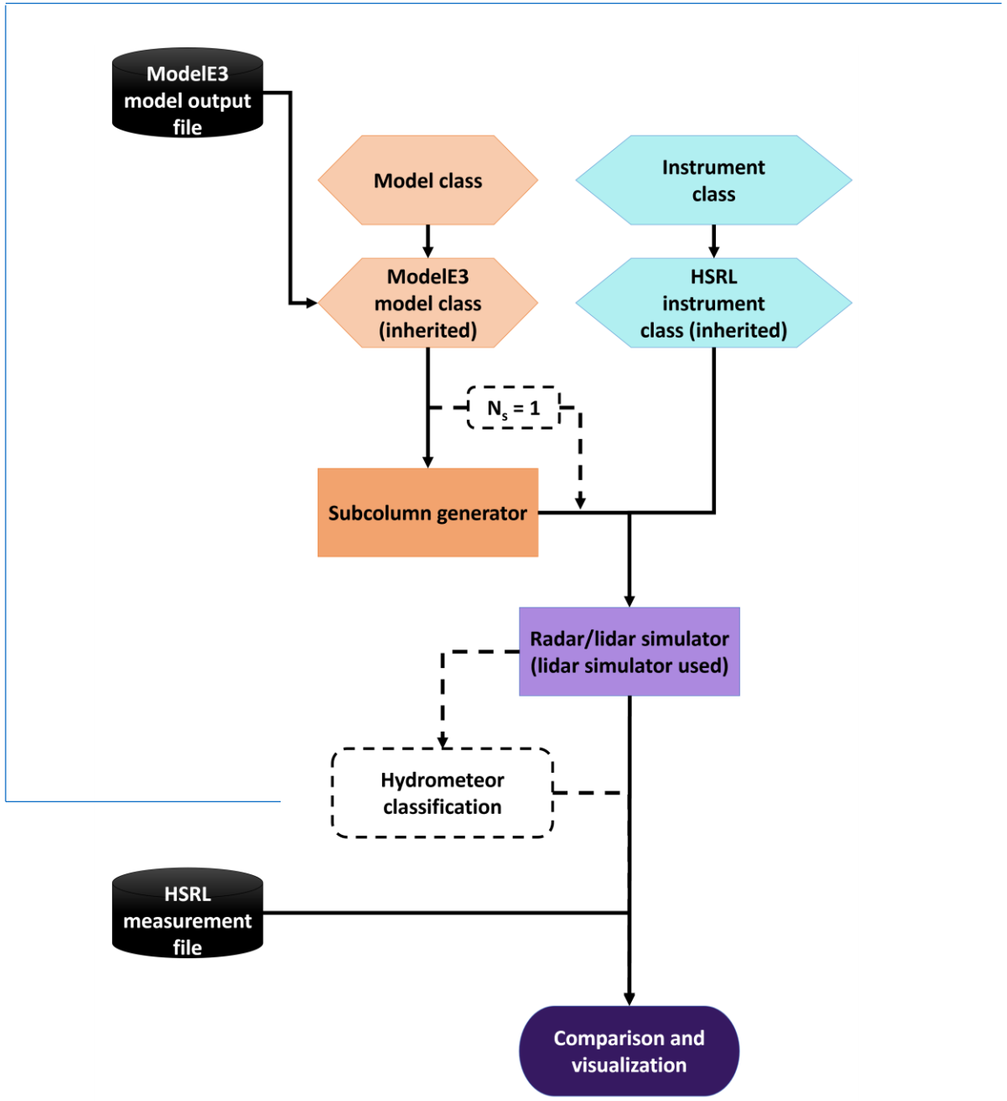
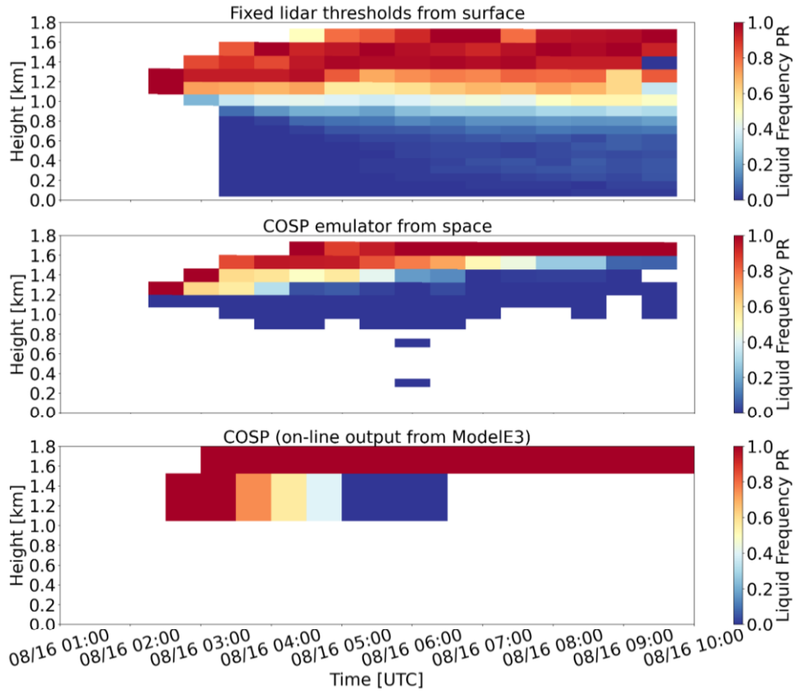
EMC² Standard Workflow



