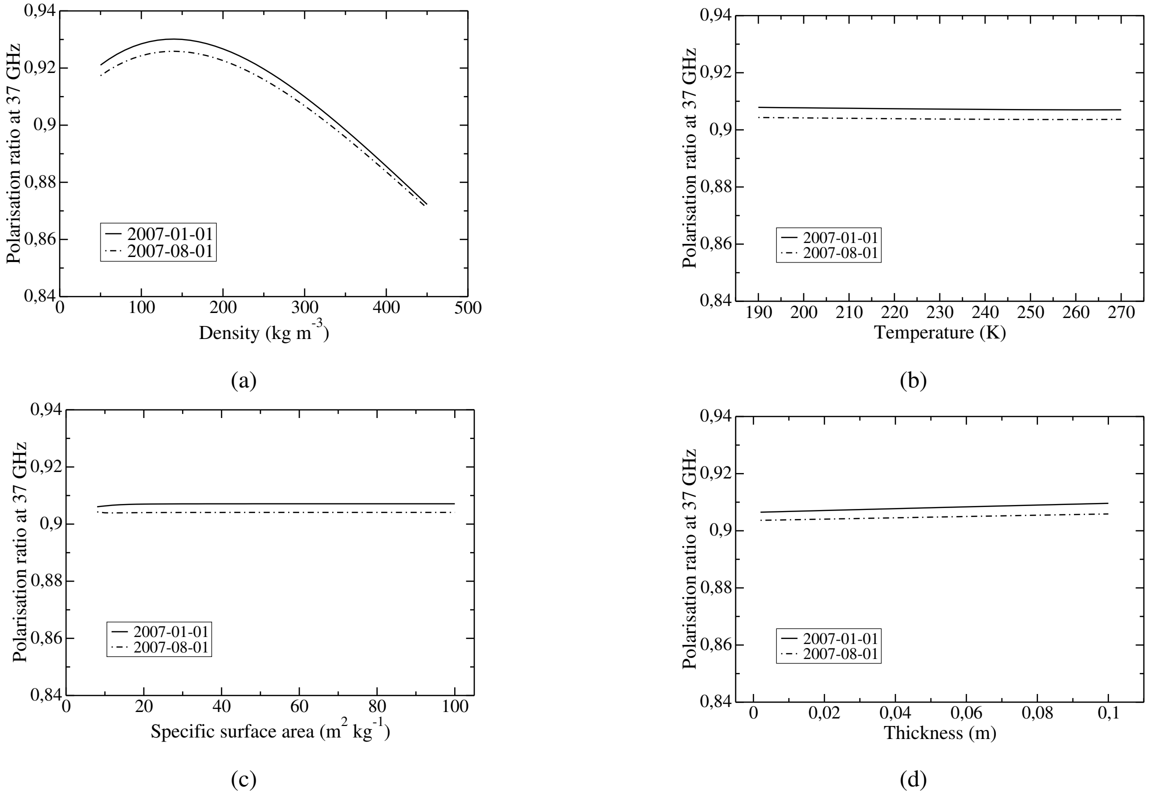

Figure 4. PR_{37} variations caused by changes in snow properties of the top layer: (a) density, (b) temperature, (c) SSA and (d) thickness. The two different dates correspond to typical winter and summer temperature profiles.

temporal PR variations between 0.88 and 0.92. Moreover, this simulation shows the weak influence of the temperature profile on polarisation ratio. The larger variation due to the different temperature profiles is 0.0043 which represents only 7.25% of the larger PR variation caused by surface density changes (from 150 to 450 $\mathrm{kg\,m^{-3}}$). This sensitivity analysis demonstrates the strong relationship between the polarisation ratio at 37 GHz and surface snow density, and herewith show the possibility to retrieve the density ρ_{sat} from the PR_{37} satellite observations.

5.3 Surface snow density evolution

Surface snow density ρ_{sat} is estimated every day by minimising the RMSE between the observed and modelled PR_{37} by changing only the snow density of the top layer. The RMSE minimisation is done by a Newton approach (scipy.optimize.newton function of python language). This method ensures a quick convergence (typically after 3–5 iterations) with a residual RMSE less than 0.001. That translates into a precision of surface snow density equal to 3.5 $\mathrm{kg\,m^{-3}}$. We use a constant vertical profile of temperature and equal to the 5-year average of the vertical temperature profile measured in the field. This choice is motivated by the fact that no temperature data are available before December 2006. However, the results are weakly affected by this