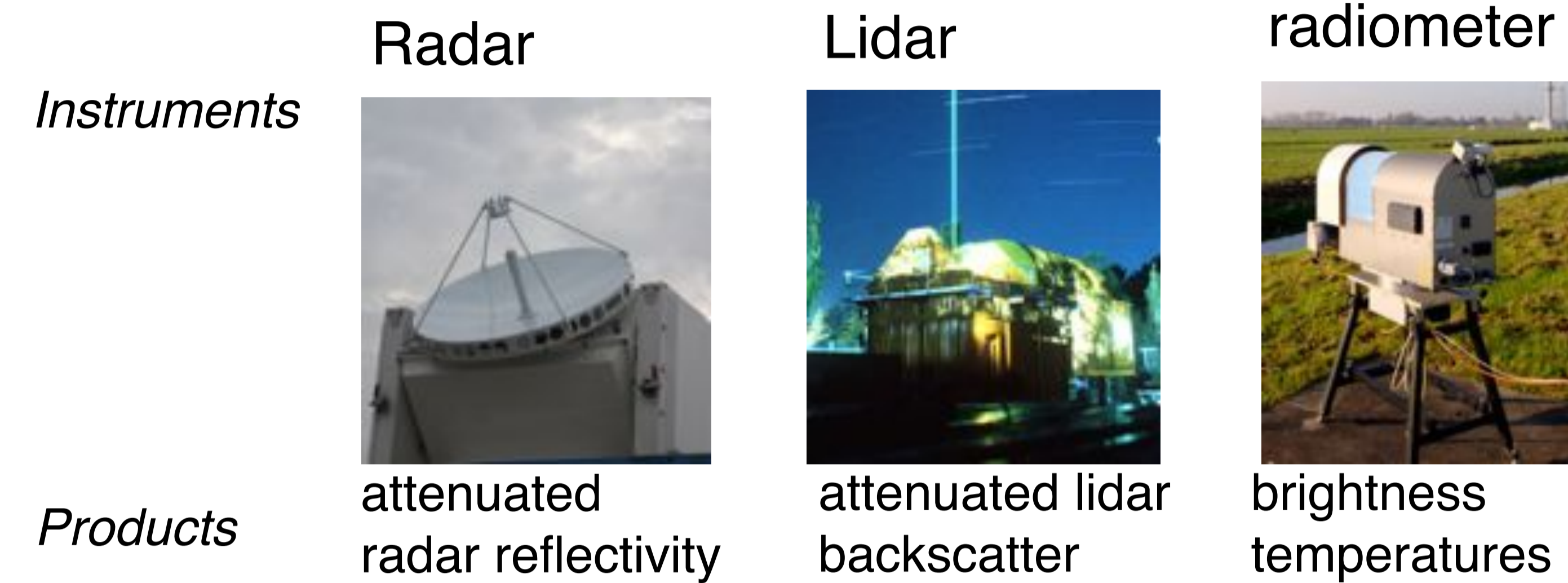


1. Motivation & Objective

Accurate representation of low-level water clouds is critical in climate modelling. Uncertainties in climate projections can be reduced by correctly characterising cloud physical properties from observations.

Objective: develop an algorithm to retrieve microphysical properties of water clouds, eventually including those with drizzle, using the synergistic combination of several different instruments.

