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Estimate of the radiative effect of brown carbon using AERONET products

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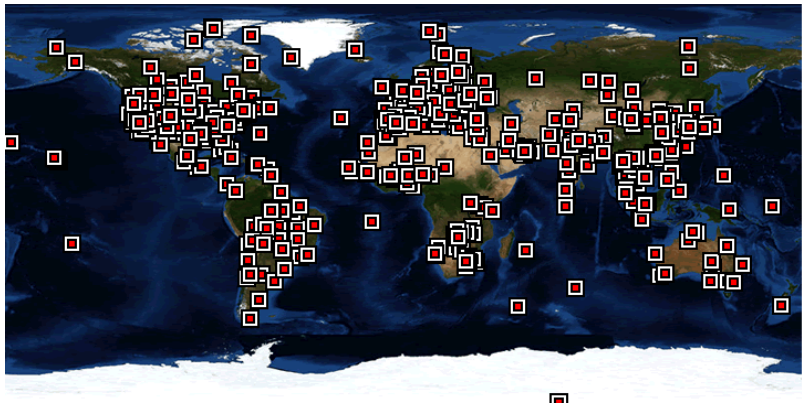
Outline

- Introduction
- Retrieval of BC, BrC, dust from AERONET
- Calculation of BrC radiative effect
- Preliminary results

Introduction

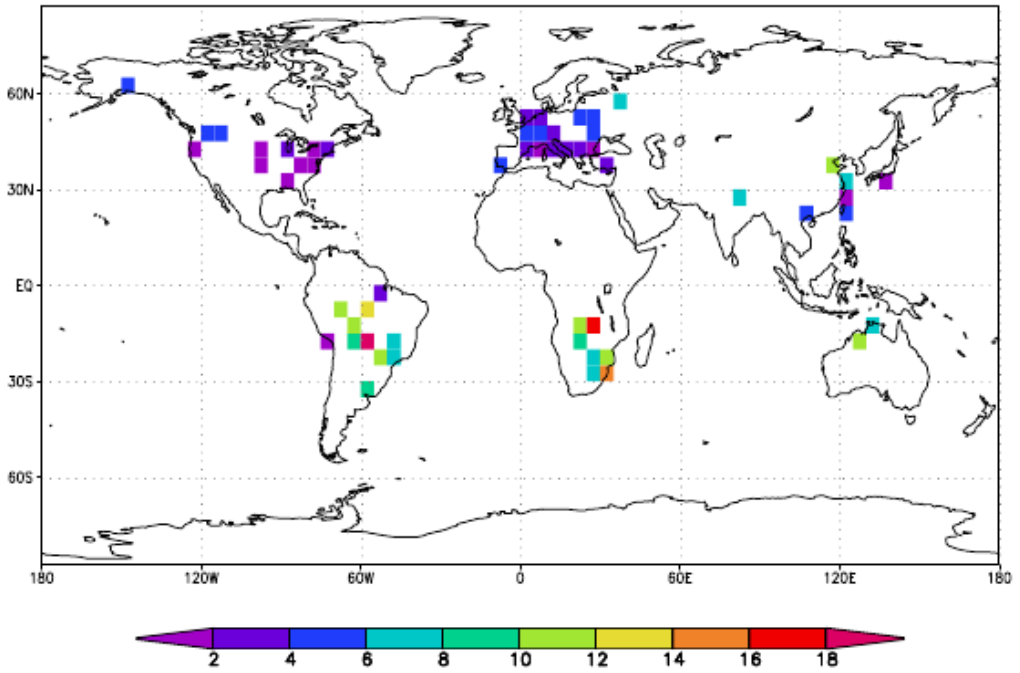
- **AErosol Robotic NETwork (AERONET) provides aerosol remote sensing data from ~670 ground sites**
- **A tempting data source for retrieving aerosol composition**
- **Retrieve aerosol composition from AERONET**
  - Speciation using imaginary refractive indices



http://aeronet.gsfc.nasa.gov/

Schuster , G. L., O. Dubovik, B. N. Holben, and E. E. Clothiaux, Inferring black carbon content and specific absorption from Aerosol Robotic Network (AERONET) aerosol retrievals, J. Geophys. Res., 110, D10S17, doi:10.1029/2004JD004548, 2005.

