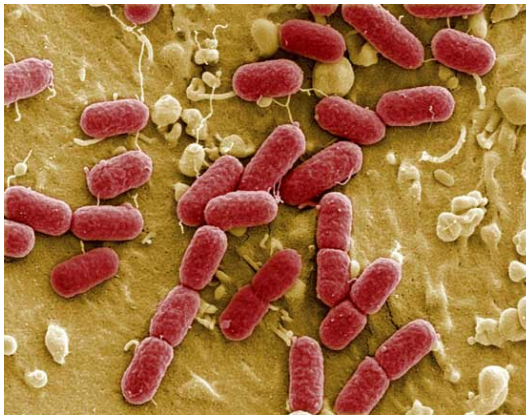
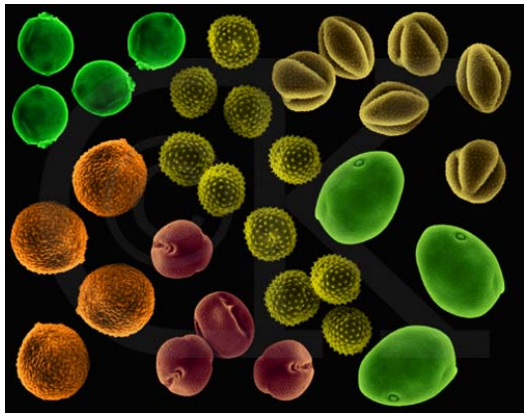
Identifying atmospheric bioaerosol