2. Sensors



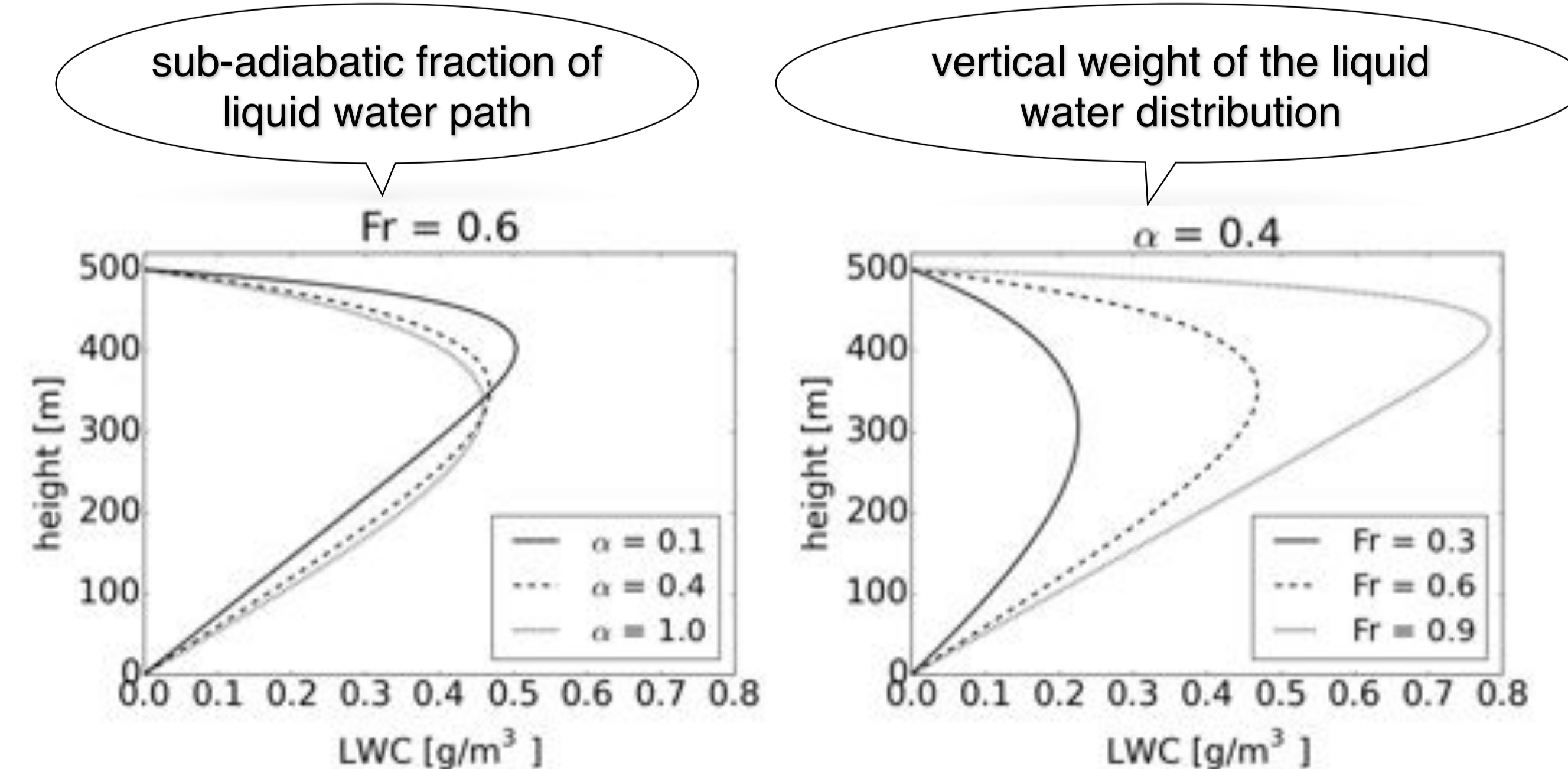
3. Theoretical basis

A. Building upon previous work (Löhnert et al. 2001), we consider here clouds without drizzle.

B. Droplet size distribution:

- monomodal (to be extended to bimodal to account for drizzle)
- generalized gamma distribution function

