The convective time-scale as indicator of predictability

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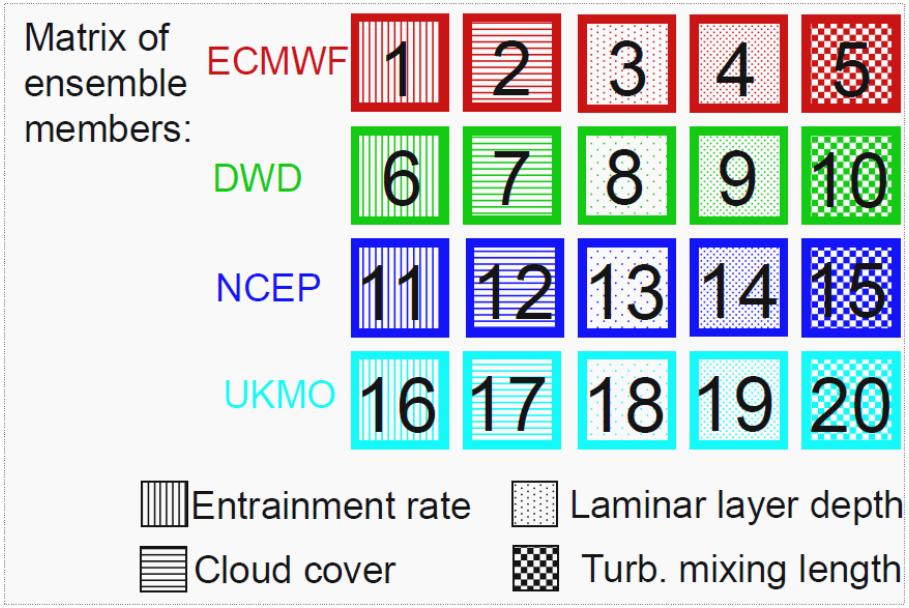
- Predictability is flow-dependent
- Sub-groups of EPS perform differently (LBC, PHYS)
- Spread in forecast quality gives information on predictability
- Convective time-scale serves as predictor



COSMO-DE-EPS

Two mechanisms for control of convection

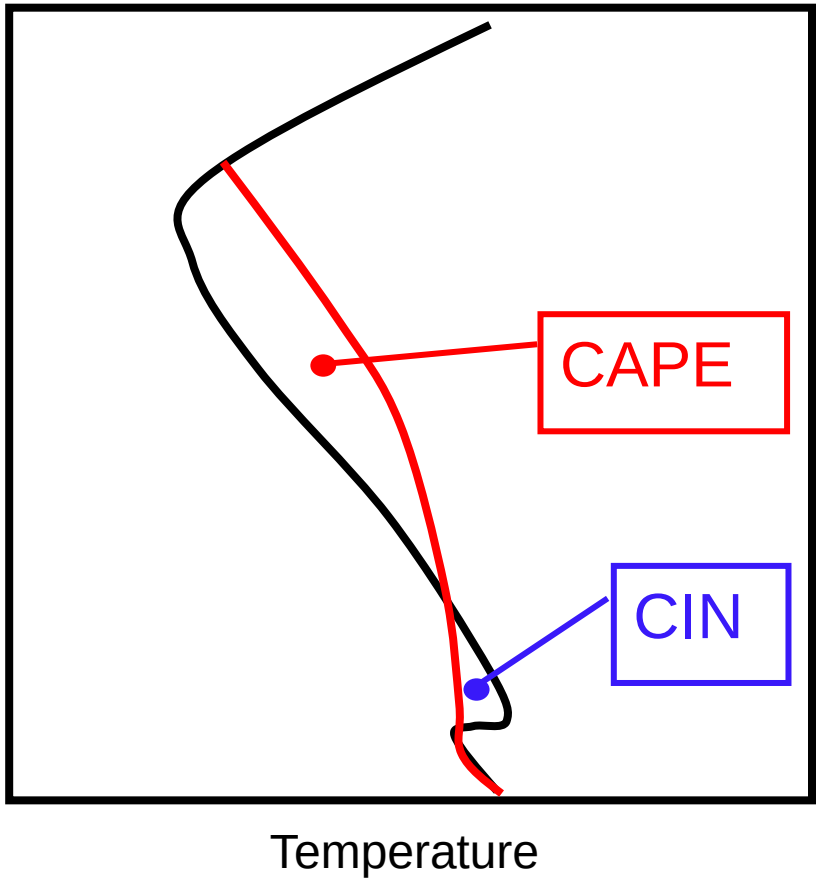
Many properties of cumulus convection depend on the large-scale environment.