Anne Perring



Bacteria: ~1 um

Spores: 2-10 um

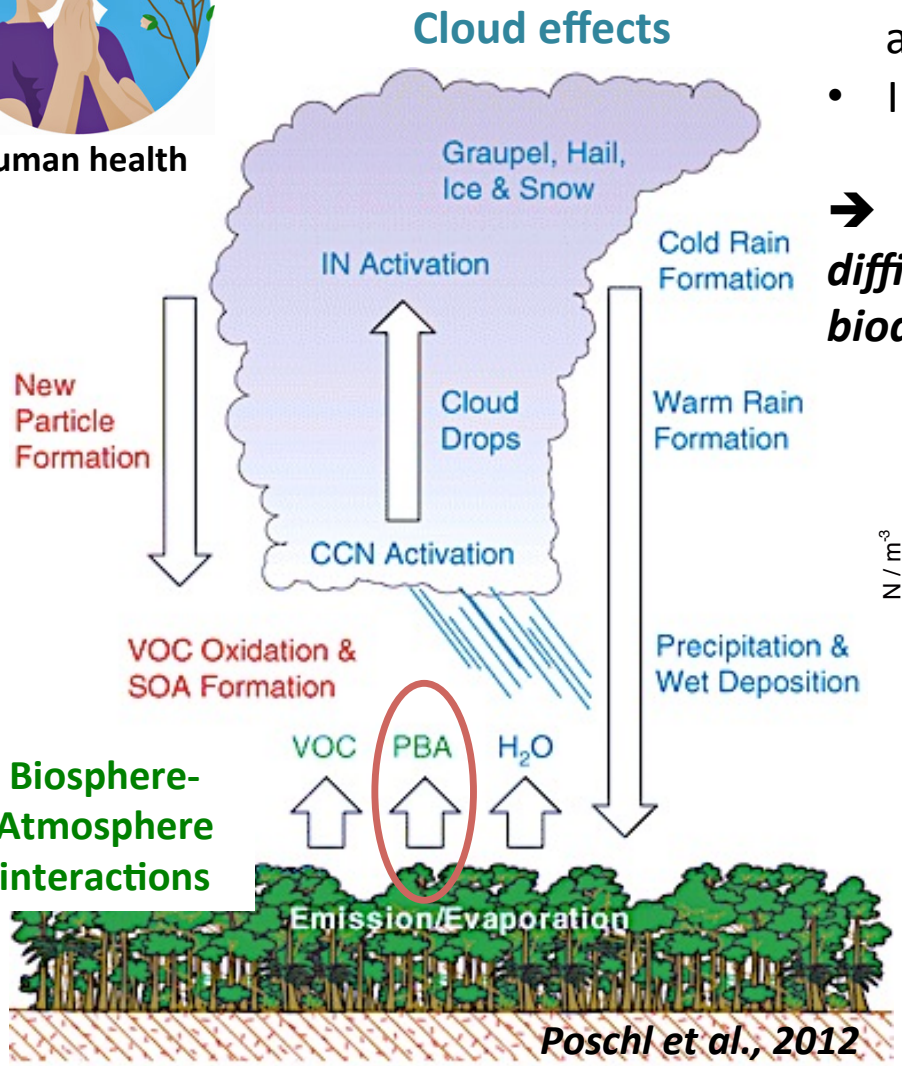


Pollen: >~10 um

- Atmospheric bioaerosol is composed of airborne bacteria, fungal spores and pollen
- There is currently high uncertainty as to the loadings, transport and effects of these particles in the atmosphere
- CSD research in this field began in 2013 with laboratory evaluations of new instrumentation and ambient measurements in various locations

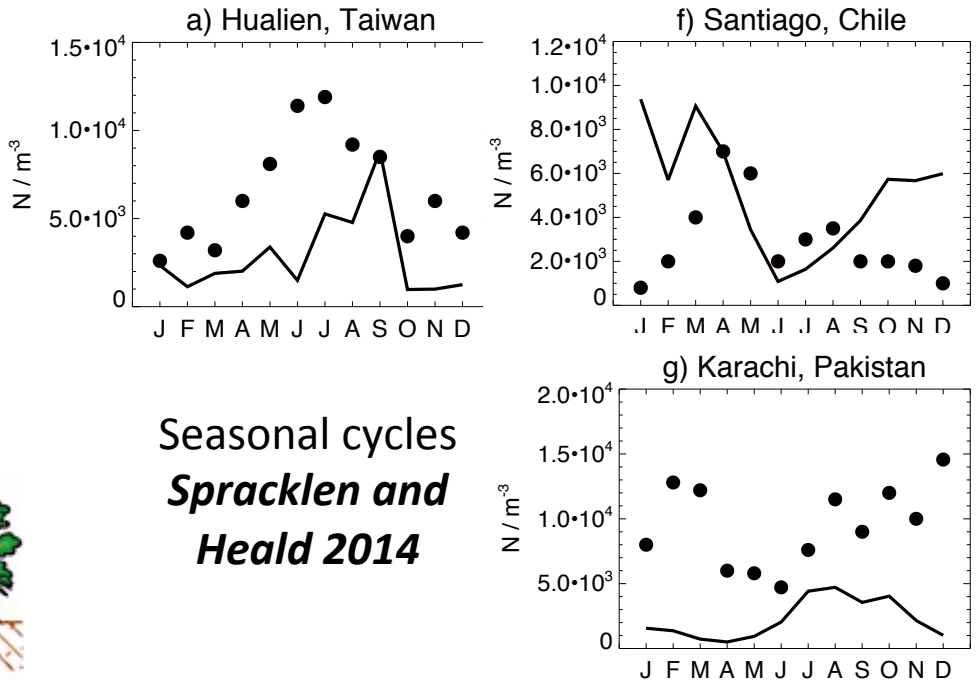
Atmospheric bioaerosol

Human health



- Can have numerous cloud effects including
  - Temperature of glaciation via ice nucleation (IN) activity
  - Droplet size distribution
  - Onset of precipitation
- Feedback mechanism between the biosphere and atmosphere?
- Impacts for human health

➔ ***Existing measurements are so sparse that it is difficult to assess the true importance of bioaerosol on local, regional and global scales***