C. Vertical profile of liquid water content is a function of two free parameters (Boers et al. 2006):

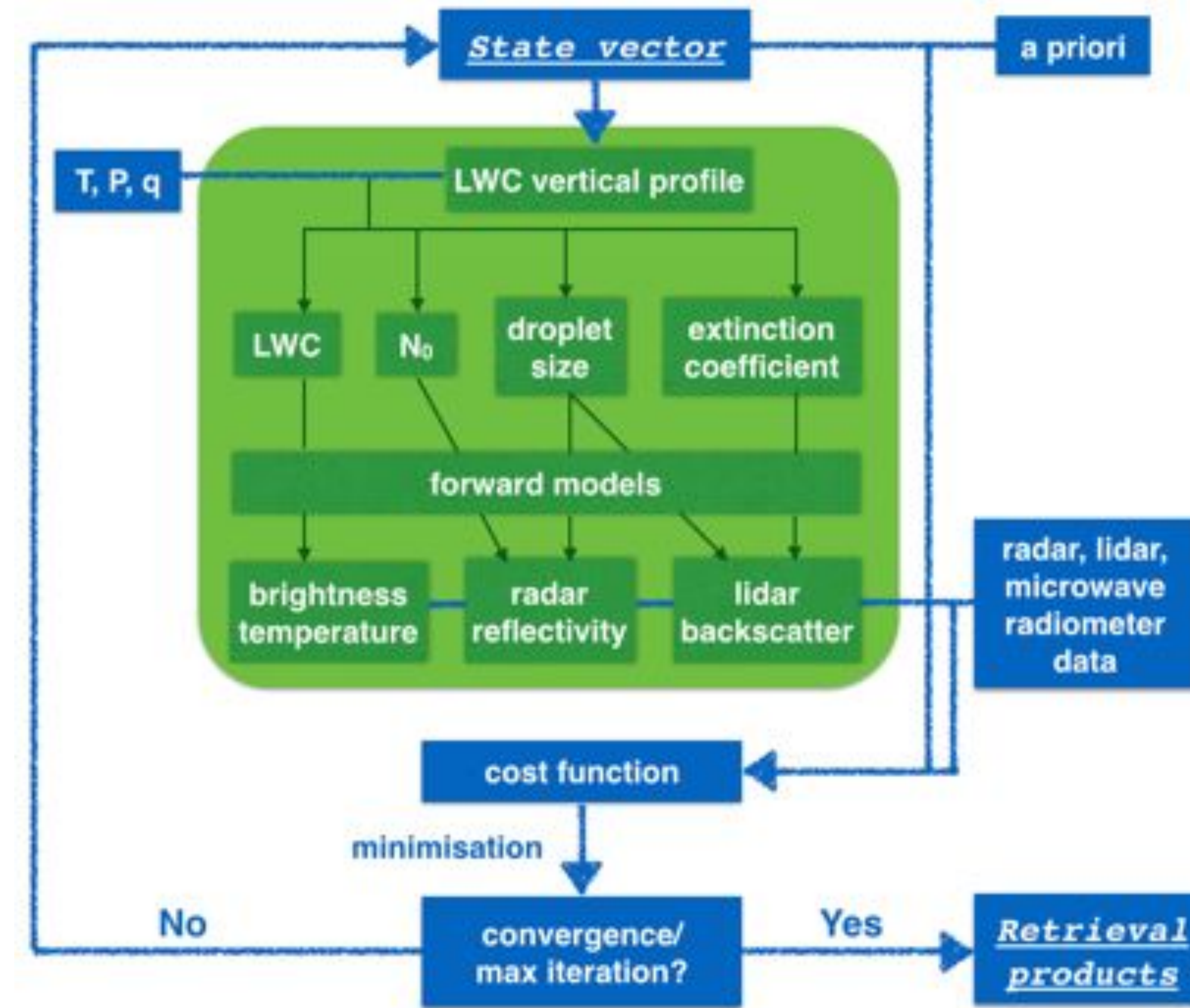


D. Forward models:

- Radar: Rayleigh approximation
- Lidar: multiple scattering approximation (Hogan 2008)
- Microwave radiometer: considers gaseous (O₂, H₂O) and liquid water absorption as in Löhnert et al. (2004)

4. Retrieval Algorithm

Bayesian inversion approach:



State vector:

- Fr
- α
- adiabatic number concentration
- gamma shape parameter
- cloud boundaries
- radar & lidar calibration