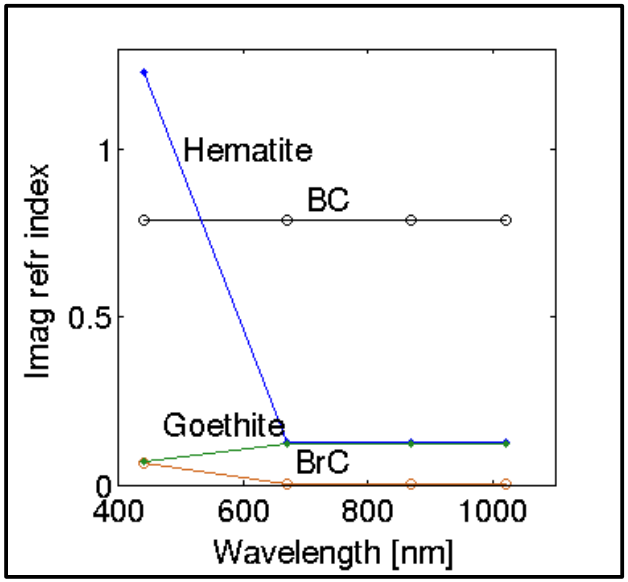
Arola, A., Schuster, G., Myhre, G., Kazadzis, S., Dey, S., and Tripathi, S. N.: Inferring absorbing organic carbon content from AERONET data, Atmos. Chem. Phys., 11, 215-225, doi:10.5194/acp-11-215-2011, 2011.

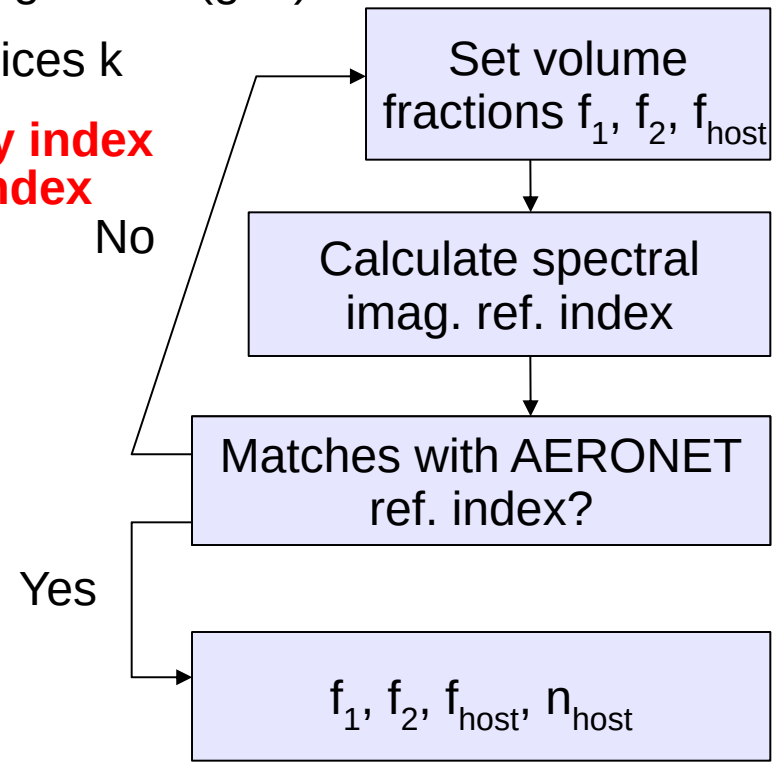


Mean absorbing OC concentration (mg/m^2) inferred from AERONET-retrieved imaginary indices for September.