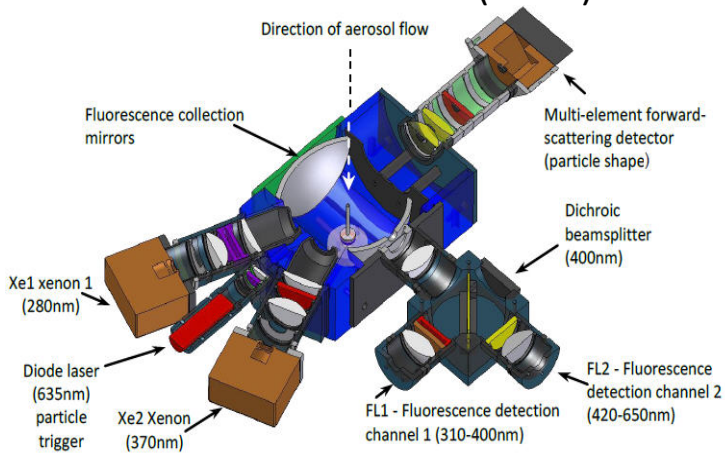


Seasonal cycles
Spracklen and Heald 2014

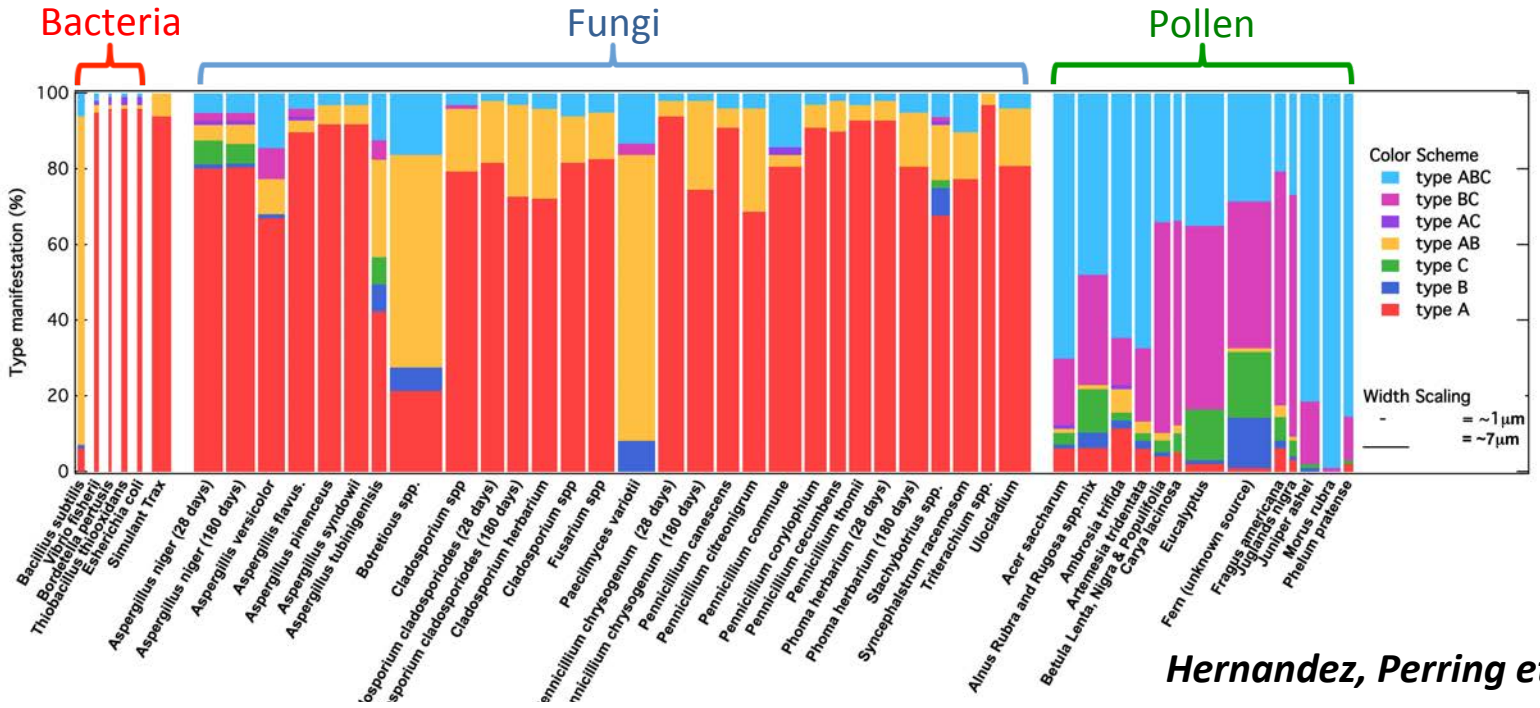
Bioaerosol detection using autofluorescence

