



NUI Galway
OÉ Gaillimh



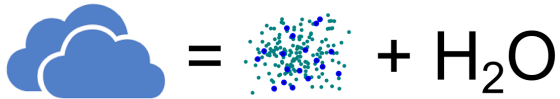
Ryan
Institute

Comparing microphysical cloud properties from remote sensing with cloud parcel model results

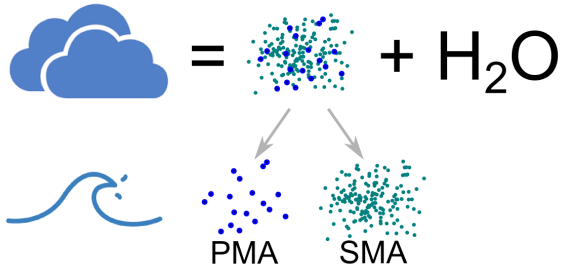
J. Preißler, K. N. Fossum, J. O'vadnevaite, C. O'Dowd
National University Ireland, Galway

11th ISTP, Toulouse, France, 20th to 24th of May 2019

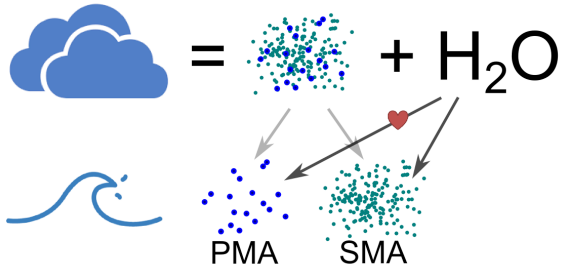
Motivation



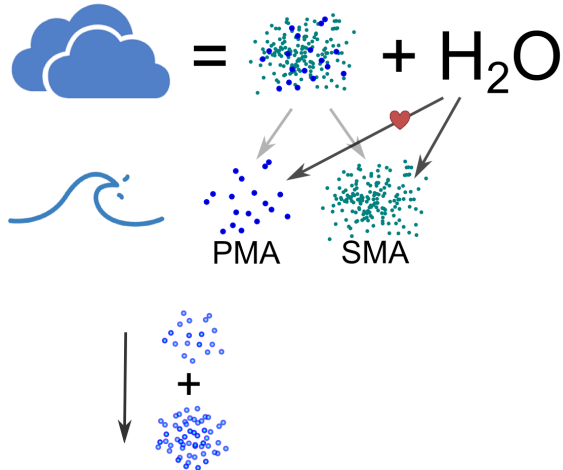
Motivation



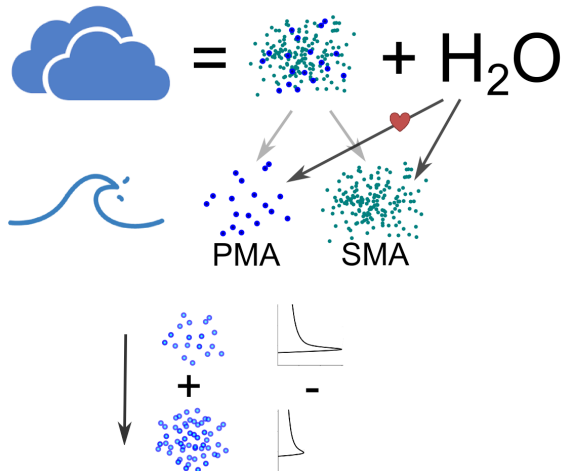
Motivation



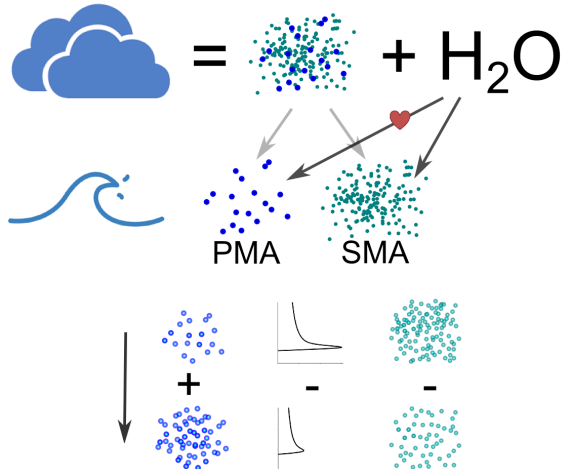
Motivation



Motivation



Motivation



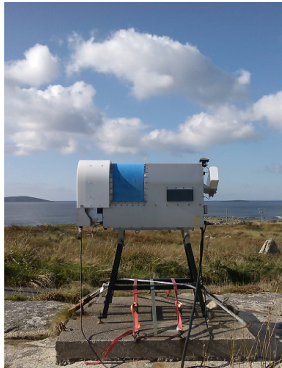
- ▶ based on ground level in-situ measurements (Antarctic cruise)
- ▶ Fossum et al. (2018), doi:10.1038/s41598-018-32047-4

Mace Head



