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Cloud, aerosols and the directional distribution of solar irradiances

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The directional distribution of solar irradiances is important to understand for the optimal utilization of solar energy technologies. This distribution is determined by gases in the atmosphere, clouds and aerosols. The latter two give rise to the most complications through their scattering optical properties. The main issue is that scattered solar radiances are not homogeneously distributed in all directions, but rather are predominantly in the direction of the Sun. This means that the commonly used division of direct normal and diffuse irradiances does not hold up. Solar heating and photovoltaic panels can utilize a wide angular range of circumsolar irradiances, while various forms of concentrating solar power systems utilize a more narrow range of direct solar irradiances. Thus, a more detailed description of the directional distribution of solar irradiances as a function of the cloud and aerosol optical properties is needed. This is what we will present. The results are based on both theoretical radiative transfer studies and high temporal resolution measurements.