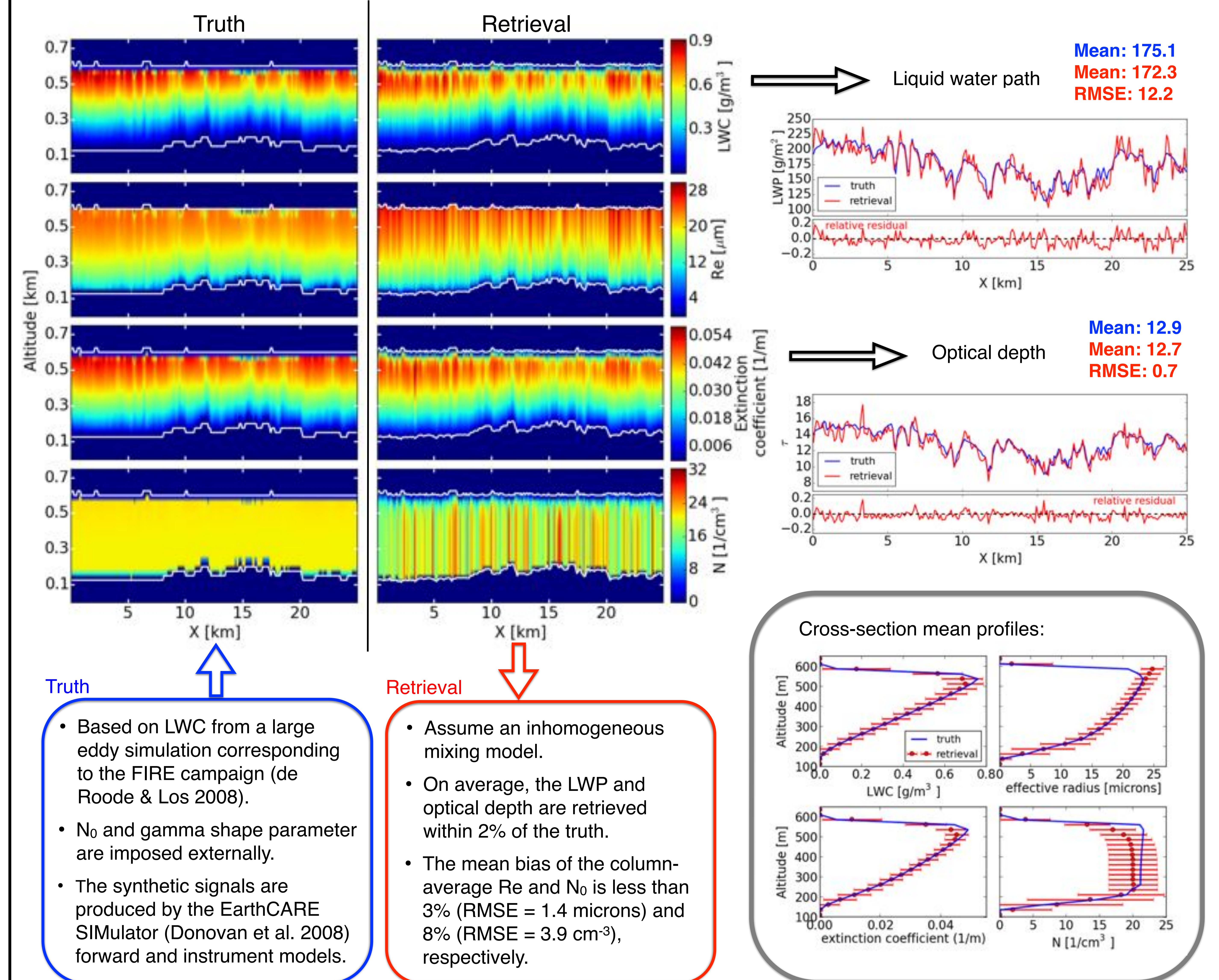
Retrieval products:

- liquid water content LWC
- total number concentration N₀
- effective radius Re
- extinction coefficient

6. Summary & Outlook

- We developed a multi-sensor retrieval algorithm based on a Bayesian inversion technique to retrieve the profiles of microphysical and optical properties of water clouds.
- Application of the algorithm to a set of synthetic signals based on the output of a large eddy simulation for clouds without drizzle shows good agreement between the truth and the retrieval.
- Inclusion and quantification of drizzle properties in the algorithm is currently under investigation.

5. Application of retrieval algorithm to synthetic signals



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