Synthesis of CCN data from the ACTRIS network and complementary observation sites

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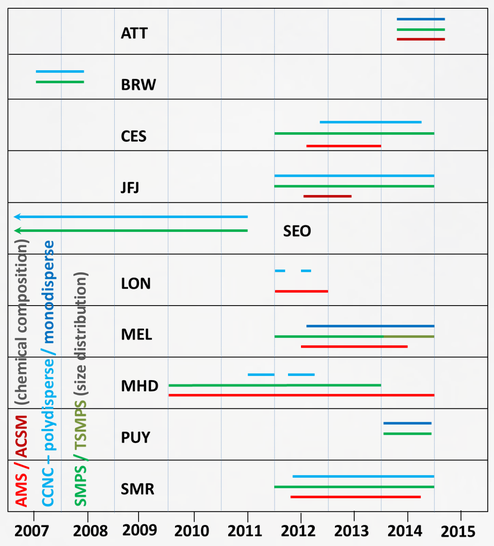
Objectives

- comparison of cloud condensation nuclei (CCN) characteristics in a number of different atmospheric regimes:
  - Arctic
  - boreal forest
  - bontinental remote
  - high altitude
  - marine
  - monsoon-influenced
  - rain forest
  - urban
- investigation of persistence and seasonal behavior
- quality assessment and assurance of ACTRIS CCN data

Data Base and Data Handling



ATT: ATTO tower, Brazil, rainforest

BRW: Barrow, USA, Arctic remote

CES: Cabauw, The Netherlands, rural / marine

JFJ: Jungfraujoch, Switzerland, high-altitude

SEO: Seoul, South Korea, Urban, monsoon

LON: London, UK, urban

MEL: Melpitz, Germany, rural-remote

MHD: Mace Head, Ireland, marine

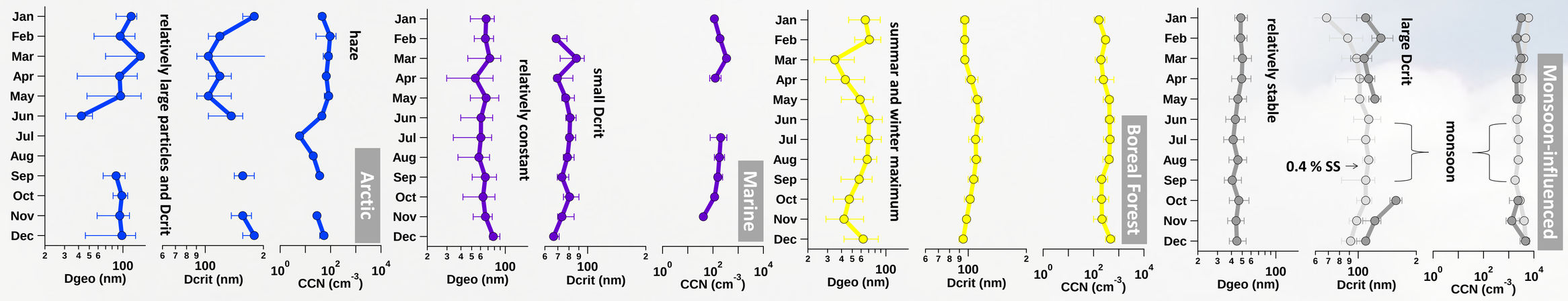
PUY: Puy de Dôme, France, remote-elevated

