Cloud Lifecycle Working Group

2010 Atmospheric System Research Science Team Meeting

CLWG Leadership

Co-Chairs:

Tony Del Genio, Matthew Shupe

Steering Committee:

Jennifer Comstock, Steve Klein,
Steve Kruger, Jay Mace

Translators:

Mike Jensen
Shaocheng Xie

The CLWG Identity
Perspectives from the Science Plan

www.sc.doe.gov/ober/Atmospheric System Research Science Plan.pdf

- Ultimate ASR objective: "Improve climate models"

- General approach: "Process-level Understanding" using observations and process models.

- Science Team design: Working groups combine observational and modeling perspectives to address specific issues

The CLWG Identity
Perspectives from the Science Plan

Dynamics
- Vertical air motions
- Entrainment
- Convective initiation

Microphysics
- Size distributions
- Ice crystal habit
- Fall speed
- Precipitation formation

Radiation
- Optical depth
- Dimming & brightening
- Spectral dependence
- Radiative heating rates

Overarching Themes
- Thermodynamic profiles
- Turbulent heat fluxes
- Surface characteristics

The CLWG Identity
Distinguishing/linking the WGs

WG overlap is by design.
The system is a “continuum”

Aerosol Lifecycle
– not much overlap

Cloud-Aerosol-Precipitation Interactions
– lots of overlap

How do we organize CLWG?

CLWG needs a higher level organizational structure

Acts as a mechanism to bridge individual and small group efforts to the broader WG and ASR objectives

Organizational groups should be guided by overarching questions; constrained by identified model difficulties/needs and observational capabilities

Focus groups can look deeper into specific issues and will often cross-cut our organizational groups and even WGs. Often combining observational and model expertise.

How do we organize CLWG?