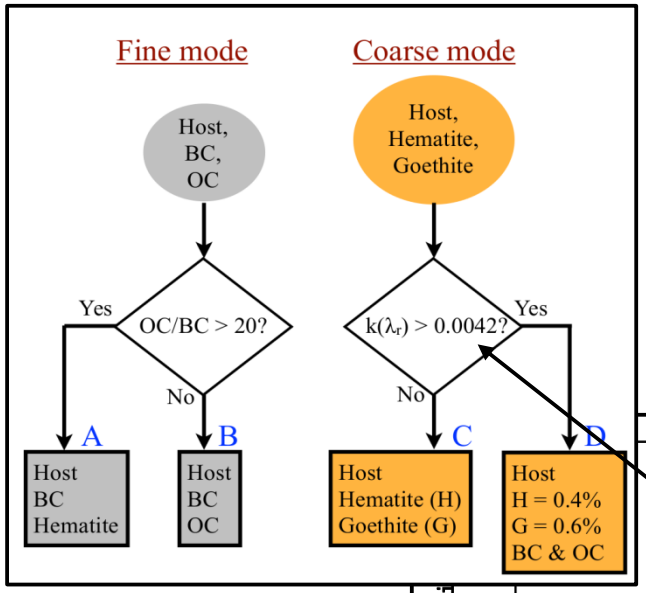
Retrieving aerosol composition 1/2

- **4 absorbing components + a scattering host**
  - Fine mode initially: brown carbon (BrC), black carbon(BC)
  - Coarse mode initially: hematite (hem), goethite (goe)
  - Fixed spectral imaginary refractive indices k
- **Adjust amounts to fit mixture imaginary index to the observed AERONET imaginary index**