- ▶ in-situ aerosol measurements at ground level (model input)
- ▶ collocated profiling of microphysical cloud properties
- ▶ Model validation: Closure of parcel model and remote sensing?

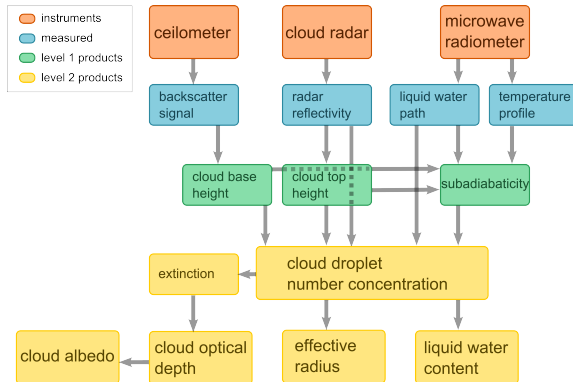
SYRSOC – SYnergistic Remote Sensing Of Clouds



Martucci and O'Dowd (2011), AMT, doi:10.5194/amt-4-2749-2011.

Preißler et al. (2016), JGR, doi:10.1002/2016JD025360.

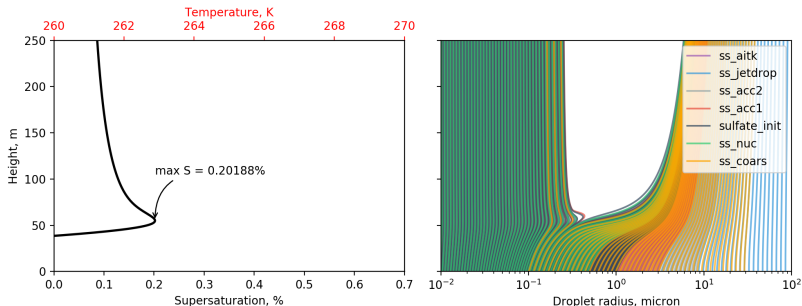
SYRSOC – SYnergistic Remote Sensing Of Clouds



- ▶ assumption: mono-modal cloud droplet size distribution
- ▶ single-layer purely liquid water clouds without precipitation

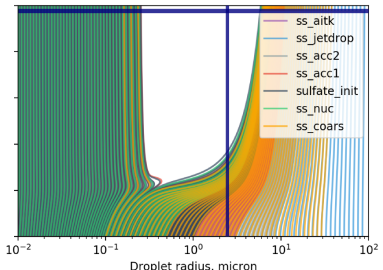
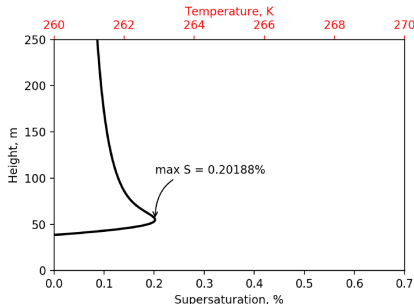
Pyrce

- ▶ python-based adiabatic cloud parcel model
- ▶ <https://pyrcel.readthedocs.io/en/>
- ▶ Rothenberg et al. (2016), doi:10.1175/JAS-D-15-0223.1

