



## **Evaluation of ECHAM5-HAM simulated Surface, TOA and Atmospheric Radiation Budgets using Global CERES-BSRN Observations**

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Atmospheric column absorption of solar radiation ( $A_{col}$ ) is a fundamental part of the Earth's energy cycle but is an extremely difficult quantity to measure directly. To investigate  $A_{col}$ , we have collocated satellite-surface observations over the 35 selected BSRN surface sites during the period March 2000-December 2004. The surface radiation budgets are averaged from the BSRN Shortwave (SW) observations over a 1-hour interval centered at the time of the NASA Terra and Aqua satellites overpass, and the TOA radiation budgets are averaged from the closest FOV satellite data to the BSRN stations. Then the atmospheric column SW absorption was inferred from the satellite TOA albedo and BSRN surface absorption. Monthly means of  $A_{col}$ , TOA albedo, and surface absorption are calculated under both clear- and all-sky conditions over the 35 selected BSRN sites which have covered different climate regimes. To evaluate the GCM simulations, we have collected the ECHAM5-HAM simulated surface, TOA and atmospheric radiation budgets by researchers at ETH Zurich and compared those simulations with observations. The preliminary comparisons have shown that the ECHAM5 simulated clear-sky surface absorption, TOA albedo, and  $A_{col}$  agree very well (1-3%) with observations. Under all-sky conditions, they have strong correlations with CERES-derived cloud fraction. The simulated surface absorption is lower and TOA albedo is higher than those under clear skies, but  $A_{col}$  does not increase too much. However, there are relatively large differences over some regions and months. A further study is needed.