Polarization Study using ARTS

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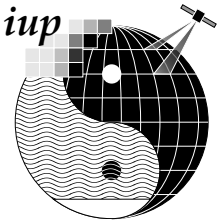

Bredbeck Workshop
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Definitions

- Types of scattering media

  p20 : randomly oriented particles
  p30 : azimuthally randomly oriented particles

- Definition of stokes vector components

$$I = I_v + I_h$$
$$Q = I_v - I_h$$

Simulation Setup

- cloud setup

  pnd : $43199\ \frac{1}{m^3}$
  $\mathrm{r_{eff}}$: $68.5\ \mu m$
  particle size distribution : $\Gamma, mono$
  $\Rightarrow$ imc : $0.02\ \frac{g}{m^3}$, $0.05\ \frac{g}{m^3}$
  cloudheight : $10.6 - 12.3\ km$

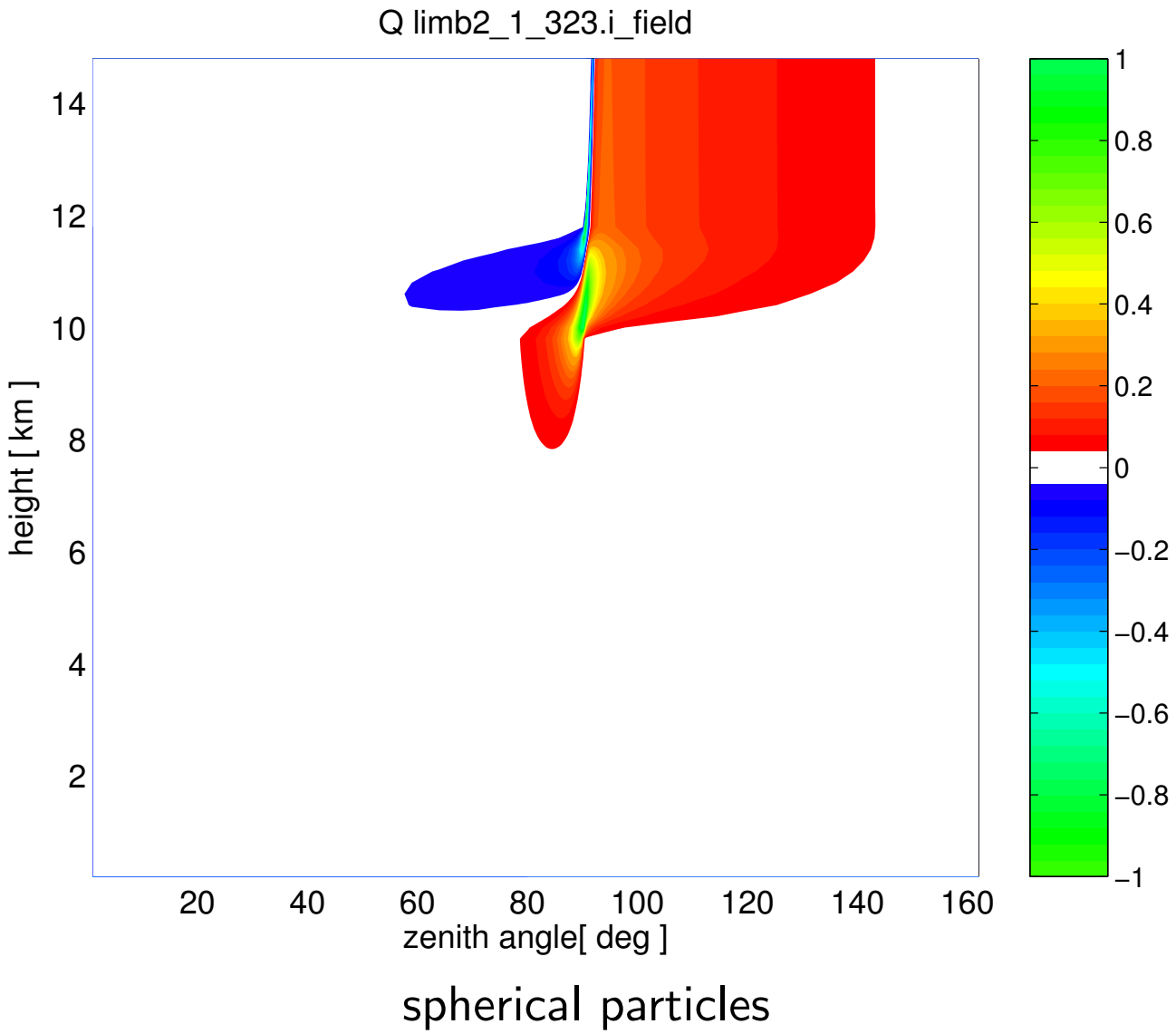
- atmospheric setup

  midlatitude-summer scenario
  profiles : FASCOD
  species : $\mathrm{H_2O}, \mathrm{O_3}, \mathrm{N_2}, \mathrm{O_2}$
  spectroscopical data : HITRAN