A perspective from the steering committee

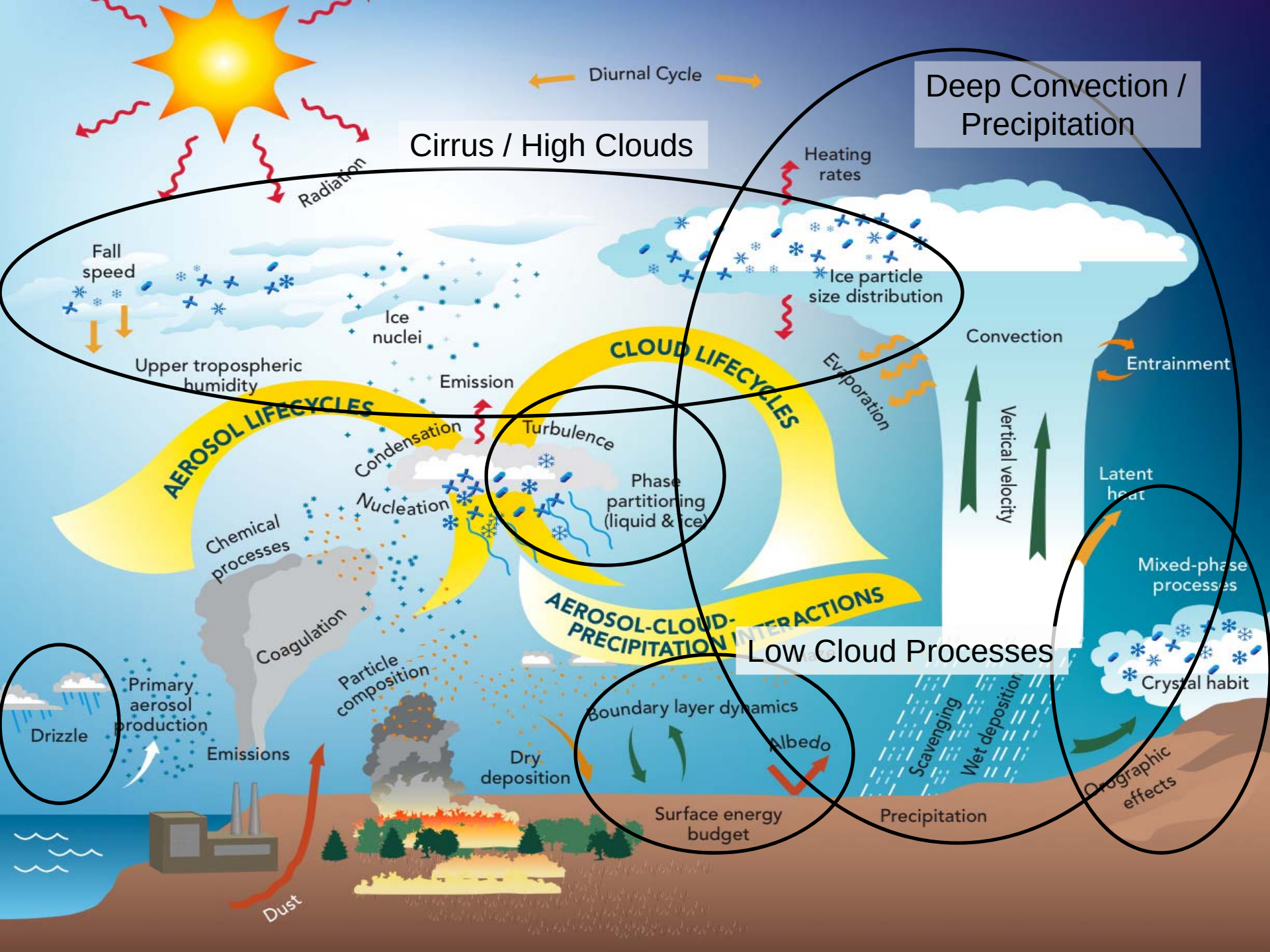
Deep Convection / Precipitation

Cirrus / High Clouds / Ice Clouds

Low Clouds

- Warm
- Cold

(Midlatitude Storm Clouds?)


Diurnal Cycle
Deep Convection / Precipitation
Cirrus / High Clouds
Radiation
Heating rates
Fall speed
Ice particle size distribution
Ice nuclei
Upper tropospheric humidity
Emission
CLOUD LIFECYCLES
AEROSOL LIFECYCLES
Condensation
Turbulence
Evaporation
Convection
Entrainment
Vertical velocity
Nucleation
Phase partitioning (liquid & ice)
Latent heat
Chemical processes
Mixed-phase processes
AEROSOL-CLOUD-PRECIPITATION INTERACTIONS
Low Cloud Processes
Coagulation
Particle composition
Crystal habit
Primary aerosol production
Drizzle
Boundary layer dynamics
Scavenging
Wet deposition
Albedo
Emissions
Dry deposition
Orographic effects
Surface energy budget
Precipitation
Dust

How do we organize CLWG?

Deep Convection / Precipitation

What determines the occurrence, depth, strength of convection?

Relations of convection to heating/cooling, drying/moistening.

Mechanisms for convective organization

Interactions w/ large-scale flow

Microphysics of graupel

Cloud ice / snow partitioning

Should Cu parameterizations be prognostic? What variables?

How do we organize CLWG?

Cirrus / High clouds / Ice clouds

Ice supersaturations

Difference between convective outflow and large-scale dynamically forced cirrus

Importance of small crystals, variability of the PSD, fall speeds.

What determines IWC and heating rates?

Cloud-scale / mesoscale, dynamical-microphysical interactions

What is the minimum complexity required for retrievals?

How do we organize CLWG?

Low warm clouds

Formation and transitions among S, Sc, and shallow Cu

Cloud-BL-surface interactions

Turbulence, entrainment, mixing

Drizzle formation

Relation between cloud properties, ambient air, and overlying free tropospheric air.

Subgrid inhomogeneity in T, q, LWP, IWP, w

How do we organize CLWG?

Low cold clouds

Relations between Arctic S/Sc and sea-ice concentrations

Mixed-phase microphysical processes

Cloud-BL-surface interactions

Cloud-scale dynamics, turbulence, entrainment, stratification

What determines cloud phase and phase partitioning?

Subgrid inhomogeneity in T, q, LWP, IWP, w

How do we organize CLWG?

Mid-Latitude storm clouds

Snow vs. Rain

Role of diabatic heating in generation of available potential energy

Relation between larger storms and local cloudiness at all levels

How do we organize CLWG?

Discussion?

Other proposals/ideas?

Cloud Lifecycle Working Group

CLWG email list

Make sure you are on it!

Fall Working Group Meetings

11-15 October 2010
Boulder, CO
Millenium Harvest House

Tentative design:
ALWG (Mon-Wed)
CAPIWG (Tues-Thurs)
CLWG (Wed-Fri)

Focus on WG activities.
NOT another Science Team Meeting