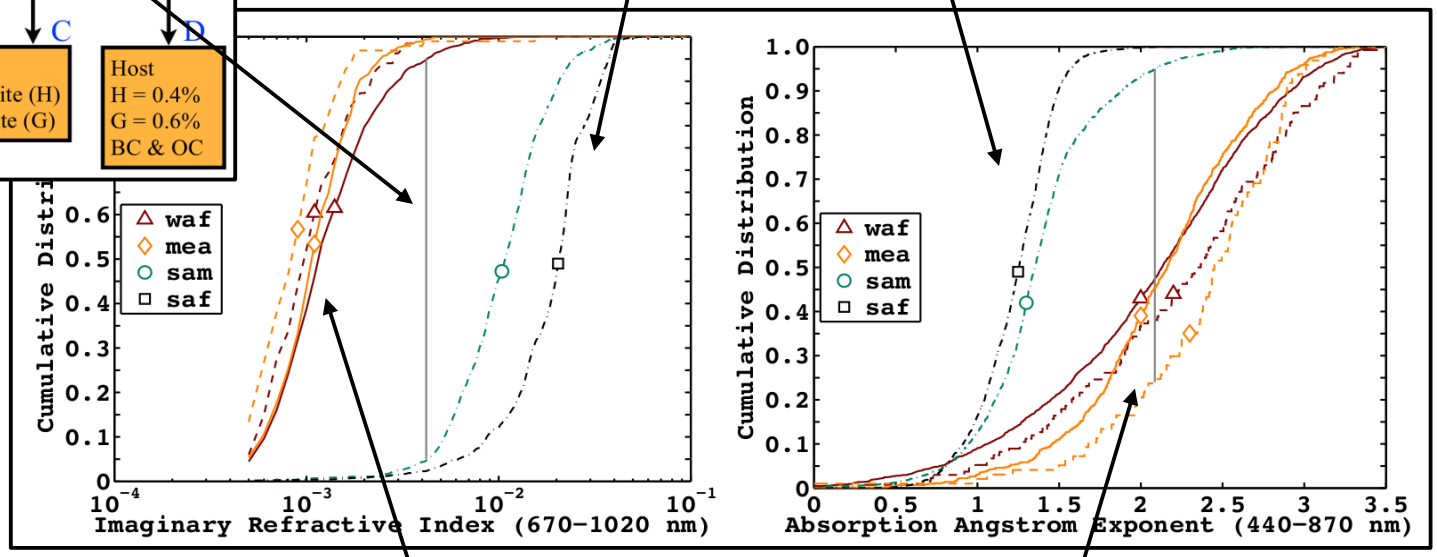


Retrieving aerosol composition 2/2



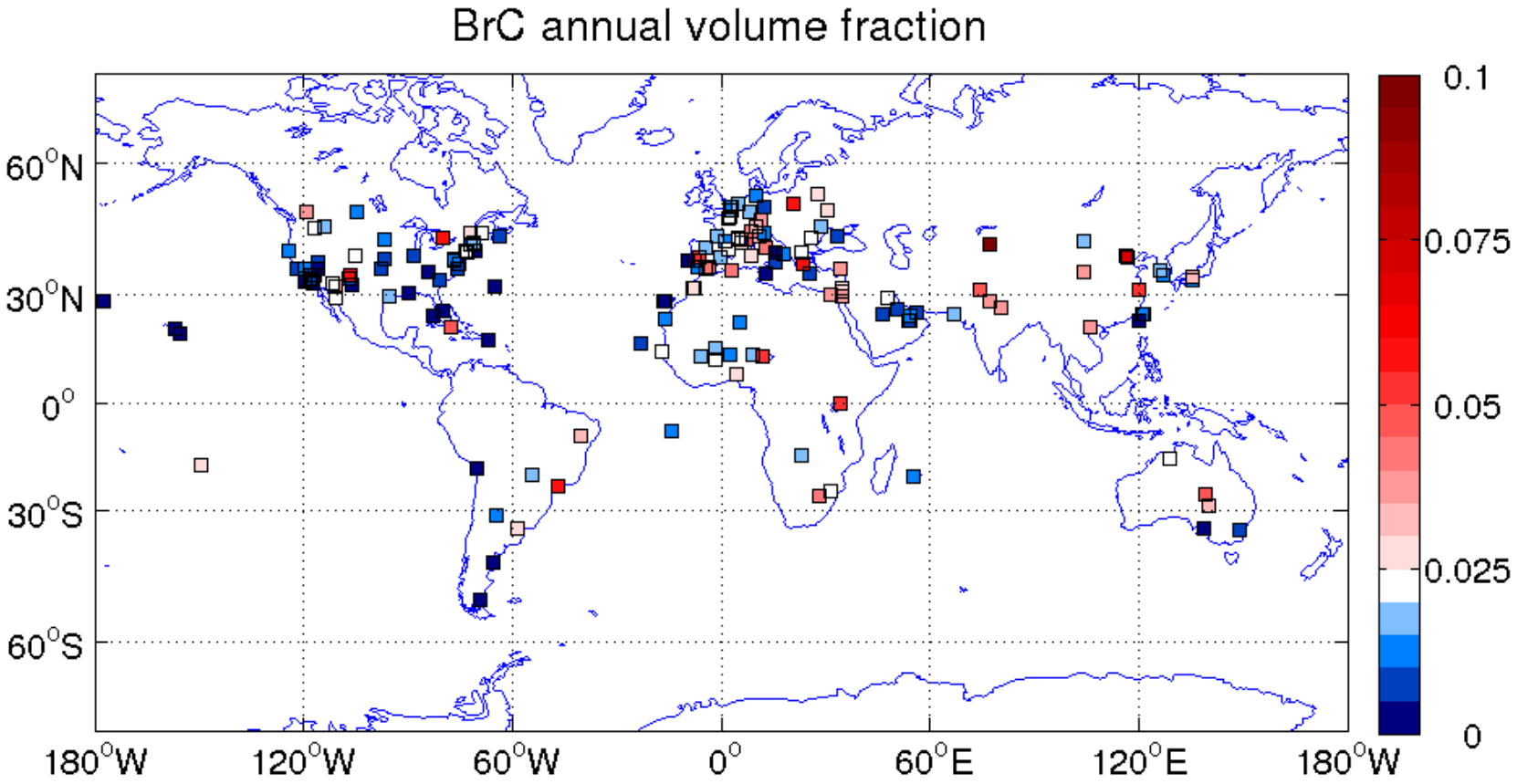
- Fine mode may also have dust
- Coarse mode may also have carbonaceous