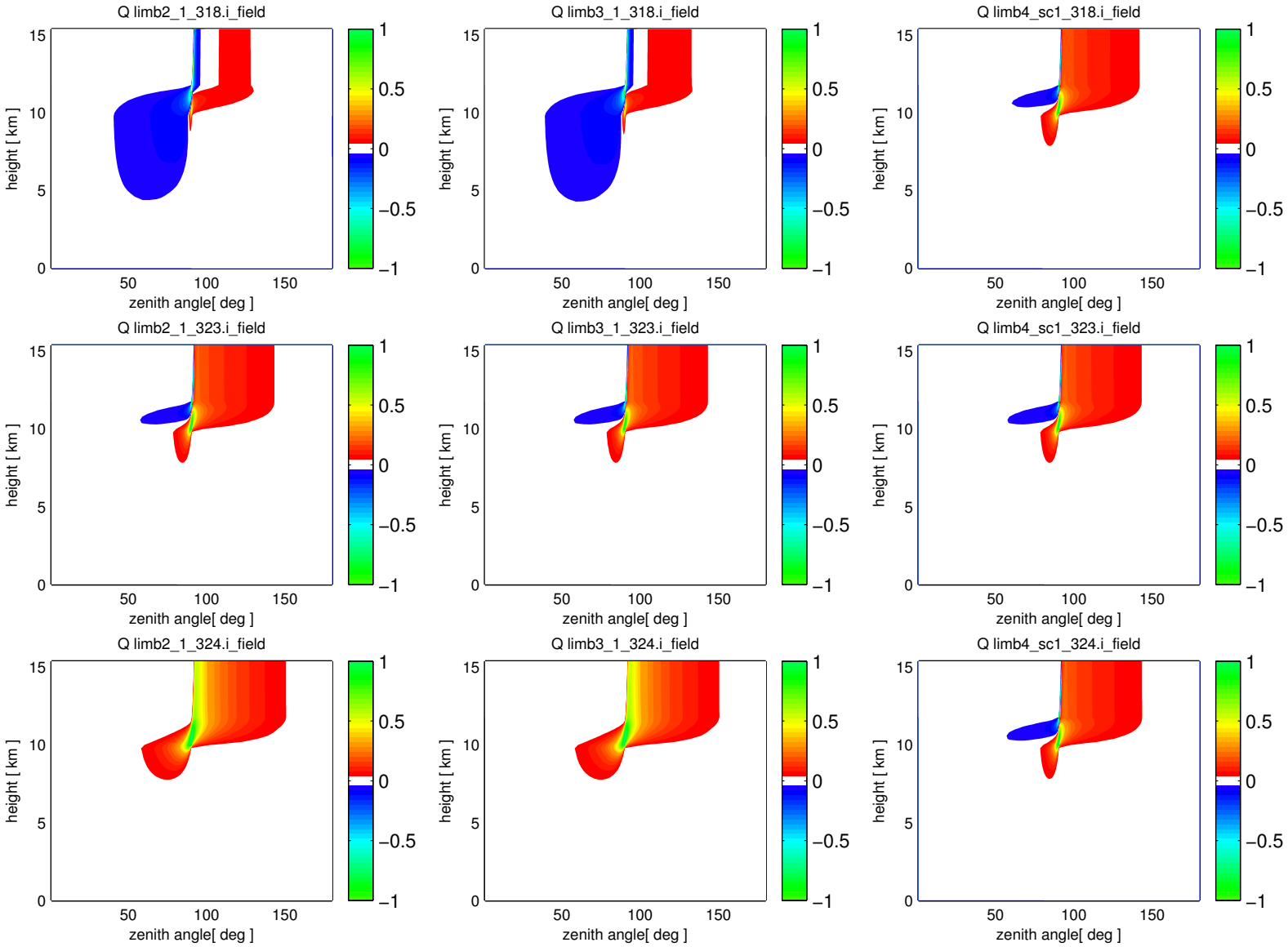
- numerical setup

  cloudbox : 6-16 km
  ssp : from Mishchenko (Γ-distr.) and PyARTS (mono-distr.)

Polarization difference field (p20, Γ, 323 Ghz)

