

A Consortium for CO_nvection-scale modelling
Research and Development

**Towards an ACCORD environment for single column
model simulations**

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Acknowledgements to ...

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1. **Concept**
2. **Challenge**
3. **MUSC documentation**
4. **EMS: motivation**
5. **ACCORD - EMS: development & application**
6. **ACCORD objectives**

1. **Concept:** from full 3D system (NWP) ...

$$E.g. : \frac{\partial q^{l,s}}{\partial t} + \mathbf{v} \nabla q^{l,s} = -\frac{1}{\rho} \nabla F^{l,s} + S^{l,s} + \frac{1}{\rho} \frac{\partial P^{l,s}}{\partial z}$$

- ▶ Non-linear interplay between momentum, energy, and matter exchange:
 - large scale dynamics (thermodynamics)(e.g. horizontal advection, subsidence)
 - subgrid-scale mixing (e.g. turbulence (including convection))
 - individual microphysical processes (e.g. condensation, freezing) and their rates
 - precipitation and sedimentation fluxes
 - surface-atmosphere coupling (lower atmospheric BC)

... to 1D system (Single Column Model):

$$\frac{\partial q^{l,s}}{\partial t} + \mathbf{v} \nabla q^{l,s} = -\frac{1}{\rho} \frac{\partial F^{l,s}}{\partial z} + S^{l,s} + \frac{1}{\rho} \frac{\partial P^{l,s}}{\partial z}$$

Physics parameterization in NWP: develop/improve, validate, compare

2. **Challenge:** ACCORD's NWP has 3 "different" Canonical System Configurations (CSCs):

▶ AROME

▶ ALARO

▶ HARMONIE-AROME

Differences in dynamics, physics parameterization, coding, ...

$$\frac{\partial q^{l,s}}{\partial t} + \mathbf{v} \nabla q^{l,s} = -\frac{1}{\rho} \frac{\partial F^{l,s}}{\partial z} + S^{l,s} + \frac{1}{\rho} \frac{\partial P^{l,s}}{\partial z}$$

3. MUSC documentation

- ▶ The first documentation (report) on MUSC (unfinished, CY31T1): [Malardel, Sylvie, 2004](#)
- ▶ A paper on developed tools for MUSC (based on HARMONIE-AROME, CY43T1): [Gleeson et al. 2020](#)
- ▶ Development and documentation on **Environment for MUSC Simulation (EMS)**: [Roehrig, Romain's, GitHub](#)

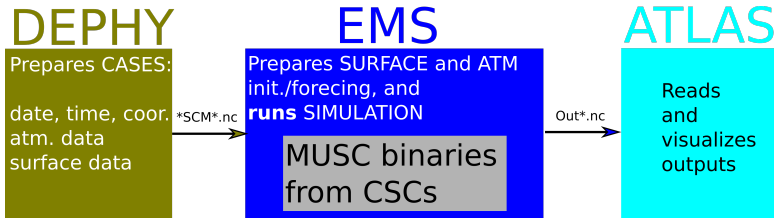
We decided to work with EMS and adjust it to the ACCORD needs.

- ▶ Documentation on setting the EMS on a common ECMWF (Atos) platform (EMS, CY46(T/h)1), [Eoin Whelan](#):

`master/EMS ↔ ACCORD/EMS/Main ↔ ACCORD/EMS/Users`

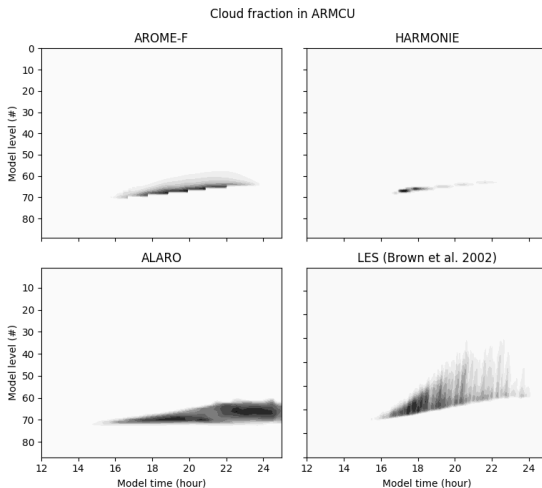
Why EMS? - How it works?