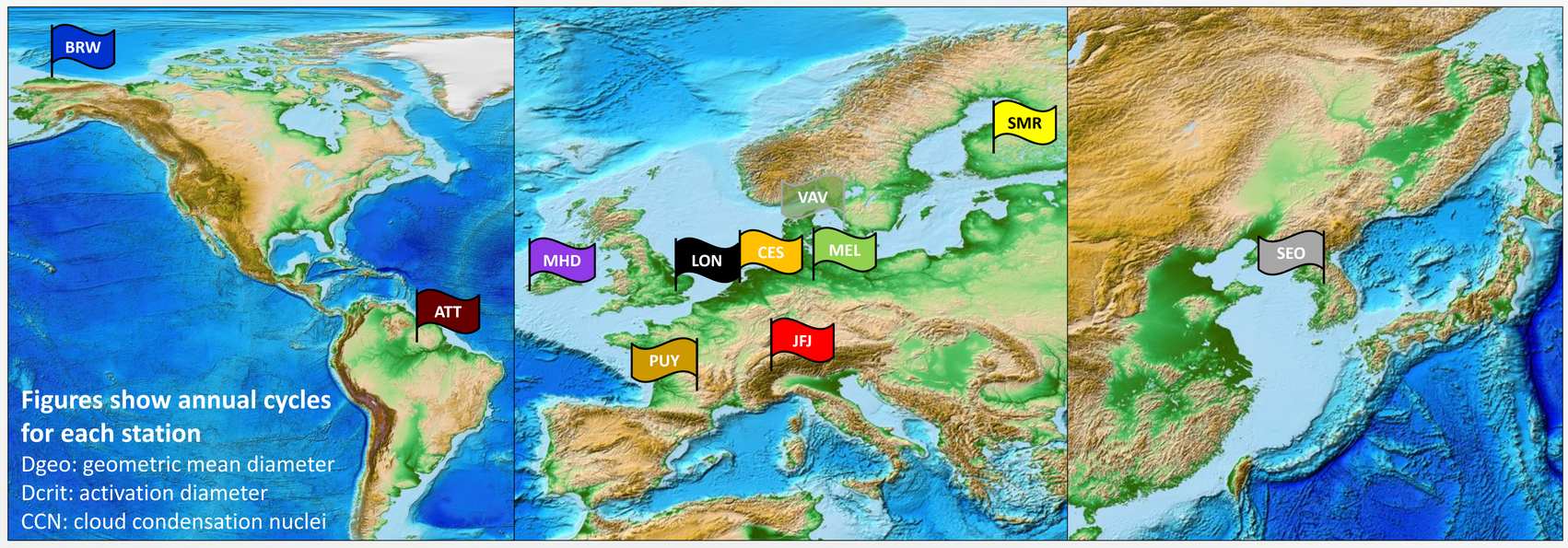
SMR: Hyytiälä, Finland, boreal forest

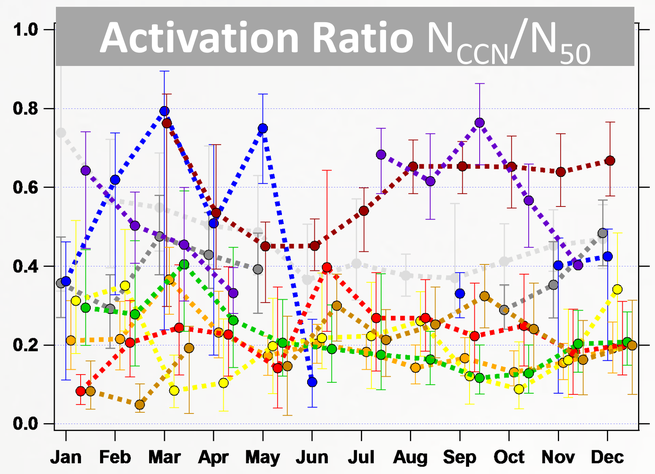
VAV: Vavihill, Sweden (upcoming)

- all data sets were directly obtained from and discussed with the PIs
- averaged to 1 h (4h or 6h), time stamp is the end of saving interval, time in UTC, all in STP
- cloud condensation nuclei concentration (DMT CCNC-100 and mini- CCNC models) measured at or interpolated to 0.2, 0.5 and 1.0 % SS
- chemical composition of PM_1, derivation of kappa after Petters and Kreidenweis (2007)
- size distribution of PM_1, determination of the critical diameter with kappa-Köhler theory
- auto-correlation, the 12 months period with the least data gaps at each station was chosen, gaps were filled with the previous 12h average
- median and interquartiles for SS = 0.2 % are shown

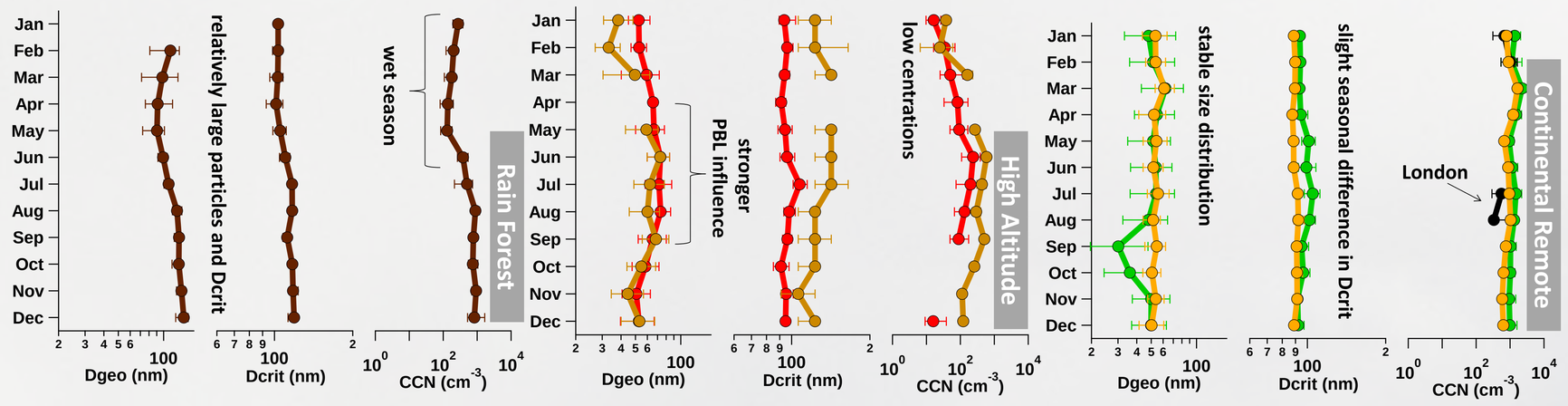
Seasonal & Geographical Variability at SS = 0.2 %