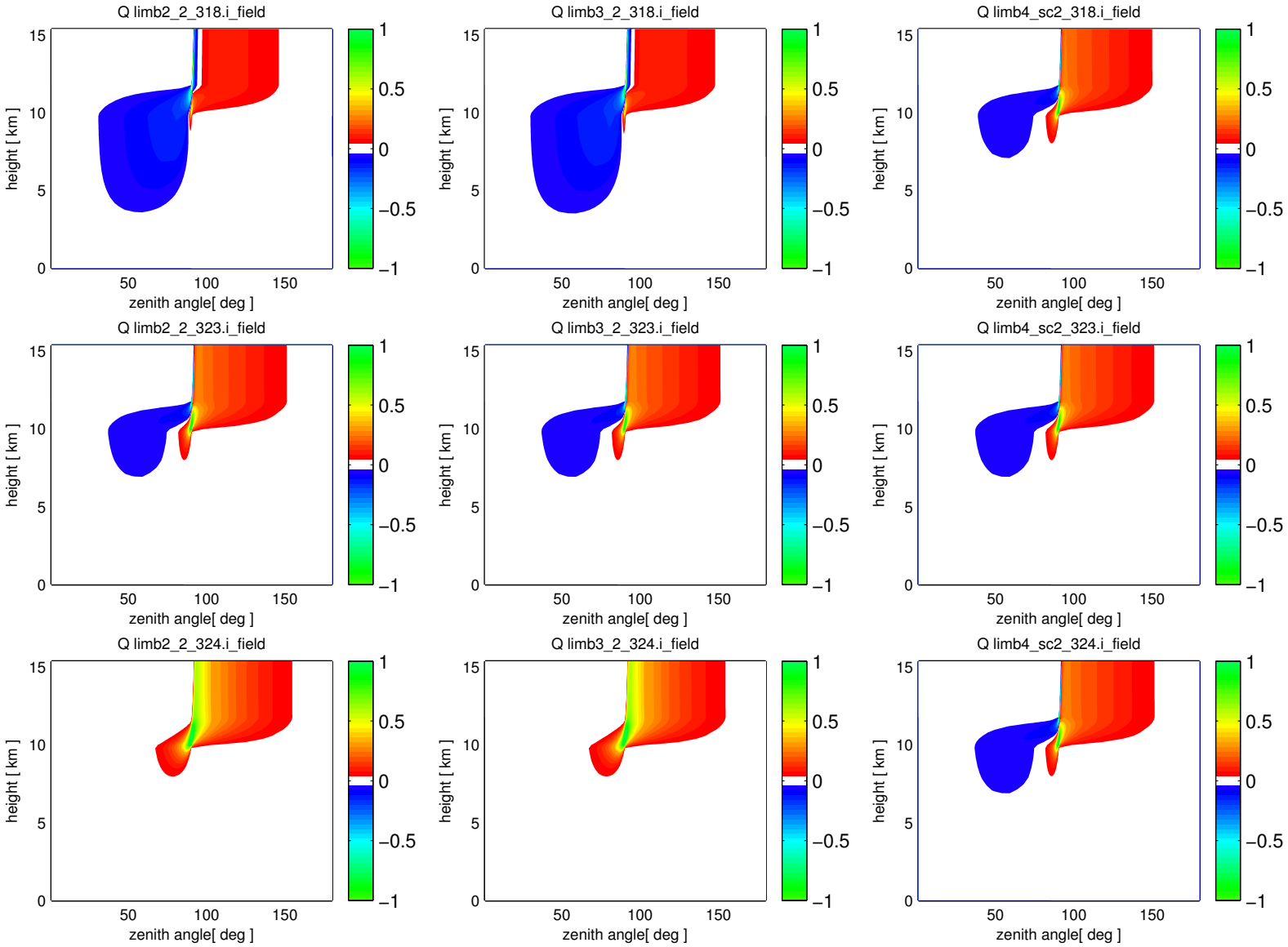


Effect of gas absorption and scattering properties (p20, Γ)



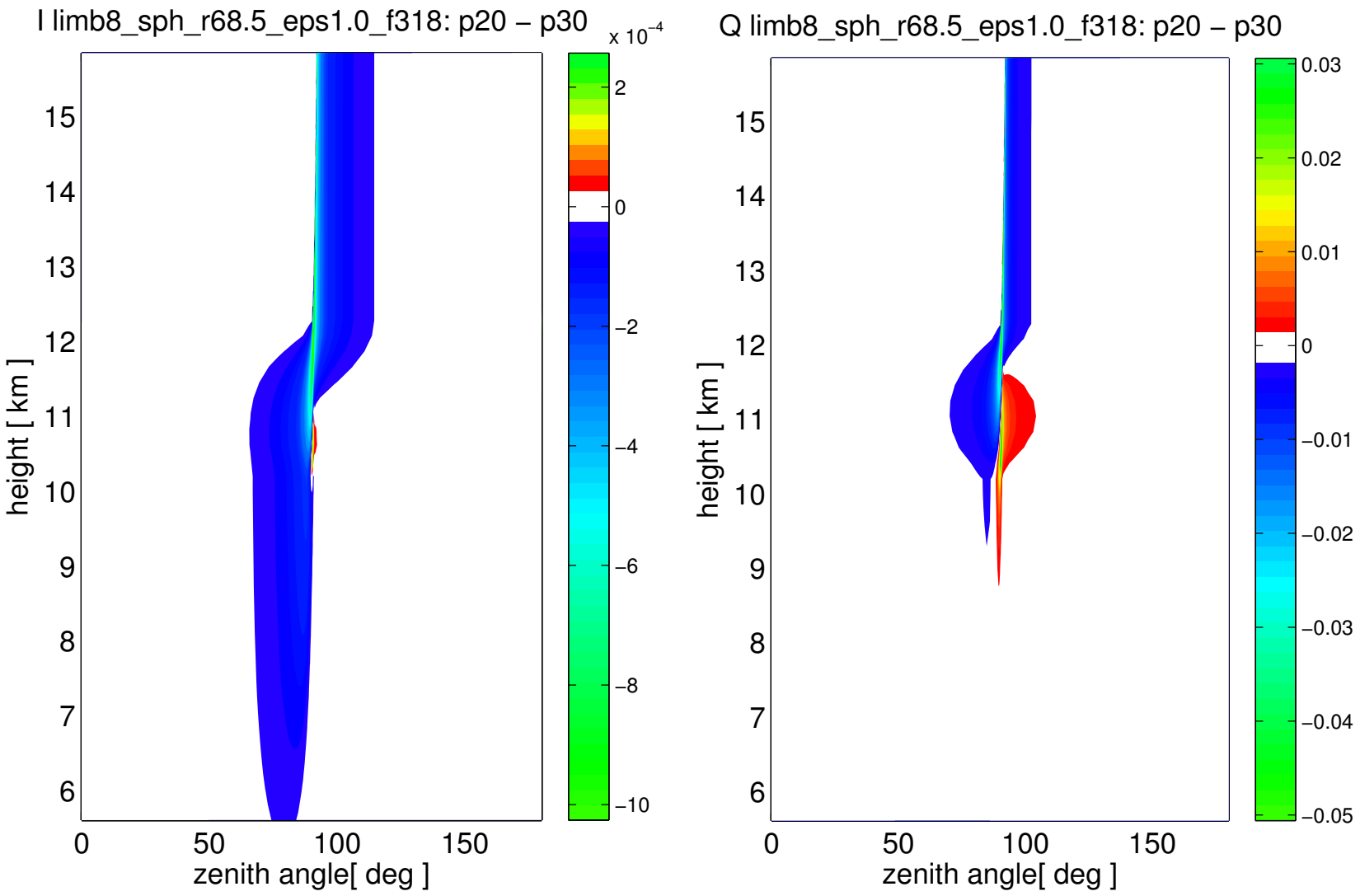
spherical particles

Effect of gas absorption and scattering properties (p20, Γ)



