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Satellite-based PV potential climatology for Alpine Regions

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Introduction
Renewable Energy production in the Alpine Region is dominated by hydroelectricity, but the potential for photovoltaic (PV) energy production is gaining momentum. Especially the southern part of the Alps and Inner Alpine regions offer good conditions for PV energy production. The combination of high irradiance values and cold air temperature in mountainous regions is well suited for solar cells. To enable more widespead currency of PV plants, PV has to become an important part in regional planning. To provide regional authorities and also private stakeholders with a high quality PV energy yield climatology in the provinces of South Tirol (Italy) and Grisons (Switzerland), the research project PV Alps was inaugurated in 2012.

Methodology
A state of the art radiative transfer model (Specmagic) has been used to calculate the clear-sky irradiance. Not only broad band, but also spectral irradiance is calculated. Aerosols and water vapor are taken into account using climatologies, whereas the surface albedo is retrieved from satellite data.. The shadowing of the mountains is calculated using a 100 meter-resolution digital elevation model. The clear-sky irradiance is modified using cloud index provided by Meteoswiss with very high temporal resolution (15 min within 2004 and 2013). Cloud detection based on Meteosat data is significantly improved for mountainious regions within the Heliomont Algorithm. In a second step, the calculated solar irradiance and the air temperature is used to calculate the potential energy yields for two PV technologies, cadmium telluride and polycrystalline silicon.

Results
We present the final dataset, which comprises monthly and yearly mean solar irradiance and energy yields for two PV technologies for the Swiss Canton Grisons and the Northern Italian Province Bolzano (South Tirol). The spatial variability in mountainous areas is very high, we calculated up to 1600 kWh yearly solar irradiance on a horizontal plane in high altitude, whereas in narrow valleys less than 1000 kWh per year are calculated. Furthermore, we will show a comparison of our calculated values with ground-based station measurements. Finally, we analyse the dataset to detect temporal and spatial patterns which are important for energy planning.

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