Geophysical Research Abstracts
Vol. 14, EGU2012-5174, 2012
EGU General Assembly 2012

The atmospheric boundary layer at Dome C on the Antarctic plateau

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Dome C on the Antarctic plateau (75°06' S, 123°20' E, 3233 m a.s.l.) was selected as one of the 119 CF-sites for the CMIP5/IPCC intercomparison project. For these sites, the participating climate modeling groups have been asked to produce a special set of high frequency diagnostics. Dome C has been selected because of the extreme weather and climate of the Antarctic plateau, but also because of the year-long continuous observations, performed with support from the permanent French-Italian Concordia station.

The lower atmospheric boundary layer at Dome C is monitored since January 2008 (Genthon et al., J. Geophys. Res., 2010). Anemometers, thermometers and hygrometers were deployed at 6 levels above the surface up to ∼42 m. Harsh local conditions (extreme cold temperatures, frost deposition) have affected the operation of the instruments. Several failed during winter 2008 but improvements have allowed almost continuous records with only limited interruptions since 2009. Cases of thermal convective mixing (adiabatic temperature profile, in summer) as well as cases of very strong inversions (more than 2°C per meter locally, in winter) were recorded.
In 2010, the temperature at the lowest level dropped below -80°C, whereas in 2009 the minimal temperature is 10 degrees higher. Winter 2009, milder but twice as much windswept than the next winter, is remarkable for the occurrences of extreme "warm events" : for two days, the temperature approached the -30°C in the depths of winter.
Independently, the Antarctic Meteorological Research Center automatic weather station at Dome C indicates that these two winters are the warmest and coldest on record over the past decade.
Therefore, it may be supposed that the 2009-2010 time series together contain enough variability to be used for the evaluation of climate models.

The data have been compared with the ECMWF meteorological analyzes, and with AMIP simulations of CMIP5 models.
The coarse vertical resolution of general circulation models limits the degree of details of the comparison. Nevertheless, this is sufficient to reveal that many of the observations' features can be reproduced, including large inter-annual variability, extreme winter inversions, warm events, etc.
However, it is clear that many models fail to account for the most extreme characteristics of the boundary layer on the Antarctic plateau, including the extreme temperature's values and the duration and intensity of warm events.
While all models predict significant warming over Antarctica the details of this warming and impact on the general meteorology of the Antarctic plateau (including e.g. snowfall) may be questioned.