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Organisation in Shallow Cumulus Convection [PPT]

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Publication date

2021

Document Version

Final published version

Citation (APA)

Siebesma, A. P., Feingold, G., & Nuijens, L. (2021). Organisation in Shallow Cumulus Convection [PPT].

Important note

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Organisation in Shallow Cumulus Convection

Pier Siebesma, Graham Feingold & Louise Nuijens
Workshop on Spatial Organisation of Convection, Clouds and Precipitation
Copenhagen May 5-7 2021

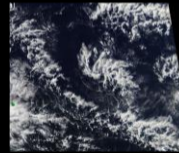
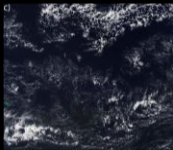
a.p.siebesma@tudelft.nl



How do we characterise the different modes of organisation?

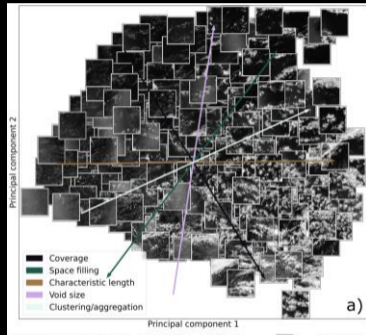
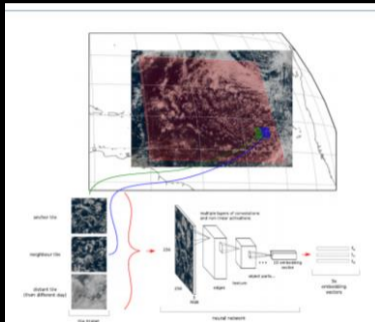
Sugar

gravel



flowers

fish

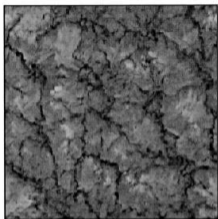


Are there well defined states of organisation in shallow cumulus convection?

If so, are we happy with sugar, fish, gravel and sugar, if not how do we proceed? (i.e. defining organisation, evaluating conceptual models, parameterisations etc)

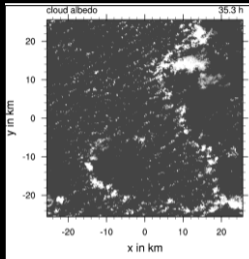
How do internal processes influence organisation?

25km

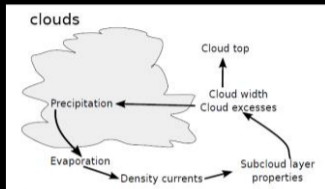


t = 8 hrs

De Roode (2004) : how large is large enough?



Seifert & Heus ACP (2013)



Internal feedback loops

Boing et al 2013

How essential is precipitation for organising shallow cumulus convection?

This poster Session:

Jule Radtke:

Witte:

Siebesma

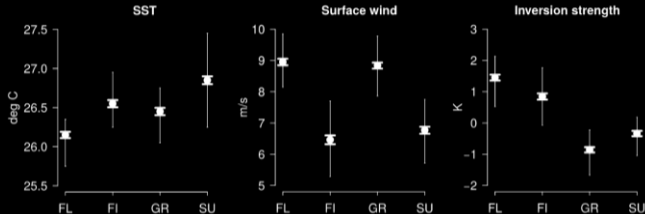
relation organisation and precipitation (patterns)

influence of microphysics

internal growth of humidity fluctuations

(How) Does organisation depend on environmental (external) conditions?

Bony et al GRL 2019



FL = Flowers
FI = Fish
GR = Gravel
SU = Sugar

This poster Session:

Louise Nuijens :
Graham Feingold :
Heike Schultz:
Isabel McCoy:
feedback!

dependance on shear
dependance on aerosols
dependance on subsidence, synoptic conditions
dependance on global warming (cloud

Which are the key external factors that promote certain modes of organisation?

Is cloud organisation mainly internal driven (upscale) or external driven (downscale)?

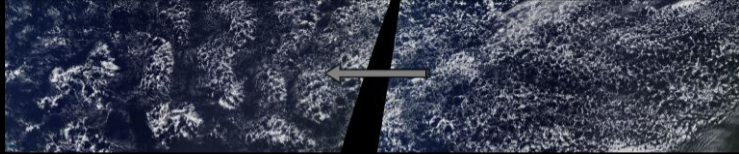
Transitions between different modes of organisation

Greenland (April 7 2021)



Cold air outbreak (April 7 2021)

NL, Ger. Dk



Gravel => Flowers (Feb 7 2021)

Atlantic Ocean

This poster Session:

Eastman:

Jan Kazil

Narenpitak:

Blossey:

Siebesma

Kurowski

Feingold

transition $Sc_u \rightarrow Cu$, closed open cells

transition closed open cells

transition sugar to flower (simulation)

transition sugar to flower (simulation)

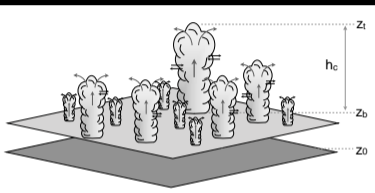
cold air outbreak

transition from shallow to deep convection

transitions in stratocumulus regimes

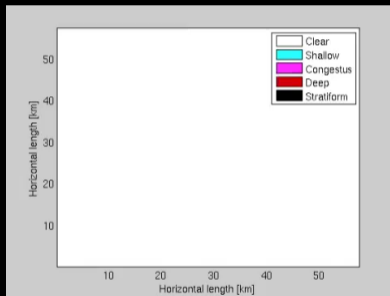
What do we know now about the transition mechanisms of shallow cumulus convection?

Building Conceptual Models / Parameterisations that incorporate organisation mechanisms



Combining "old school" multiplume models with:

Dorrestijn et al 2015



Cellular automata that let clouds/plumes interact

This poster Session:

Boualem Khouider:

Roel Neggers:

Philip Griewank:

Doug Parker;

Marcin Kurowski

Chen

stochastic multicloud model

interacting plumes

plume-plume interaction

Rainy-Benard Model

interacting multiplume model

cloud-cloud interaction

How sure are we about the interaction mechanisms that essentially determine the dynamics of conceptual model / parameterisation?

Discussion Points for low clouds

What is an appropriate measure for organisation?

Are there distinct organisational modes?

What drives cloud organisation (external vs Internal, transition)?

Do we have enough understanding to build conceptual models.

How essential is precipitation for the formation of low cloud organisation

How will the relative frequencies of the various organisation modes change in a warmer climate

Will it matter for cloud feedback?

Can the various organisation modes be considered as equilibrium states

To what extent can we simulate it (explicit or with conceptual lower dimensional models)