4. Motivation

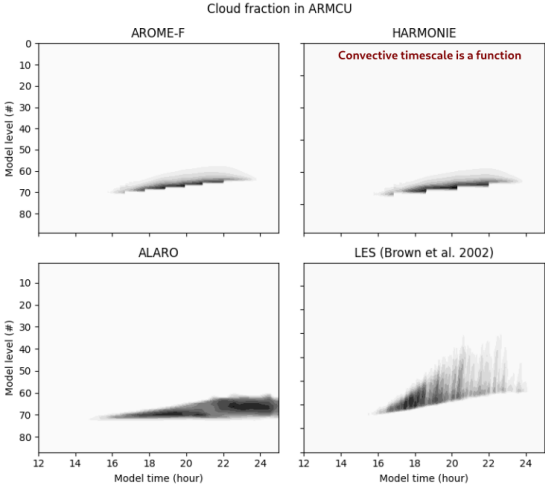


- ▶ Well structured and efficient (easy for further development)
- ▶ **One** command to run and **one** to plot
- ▶ We have integrated and documented the system based on HARMONIE binaries
 - AROME and ARPEGE namelists runs with no problem
 - ALARO runs EMS only offline for now; MUSC on own HPC with forcing from EMS

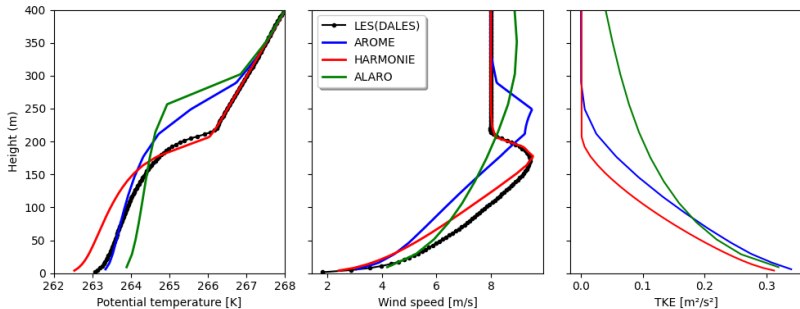
5. Application: run and compare USED cases (e.g. StCu)



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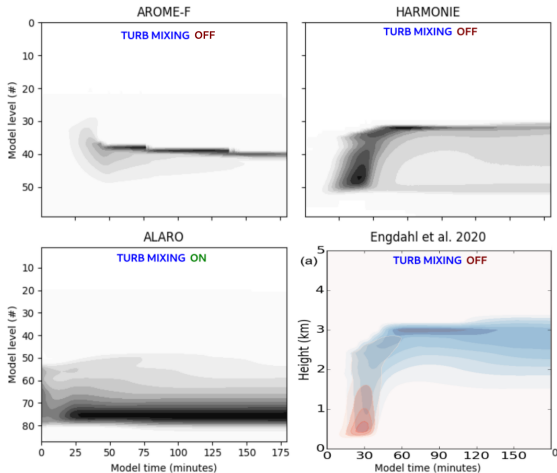


5. Application: **modify**, run and compare USED cases (e.g. GABLS1)



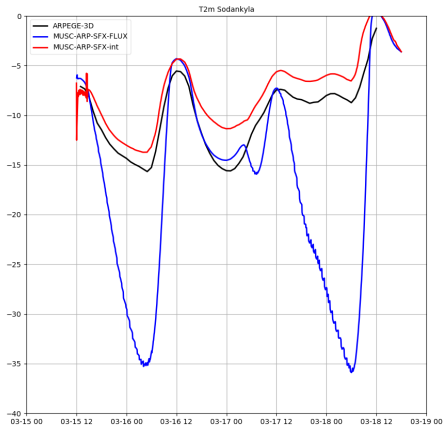
5. Application: **Create**, run and compare **NEW** cases (e.g. SCLD)

Specific Mass of Cloud Liquid Water in SCLD (Engdahl et al. 2020)



Switching OFF turbulence in AROME and ALARO in progress

5. Application: **Create**, run and compare **REALISTIC** cases



Summary: MUSC on the ACCORD agenda (RWP)

6. ACCORD objectives

- ▶ Establish, maintain, and upgrade the common MUSC; align the use of a common T-cycle version for MUSC in each CSC team
- ▶ Create and add (idealized) test cases: agree and implement a set of common test 1D use cases, with their relevant input data, for all CSCs
- ▶ Implement at least one MUSC test in DAVAĪ (that would test all three CSCs for the same 1D use case)
- ▶ Set up for daily MUSC runs (vs. Cloudnet data, LES)
- ▶ MUSC/EMS training and working days