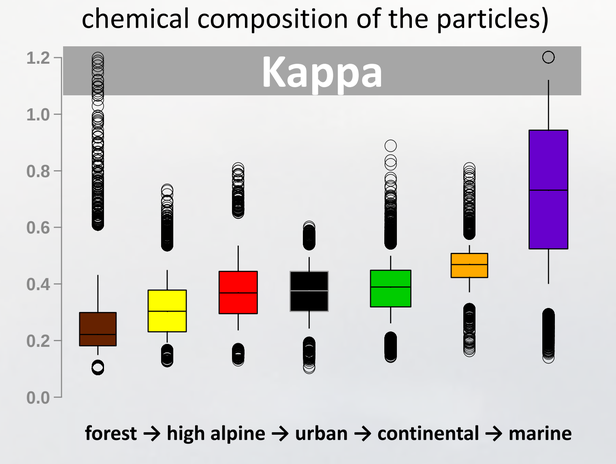




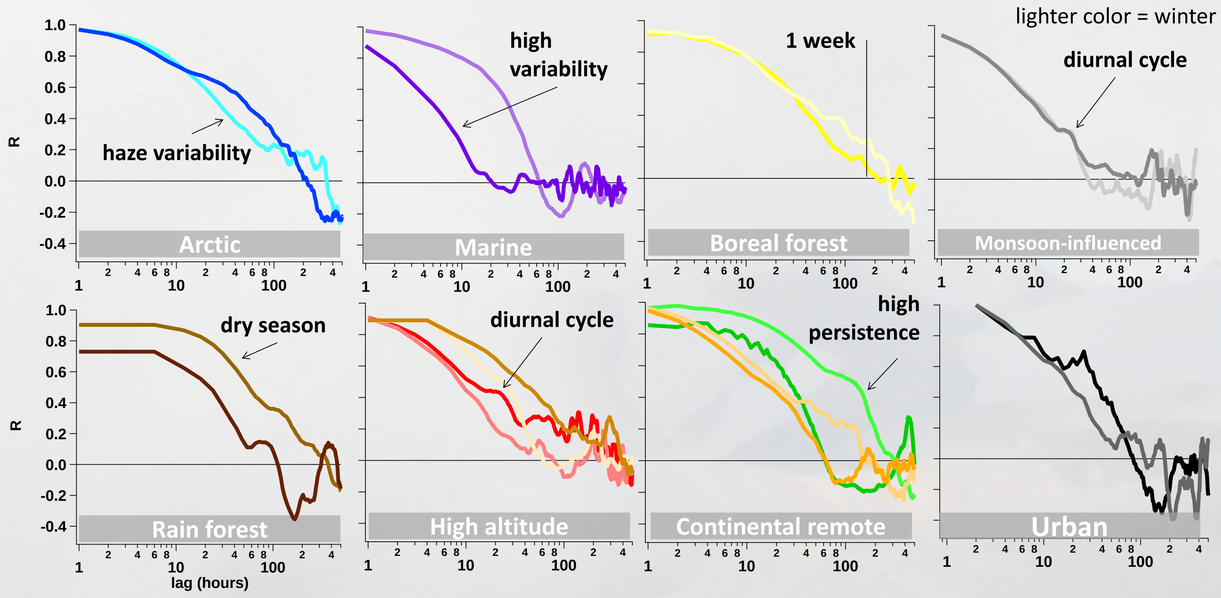


hygroskopicity parameter kappa is based on kappa-Köhler theory (derived from the chemical composition of the particles)





Persistence of CCN concentrations: Winter vs Summer



Figures show the auto-correlation coefficient R versus the time lag for each station type

Summary

- Different environmental conditions lead to station specific CCN variability:
  - rural and marine locations show flat annual and only weak diurnal cycles
  - mountain stations show clear concentration maxima during summer with boundary layer influence and diurnal patterns
  - in the Arctic the Haze season has a strong influence
  - in the rainforest and in Seoul the wet season leads to markedly lower CCN concentrations
- Kappa values are lowest in forest environments, highest near the ocean, and intermediate for remote continental, free tropospheric and urban conditions.
- The activated fraction of particles at each station generally increases with larger geometric mean diameters, independent of higher or lower kappa values.
- Only at the mountain stations CCN are more persistent in summer.
- Largest differences in seasonal persistence occur at the marine site, the rain forest and remote continental locations.

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