1. **Strong forcing** (equilibrium): Dynamical production of CAPE

   - convection removes CAPE rapidly in comparison to the rate it is being generated

2. **Weak forcing** (triggered): Local perturbations to overcome CIN

   - large amounts of CAPE can build up if triggers not present



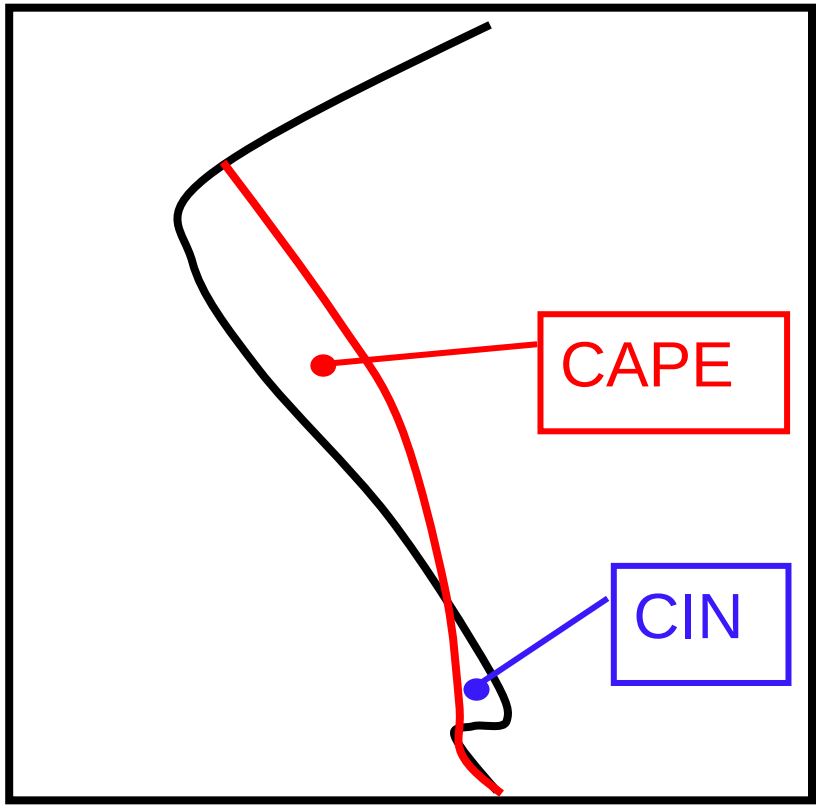
The convective time-scale τ_c

To identify regime, consider time-scale over which convection removes CAPE:

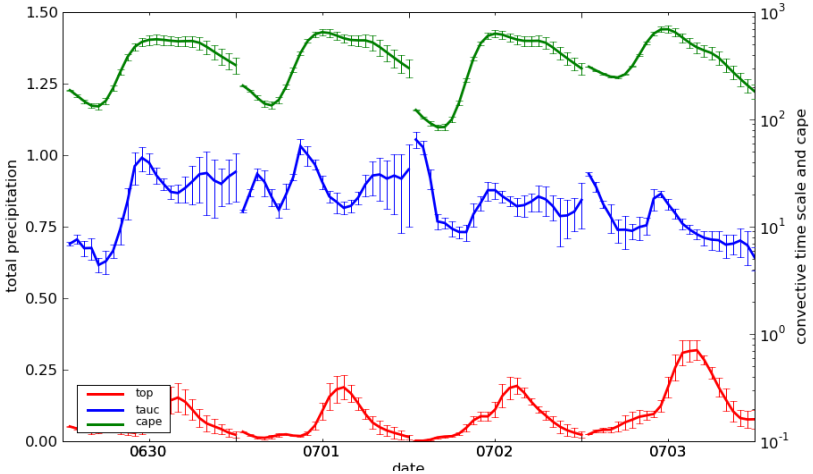
$$\tau_c = \frac{CAPE}{\frac{dCAPE}{dt}}$$