Biomass burning season

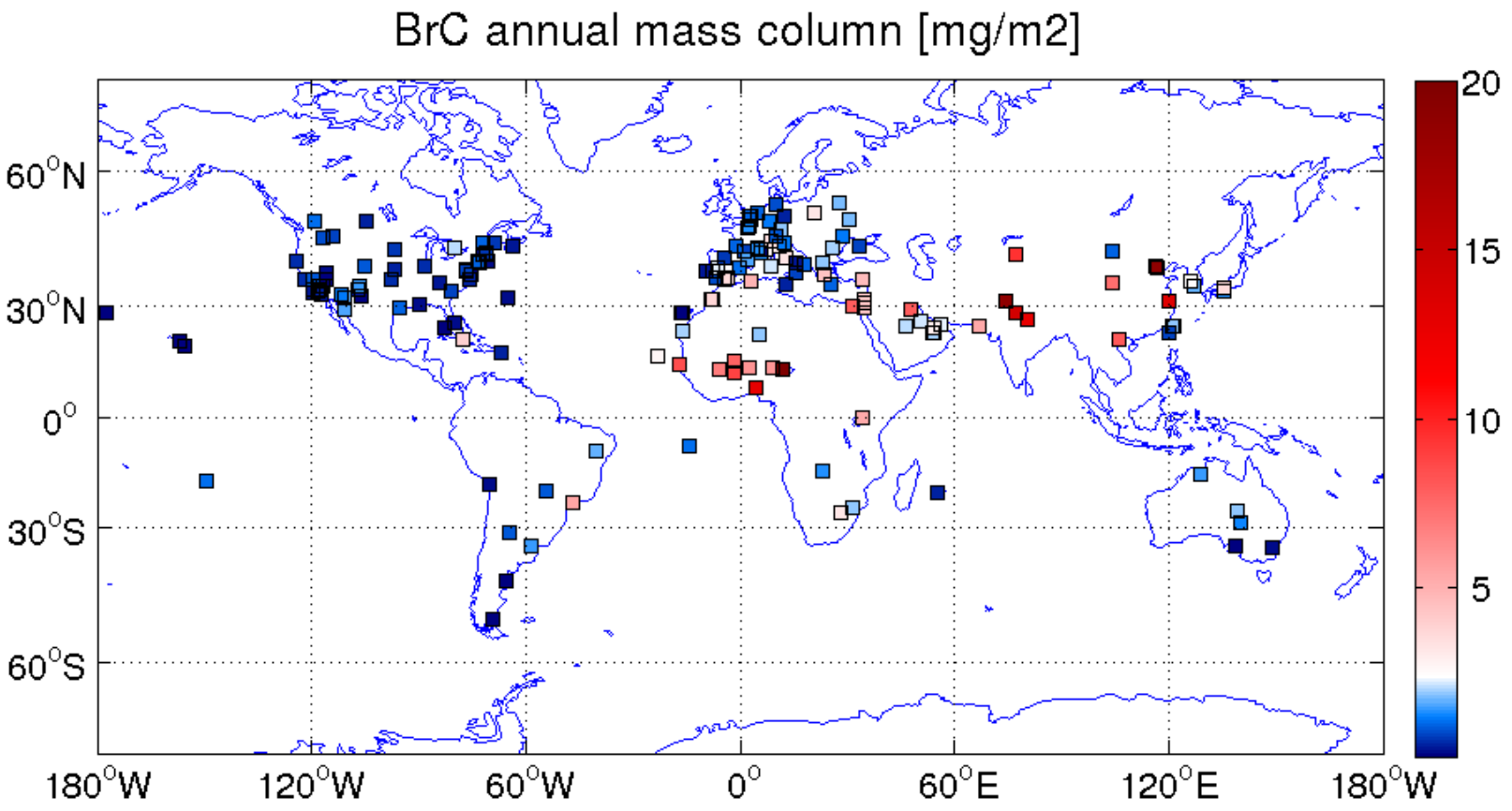


Dust: fvf < 0.05, dp(532nm) > 0.2

Global distribution of BrC

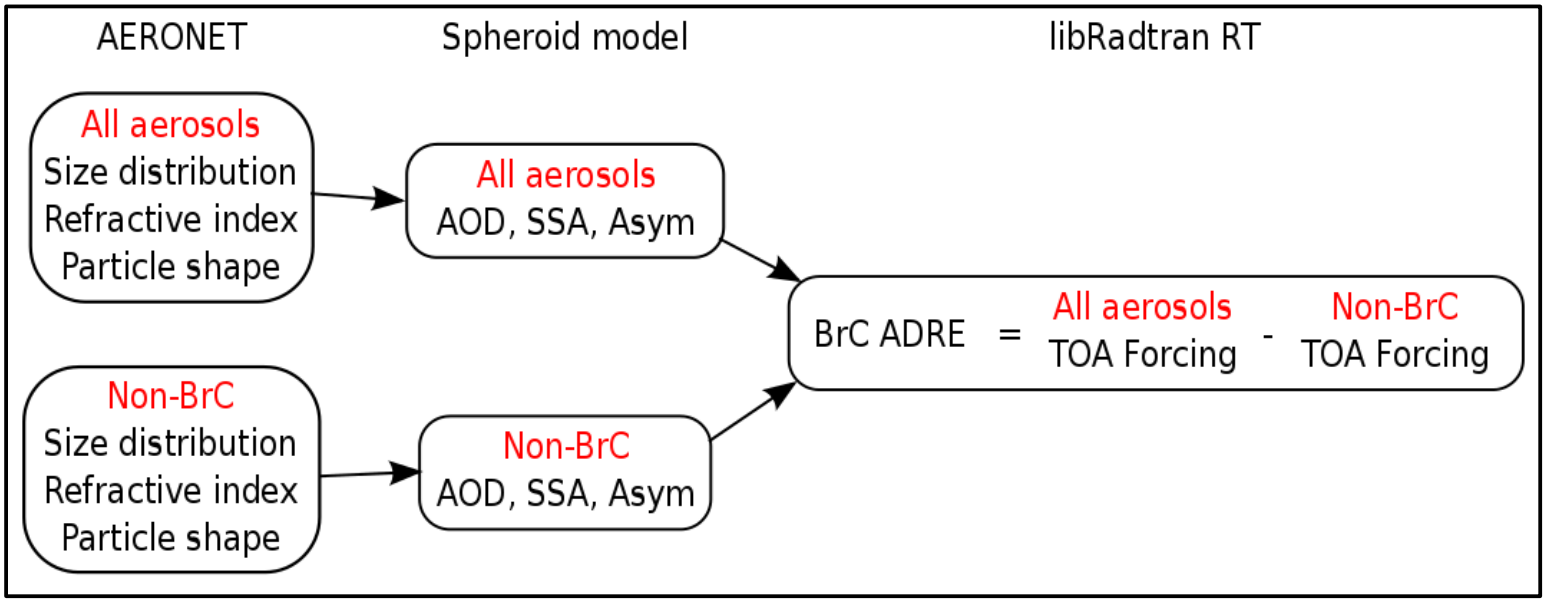


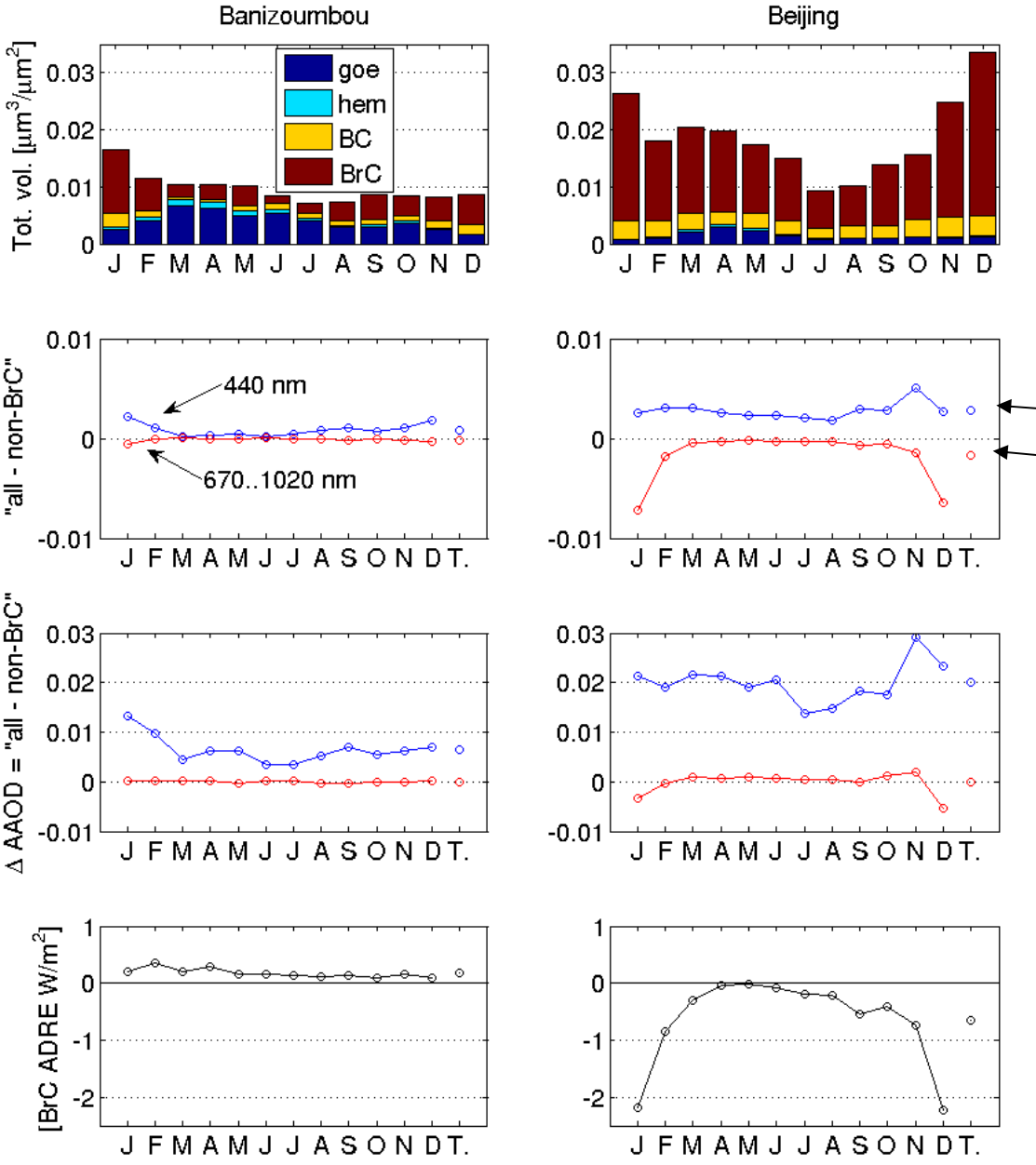
Global distribution of BrC



Means to calculate BrC ADRE

