Geophysical Research Abstracts
Vol. 16, EGU2014-11063, 2014
EGU General Assembly 2014

Evaluation of the radiation budget with a regional climate model over Europe and inspection of dimming and brightening

Marc Chiacchio (1), Fabien Solmon (1), Filippo Giorgi (1), Paul Stackhouse, Jr. (2), and Martin Wild (3)

(1) ICTP, Trieste, Italy (mchiacch@ictp.it), (2) NASA Langley Research Center, Hampton, Virginia, USA, (3) Institute for Atmospheric and Climate Science, ETH Zurich, Switzerland

Shortwave (SW) and longwave (LW) components of the radiation budget at the surface and top of the atmosphere (TOA) are evaluated in the RegCM4 regional climate model (RCM) driven by European Centre for Medium-Range Weather Forecasts (EWMCF) Reanalysis (ERA-Interim) over Europe. This was accomplished by comparing them to satellite-based products, reanalysis and surface observations including Global Energy and Water Cycle Experiment Surface Radiation Budget (GEWEX SRB), ERA-Interim, Clouds and the Earth's Radiant Energy System (CERES), and Baseline Surface Radiation Network (BSRN). At the surface the model overestimated the amount of solar radiation absorbed but was compensated by a greater loss of thermal energy while both SW and LW TOA net fluxes were underestimated representing too little solar energy absorbed and too little outgoing thermal energy. These biases were dependent on errors in cloud fraction, surface and planetary albedo and less dependent on surface temperature associated with the surface longwave parameters and are in line with other studies. Clear-sky fluxes showed better results when cloud cover errors had no influence. We also found a clear distinction between land versus water with smaller biases over land at the surface and over water at the TOA due to errors in cloud fraction and albedo. From this result, it was discovered that planetary albedo (including cloud albedo) played a larger role than cloud fraction on errors in all-sky SW absorption at the TOA. Finally, we inspected dimming and brightening for the period 1979-2010 with an indication for dimming early in the time series (i.e. 1979-1987) and brightening after, which agrees with surface-based observations. After 2000, however, a decrease was evident which is in contrast to the continued brightening found in surface records. Despite these biases, we found the model able to properly simulate the radiative energy budget and suitable for climate related applications.