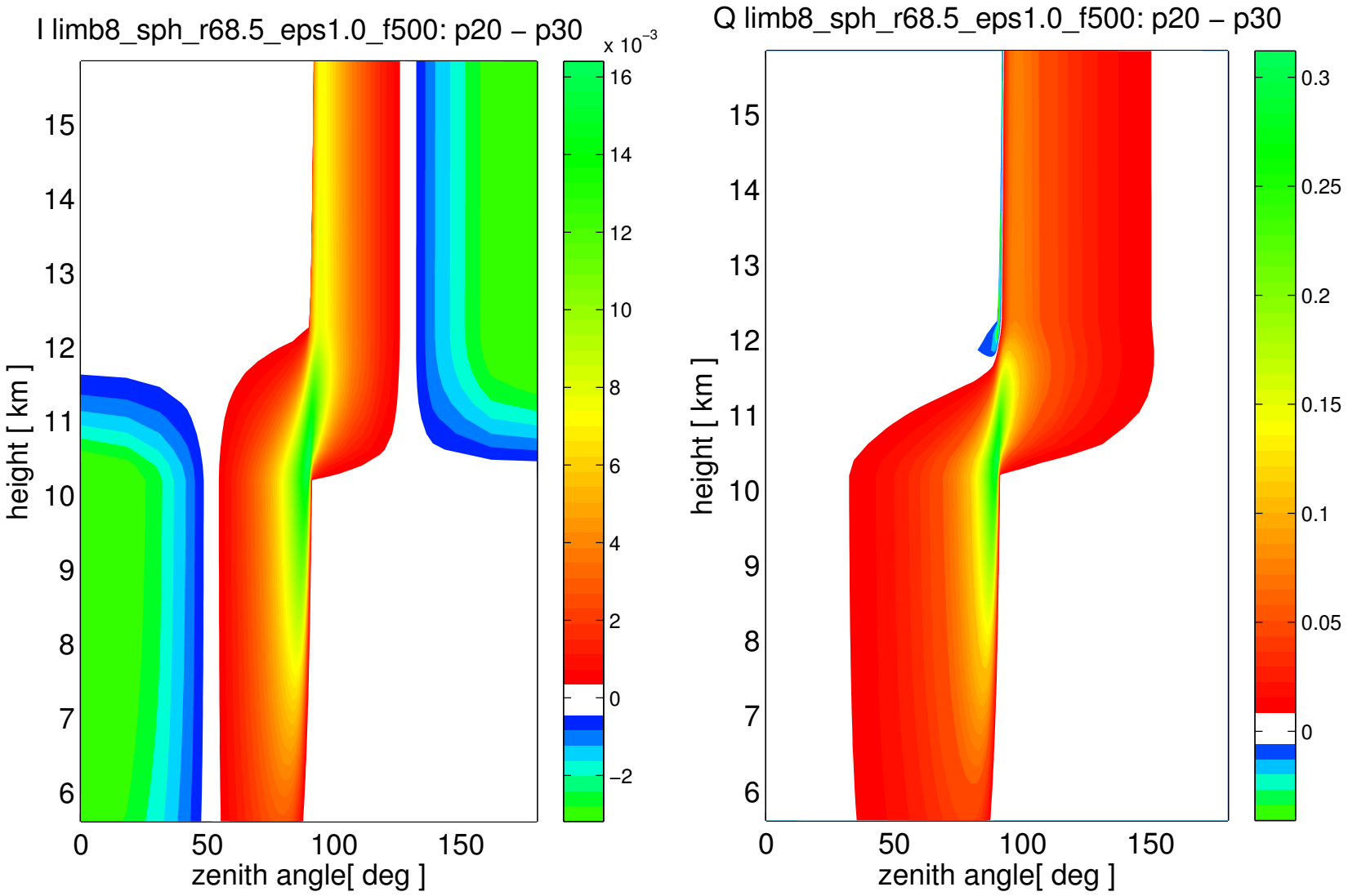
cylindrical particles with aspect ratio 0.3