- New technique in atmospheric applications
- WIBS counts and sizes particles > 0.8 um
- Working with DMT on improvements and evaluation of WIBS capabilities and limitations.
- Collaboration w/ CU-Boulder to build a reference library

The Wide-band integrated bioaerosol sensor (WIBS)



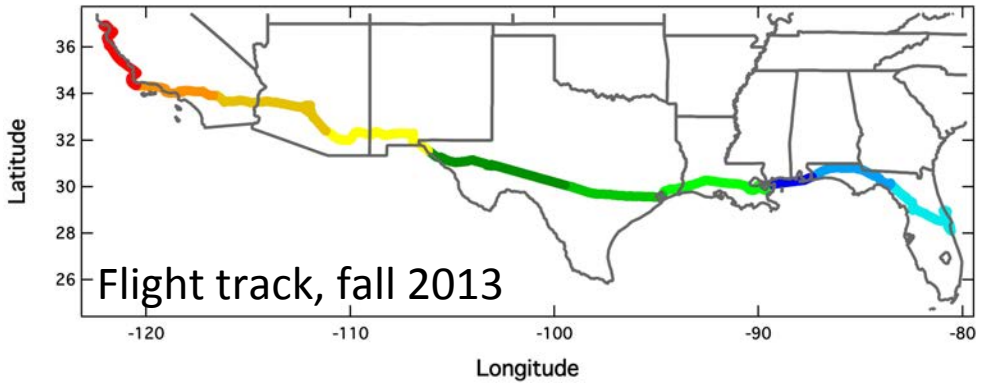
→ CSD-developed classification scheme allows good discrimination between bacteria, fungi and pollen based on measured properties



Colors show different response signatures

Hernandez, Perring et al., in prep. 2015

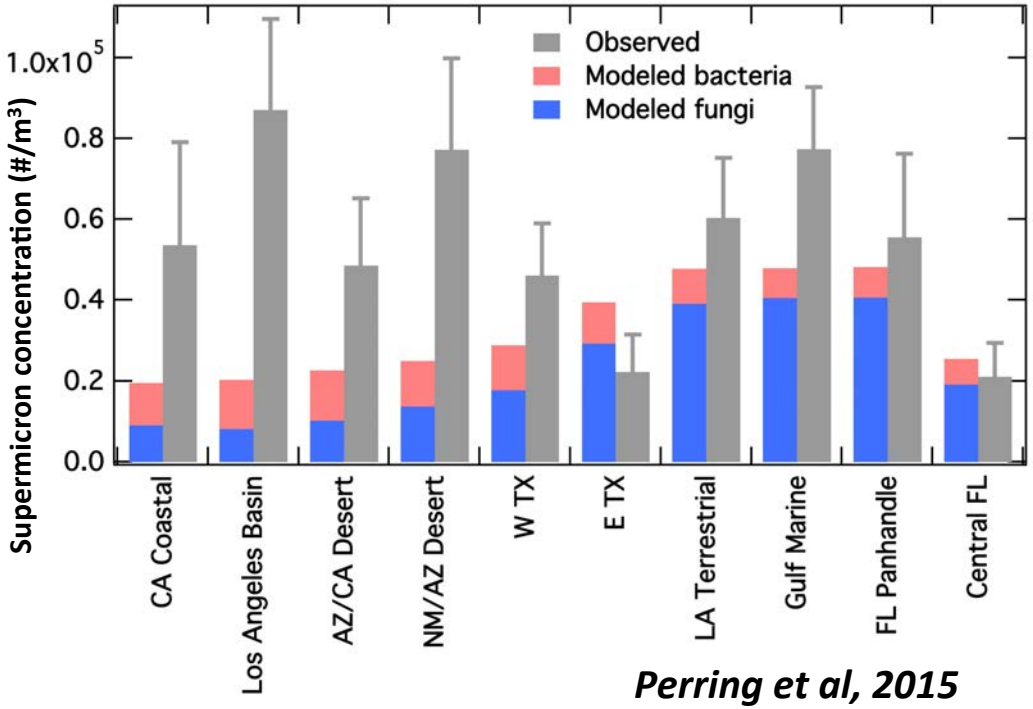
CloudLab Study



- 1st published airborne WIBS measurements
- Wide longitudinal extent and numerous ecosystem types
- Strong trends observed in bioaerosol characteristics and loadings