Silber et al., *GMD*, 2022

Classification:

- Supplementing model-observation comparisons
- Includes lidar-based classification and COSP lidar simulator emulator



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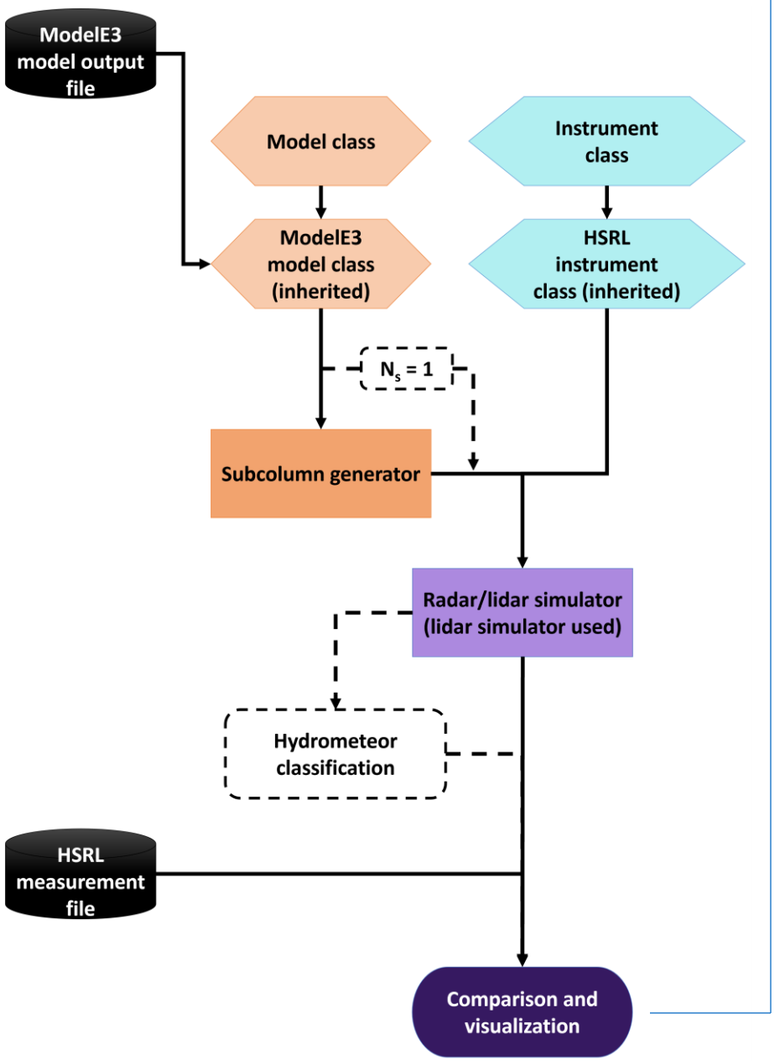
EMC² Standard Workflow