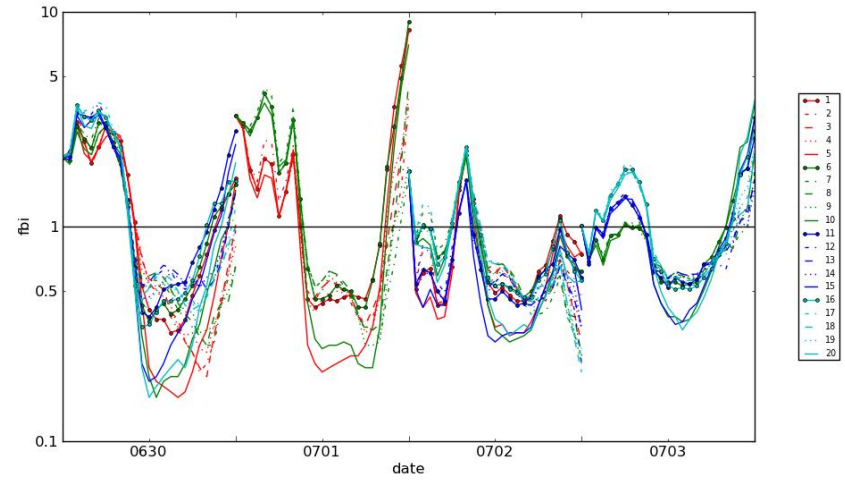
$$\frac{dCAPE}{dt} = \frac{1}{3600} \cdot \frac{L_v}{c_p} \frac{g}{\rho_0 T_0} P$$

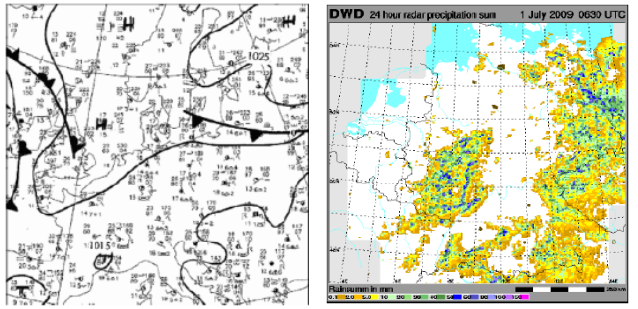
$$\tau_c \sim \cdot \frac{CAPE}{P}$$



Weak forcing (locally-forced, non-equilibrium)