Consistency check for 318 GHz



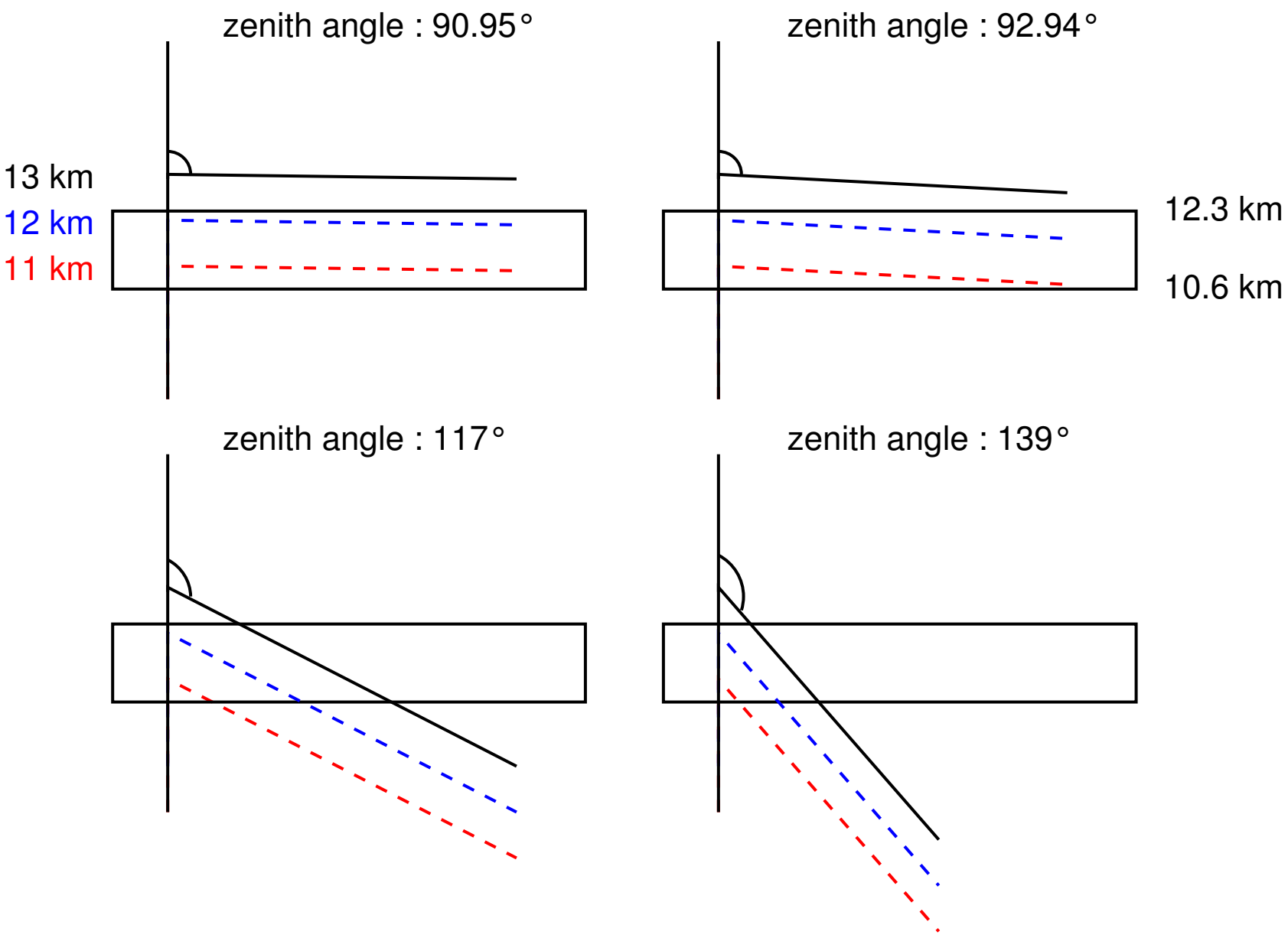
spherical particles

Consistency check for 500 GHz

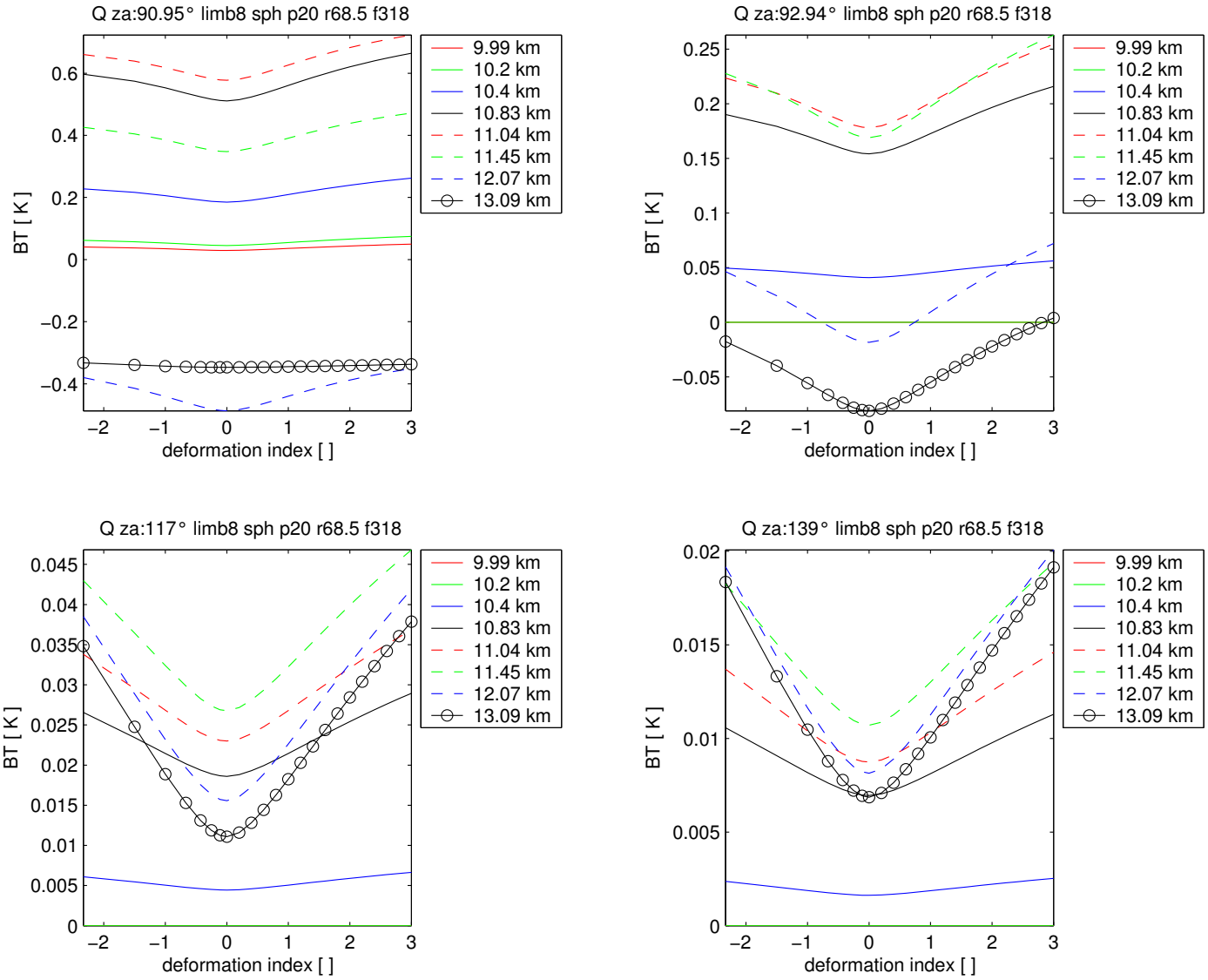


spherical particles

Lines of sight in the cloud

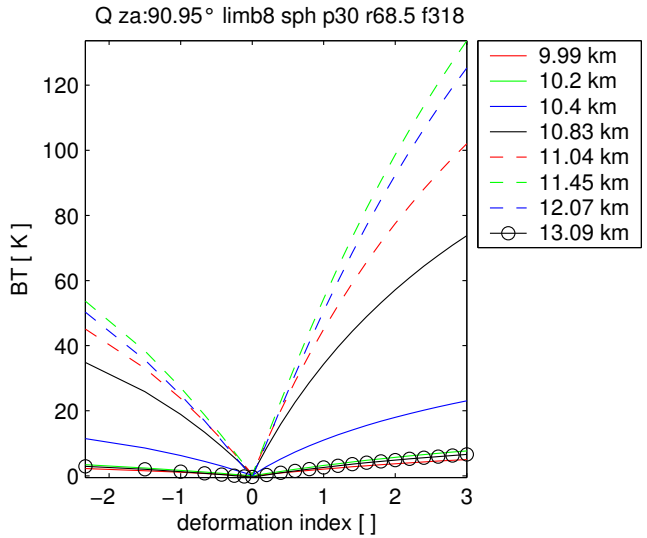