Model-measurement comparison

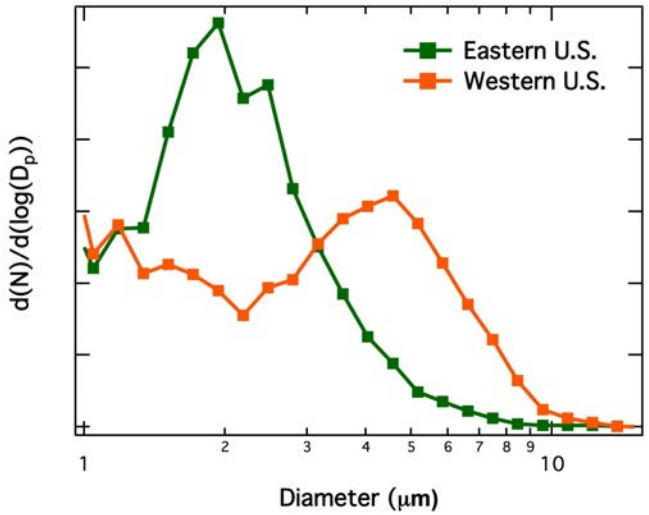
Model underestimate ⟵ Good agreement

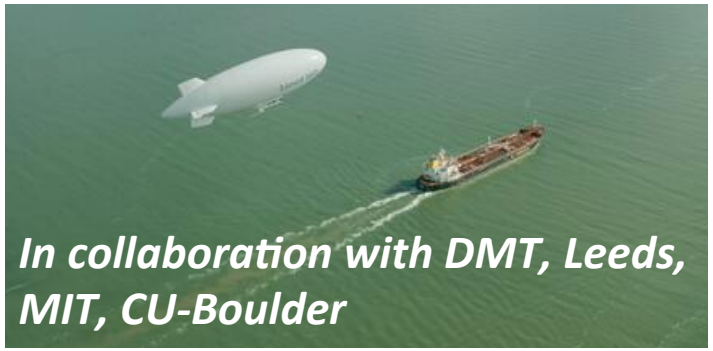


Perring et al, 2015

Bioaerosol size distributions

Larger in the west ⟶

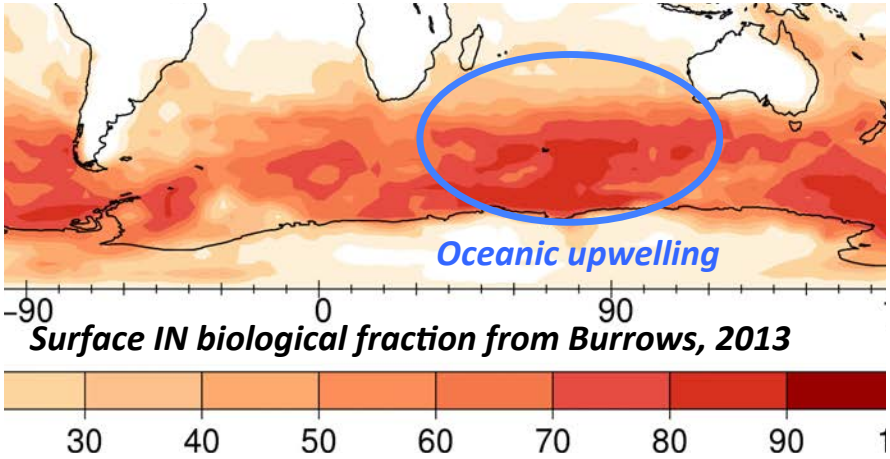




Bioaerosol at Reunion Island

Objectives

- Characterization of southern hemisphere and marine bioaerosol
- La Reunion is downwind of areas of high oceanic productivity
- Ground station with regular nighttime sampling of free tropospheric air
- First ambient comparison of WIBS observations with direct bacteria, spore and pollen counts



Measurements

WIBS: real-time fluorescent aerosol

Collection via impaction: optical microscopy, genetic and component analyses, size-segregated ice nuclei concentrations

In collaboration with CU-Boulder, University of Denver, DMT, Blaise-Pascal Clermont, Meteo France and Universite de la Reunion