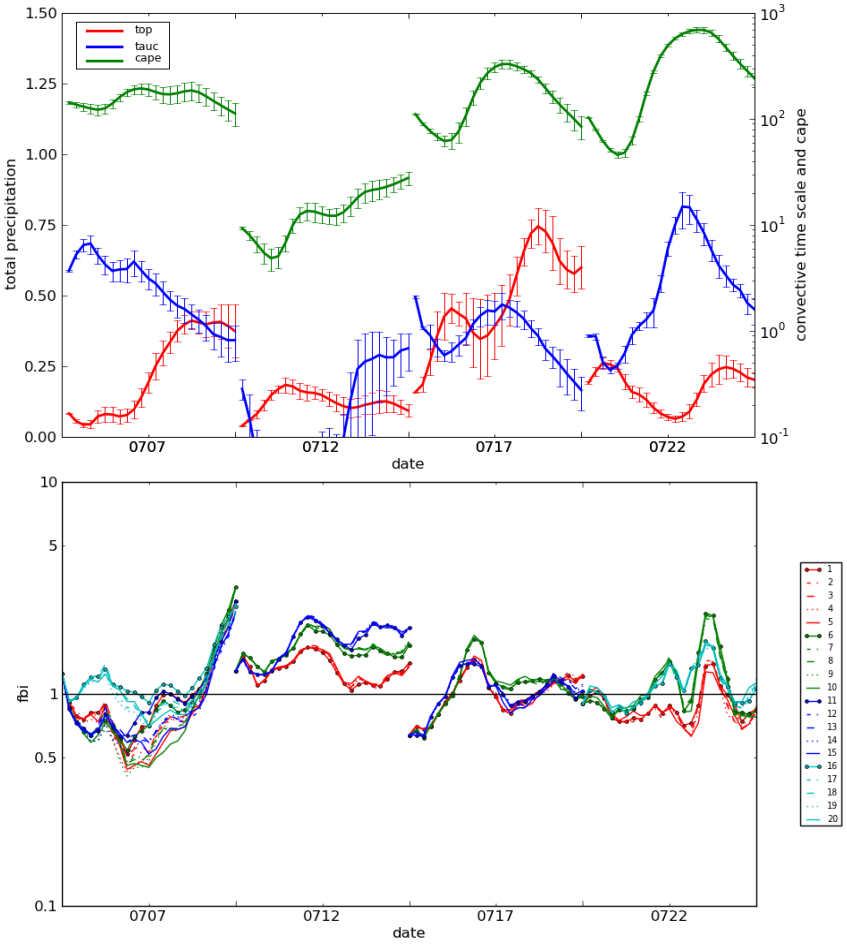


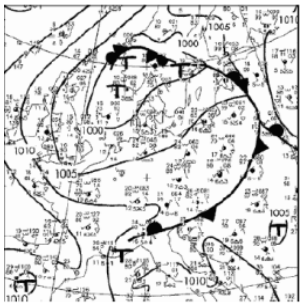
Matrix of ensemble members:

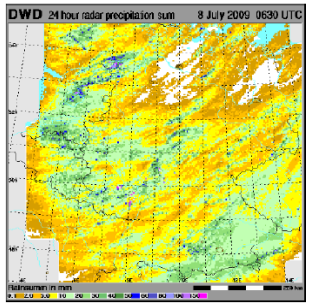
ECMWF	1	2	3	4	5
DWD	6	7	8	9	10
NCEP	11	12	13	14	15
UKMO	16	17	18	19	20

Entrainment rate
Laminar layer depth
Cloud cover
Turb. mixing length

Strong forcing (synoptically-forced, equilibrium)







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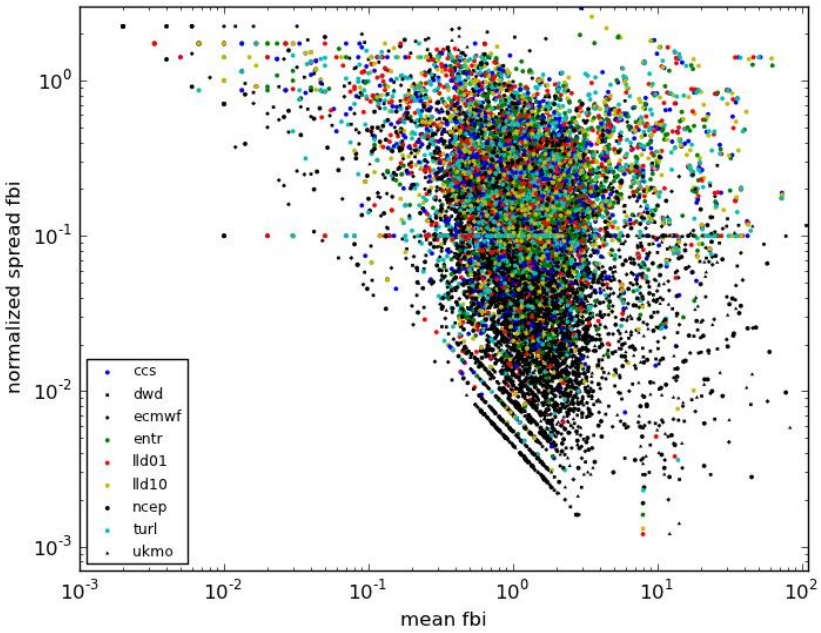
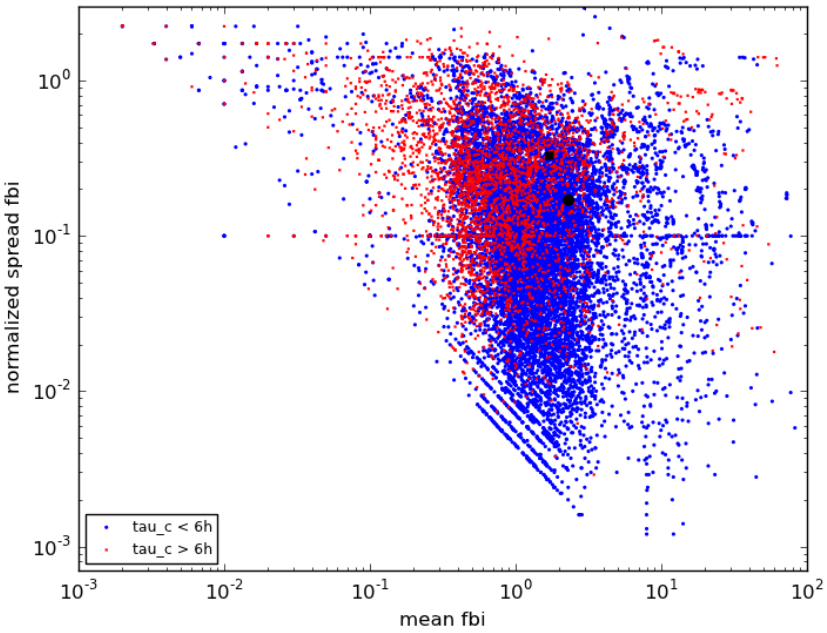
Spread-skill relationship stratified by unc. and τ_c