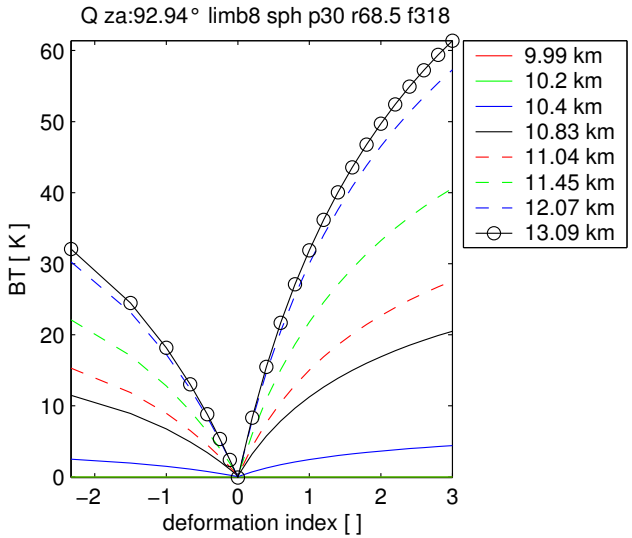
Q depending on aspect ratio (p20, 318 Ghz)

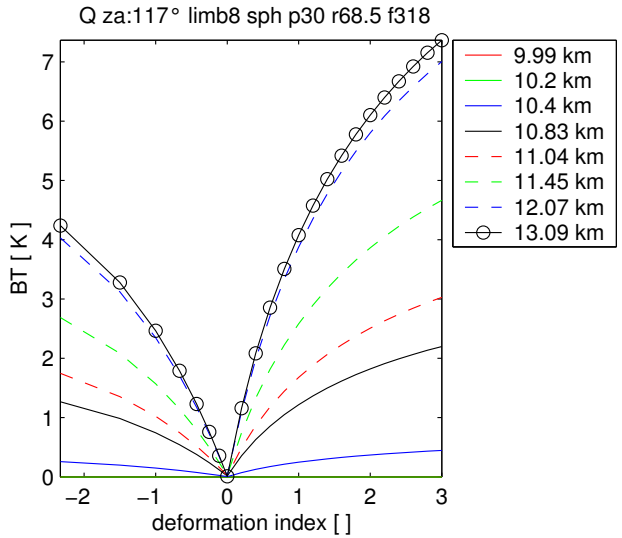


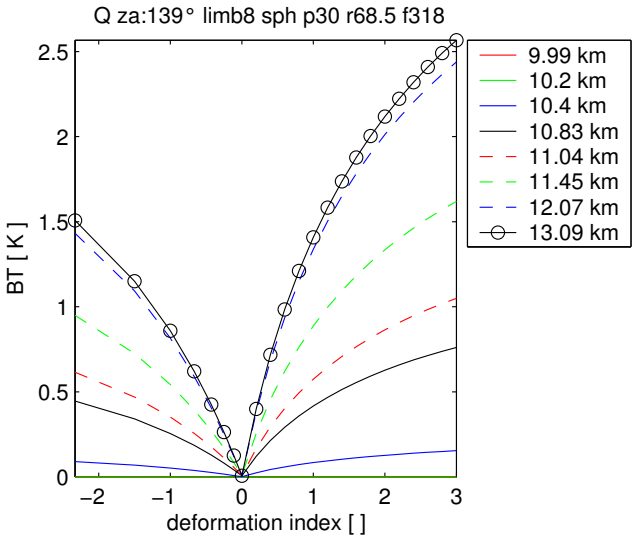
spheroidal particles

Q depending on aspect ratio (p30, 318 Ghz)