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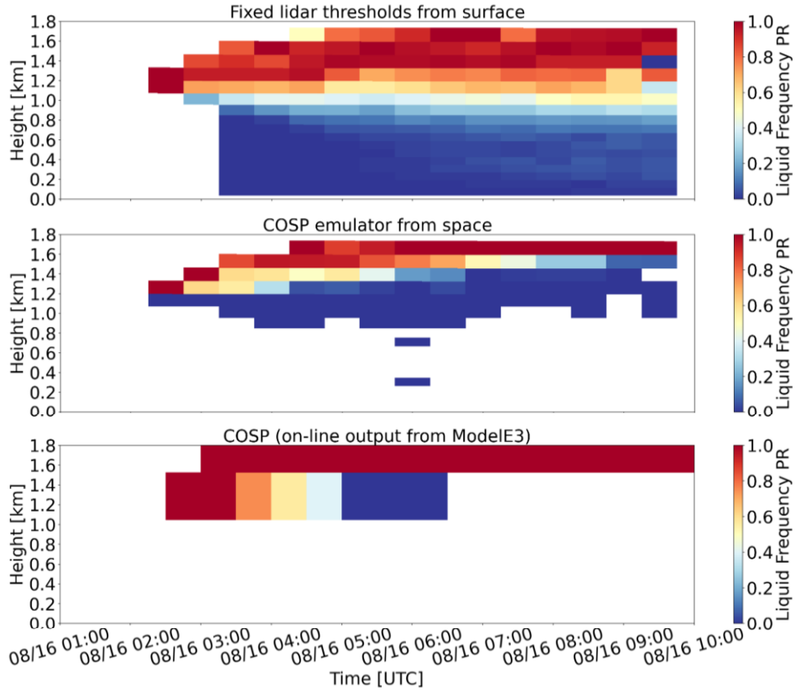
Visualization:

- Internal methods for:
  - Curtain plots with hatched areas for undetectable hydrometeors
  - Phase partitioning statistics and plots
  - Mean profiles and time series



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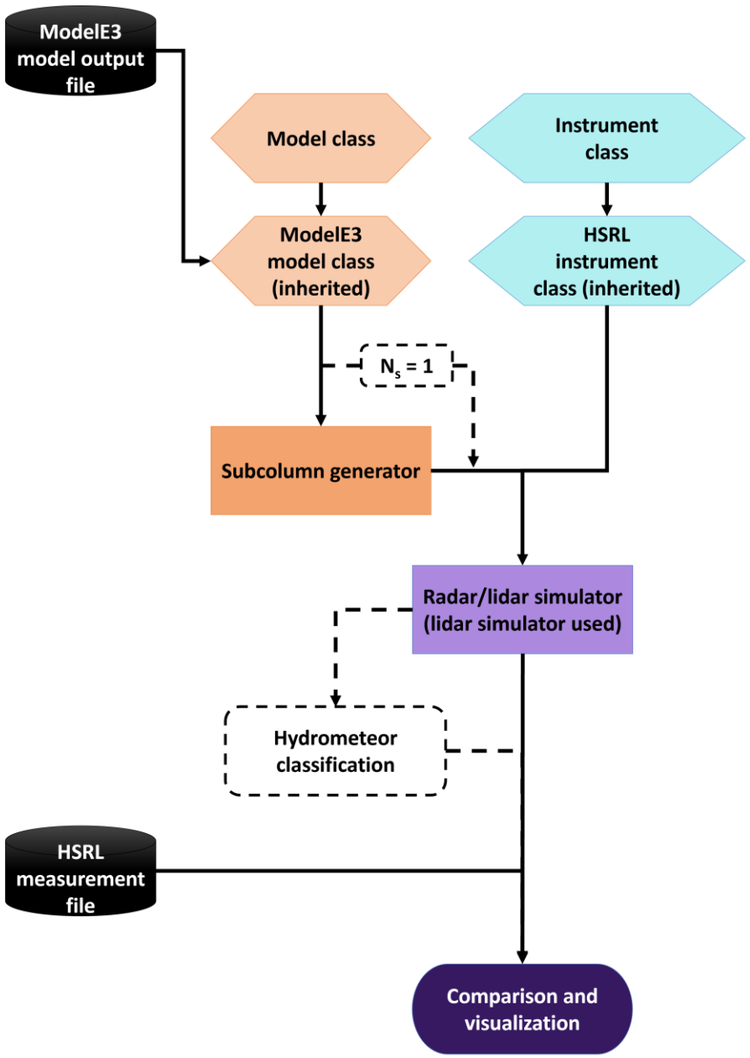

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Demo Notebook…

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