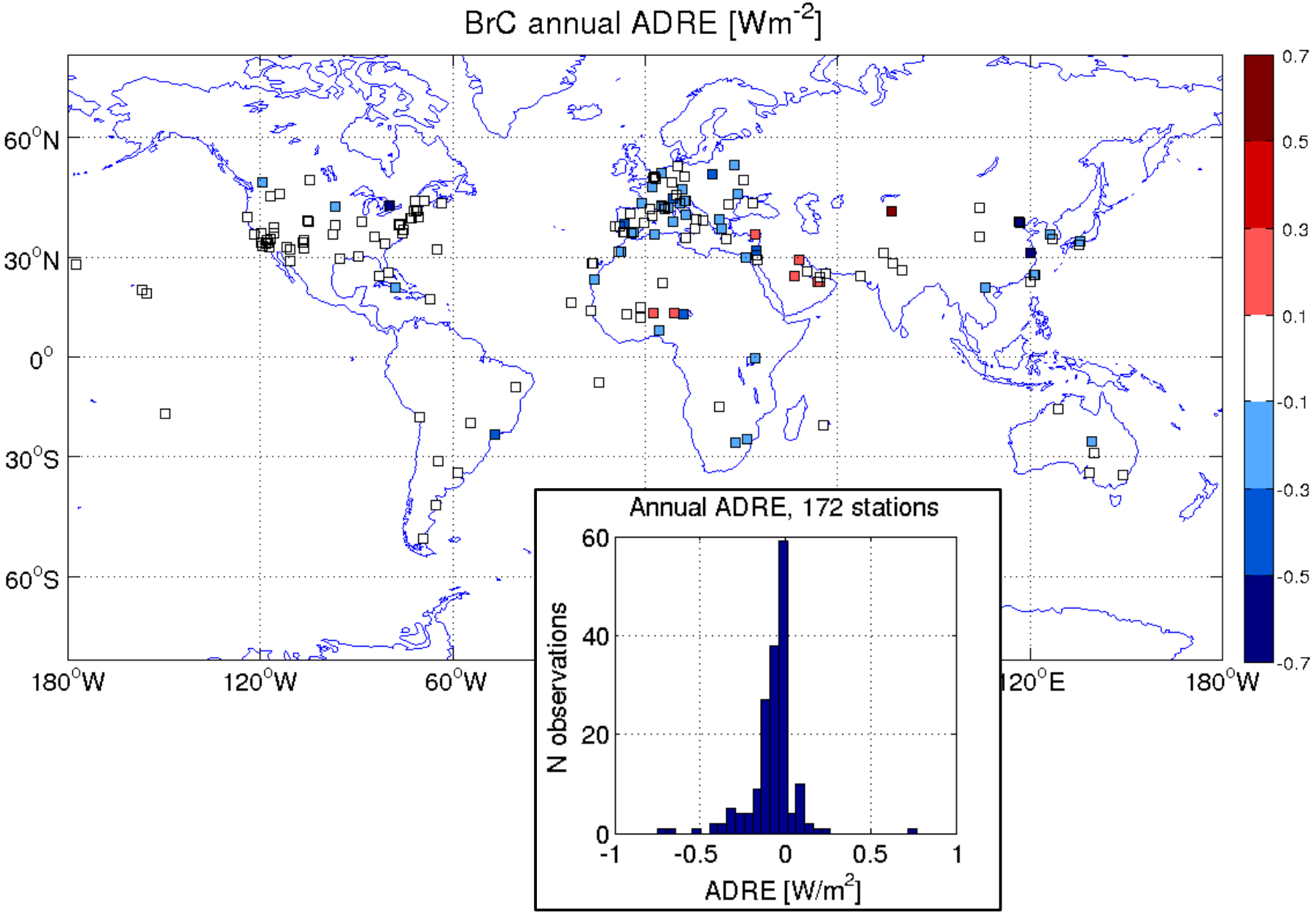
- **BrC quantity from retrieval**
- **Spheroid model: AOD, SSA, asymmetry parameter, sphericity (Dubovik et al., 2006)**





- 400 nm: BrC absorber
- 670-1020: BrC scatterer

- Reasoning BrC ADRE:
  - Albedo
  - Other aerosols


BrC annual ADRE [Wm-2]
60°N
30°N
0°
30°S
60°S
180°W
120°W
60°W
120°E
180°W
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
-0.7
Annual ADRE, 172 stations
N observations
60
40
20
0
-1
-0.5
0
0.5
1
ADRE [W/m2]

Summary

- **Retrieve BC, BrC and dust amounts from AERONET**
  - Fit spectral imaginary refractive index
- **BrC ADRE seems to range between -0.8 and 0.8 W/m^2**
- **Future work with BrC climatic effects:**
  - Combine with a climate model for global coverage
  - Extend to estimate BC ADRE