➢ Two predictability regimes:

- **strong forcing**: sensitive to LBC, τ_c less than a few hours, more predictable
- **weak forcing**: sensitive to PHYS, τ_c more than a few hours, less predictable

Hans-Ertel-Center for data assimilation

Ensemble-based convective-scale data assimilation and the use of remote sensing observations

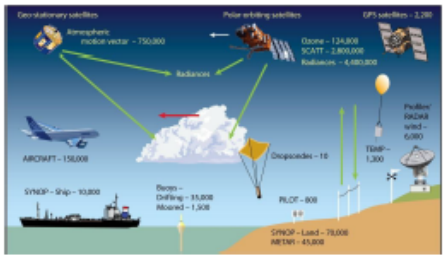
- Research group at LMU Munich, collaboration with DLR
- Strong interaction with DWD research department
- Funding from DWD: 2011-2014

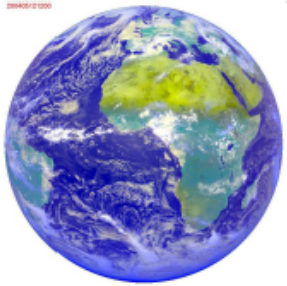
Goals:

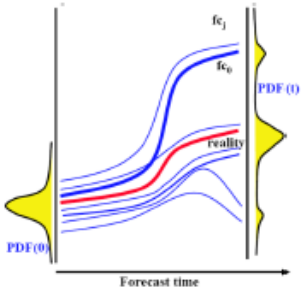
• Fundamental research in the areas of data assimilation (DA) and ensemble forecasting

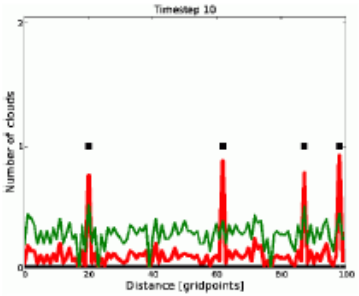
• Training of young researchers and students

Research areas









Observation impact	Satellite observations	Ensemble forecasts	DA methods
Tools to quantify the analysis and forecast impact of observations in EnDA	Direct assimilation of MSG SEVIRI VIS+NIR radiances in KENDA	Improved representation of forecast uncertainty	Methods for convective-scale DA
Monitoring of observations	AMV height correction with lidar observations	KENDA initial perturbations	Idealized tests with non-Gaussian error statistics (toy models)
Optimized use of observations	(Lightning) (ADM-Aeolus)	Flow-dependence and impact time of perturbations	Robust methods for highly non-linear systems