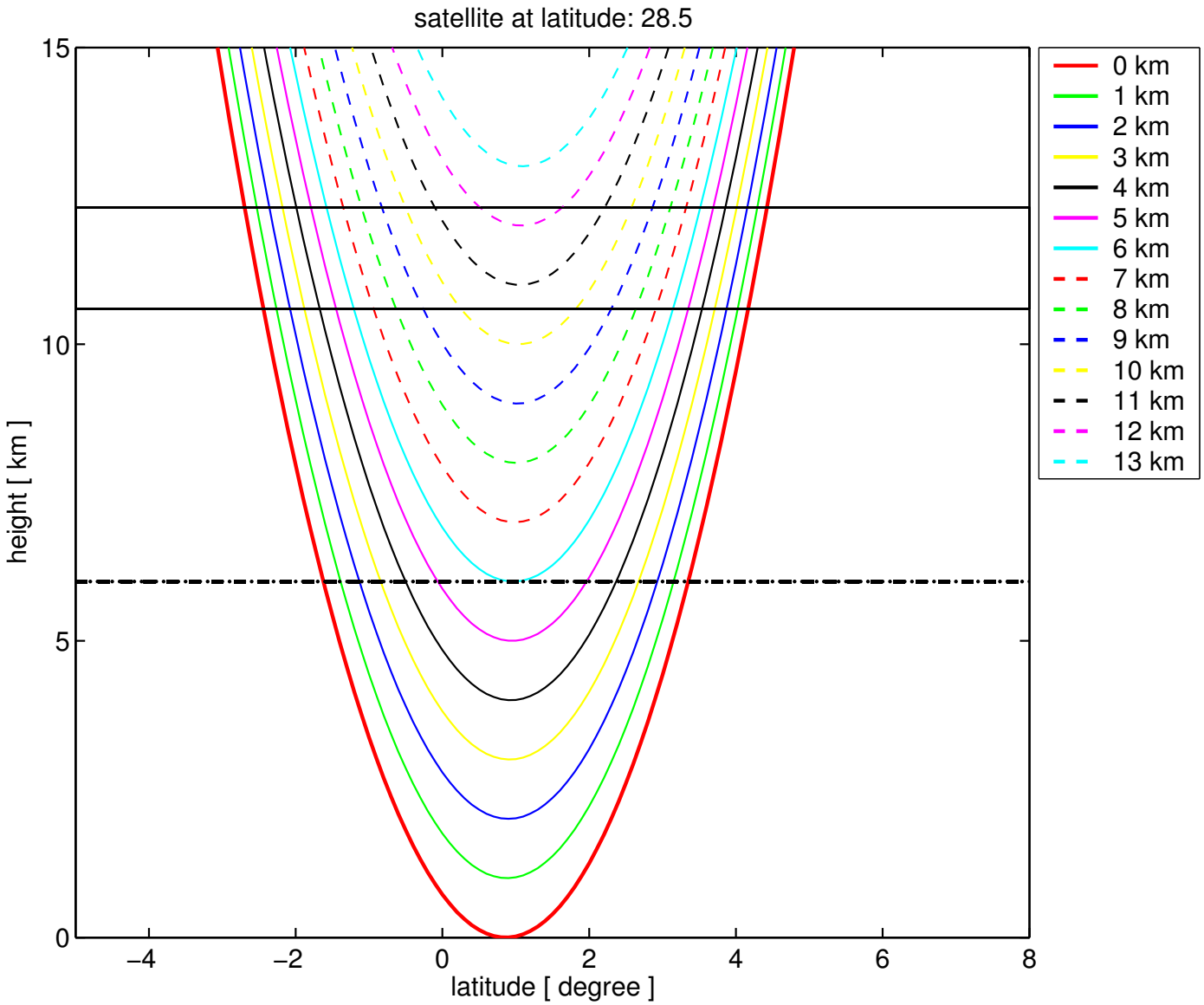




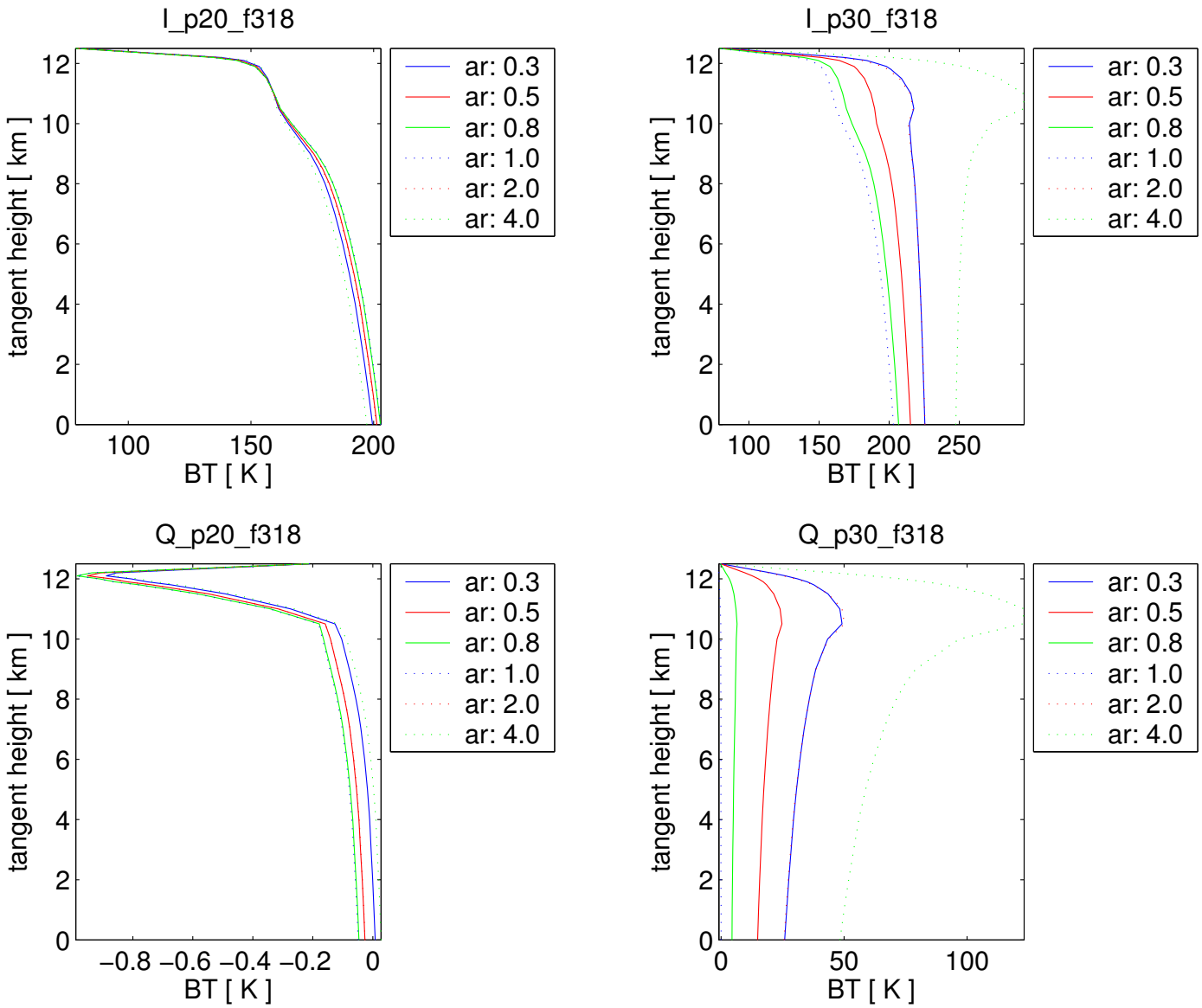


spheroidal particles

Lines of sight from the satellite

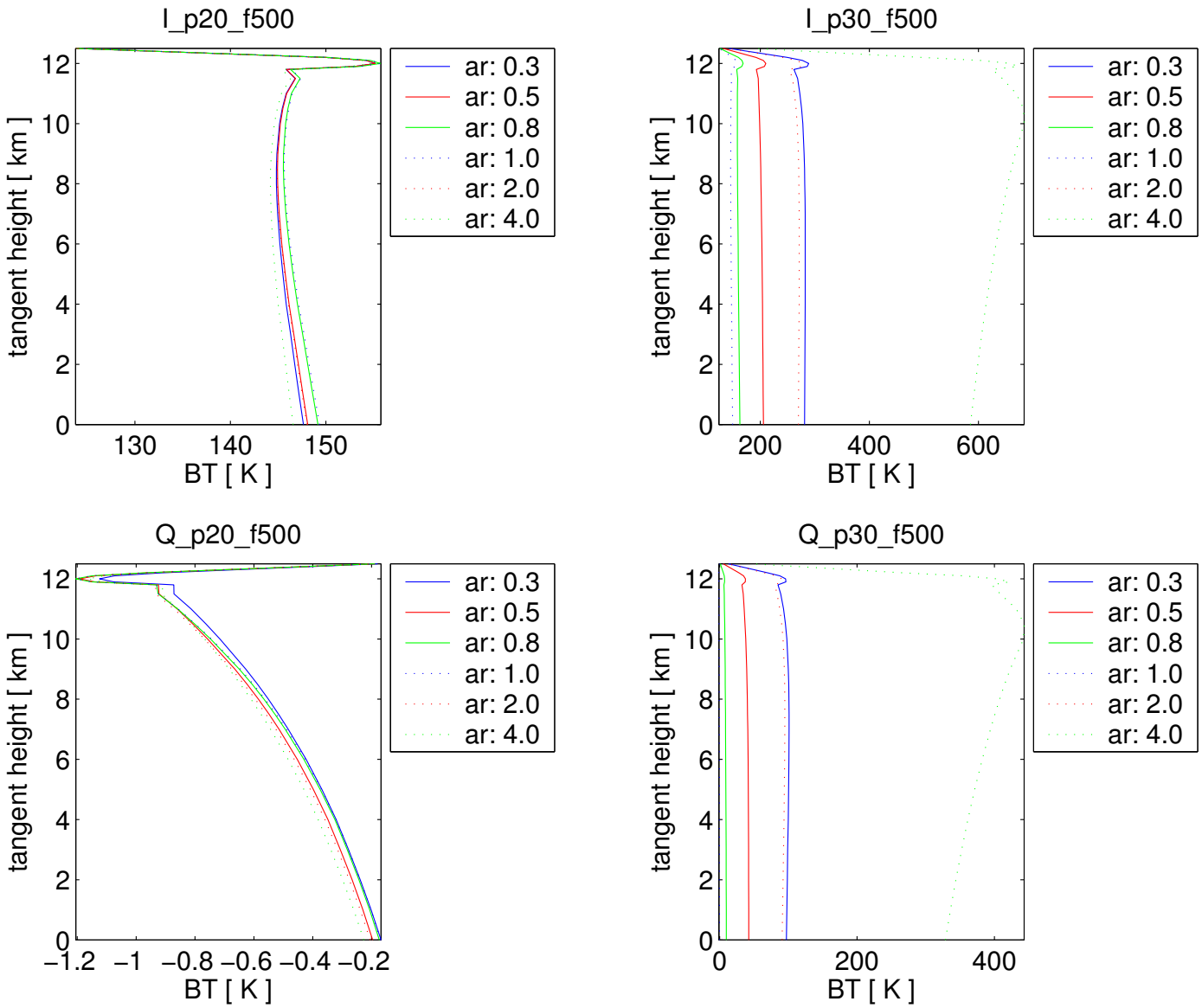


Limb radiances for p20 and p30 (318 Ghz)



spheroidal particles

Limb radiances for p20 and p30 (500 Ghz)



spheroidal particles

Summary and Outlook

- Summary
  - Polarization difference depends strongly on the gas absorption
  - Polarization difference depends weakly on the single scattering properties inside a MASTER band (p20)
  - For spheroidal particles the polarization difference increases with the absolute value of the aspect ratio
  - For spheroidal azimuthally randomly oriented particles (p30) the polarization difference is stronger than for totally randomly oriented particles (p20)

- Outlook
  - Further investigations of azimuthally randomly oriented particles (p30) will be performed
  - Dependency of polarization difference on aspect ratio, frequency, particle size, particle orientation, gas absorption and ice mass content