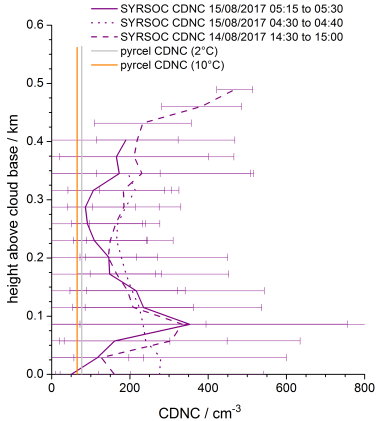


Pyrcel

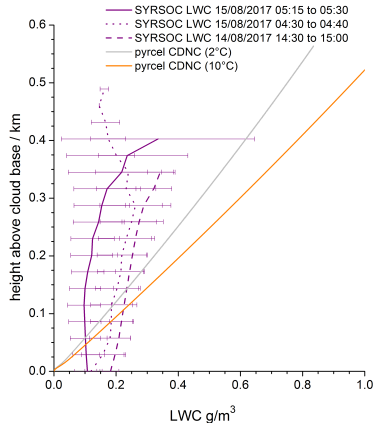
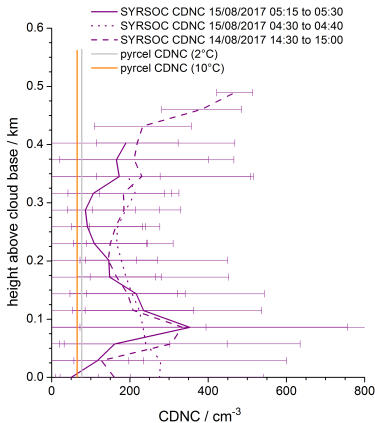
- ▶ initial aerosol population of various species, modes
- ▶ derived from aerosol chemistry (AMS) and number size distribution (SMPS)
- ▶ input of meteorological conditions (T, RH, p, updraft)
- ▶ sensitivity study: sensitive to updraft, mode positioning, critical diameter
- ▶ constrain updraft from CCN supersaturation spectra



Cloud study on 14 and 15 August 2017

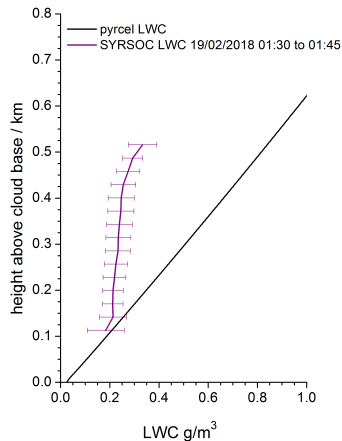
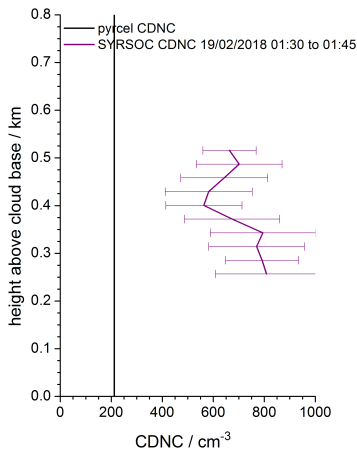


Cloud study on 14 and 15 August 2017



- ▶ summer case, high fraction of marine organic aerosol
- ▶ accumulation mode concentration about 91 particles/ cm^3 (7% sea salt)

Cloud study on 19 February 2019



- ▶ winter case, with high sea salt concentration
- ▶ accumulation mode concentration about 230 particles/ cm^3 (71% sea salt)

Summary and future work

- ▶ comparing remote sensing cloud profiles with parcel model
 - ▶ difficult to find cases due to limitations of SYRSOC and availability of instruments
 - ▶ large variability in SYRSOC profiles (and uncertainties up to 45% for CDNC, and 24% for LWC)
 - ▶ pyrcel results fall into range of variability and uncertainty of SYRSOC in summer case
 - ▶ large difference between pyrcel and SYRSOC for winter case
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- ▶ verify drizzle detection
 - ▶ find more cases
 - ▶ find closure?

Thank you for your attention!

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Acknowledgement: Funded by Irish Environmental Protection Agency through fellowship (2015-CCRP-FS.24), by European Union Horizon 2020 research and innovation programme under grant agreement No 654109 for ACTRIS-2, and by Science Foundation Ireland through research centre MaREI.