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# SPATIAL AND TEMPORAL VARIABILITY OF RADIANT FLUX DENSITY AT TOP OF THE ATMOSPHERE AND AT THE SURFACE

**M. Sommer, N. Gundelwein, F. H. Berger**

*Professur Meteorologie, Technische Universität Dresden, Mommsenstraße 13, 01062 Dresden*

msommer@forst.TU-Dresden.de; http://www.forst.tu-dresden.de/ihm

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## 1 Aim of the research within QUIRCS

At present no long-term area-wide datasets of global or regional radiant flux densities, e.g. for Europe, are available. These quantities would, however, be very helpful for an extended validation of the performance of regional climate models. Therefore, this project computes radiant flux densities from satellite data at the top of the atmosphere (TOA) and at the earth's surface and provides them to the central model evaluation within QUIRCS. Satellite data with high (30 x 30km, 3h) and less (280 x 280km, 3h) spatial resolution are used to determine radiant flux densities with the aid of radiative transfer models. The area under investigation is Central Europe within a long-range defined boundary of 15°W-35°E and 30°-65°N to verify the statistical results.

## 2 Recent and completed activities

The main important data sources are cloud data products from the *International Satellite Cloud Climatology Project* (ISCCP) for more than 15 years. Computations are done for ISCCP-DX and D1/D2-datasets by using the 1D radiative transfer model STREAMER (Key, 1999). The DX-dataset with its high spatial and temporal resolution is procured for four years at present, and the D1/D2-datasets are completely organized and used to initiate STREAMER. These datasets contain the cloud amount and other relevant parameters, e.g. optical depth of clouds and cloud top temperature, and they are available from July 1983 to September 2001 at *NASA Goddard Institute for Space Studies*. The determination of shortwave and longwave radiant flux densities has been carried out for the D2-dataset completely within the period July 1983 – December 1998. Because of the amount of the DX- and D1-dataset computations are based on lookup tables to reduce computing time. The results are analysed concerning spatial and temporal variability and temporal trends.

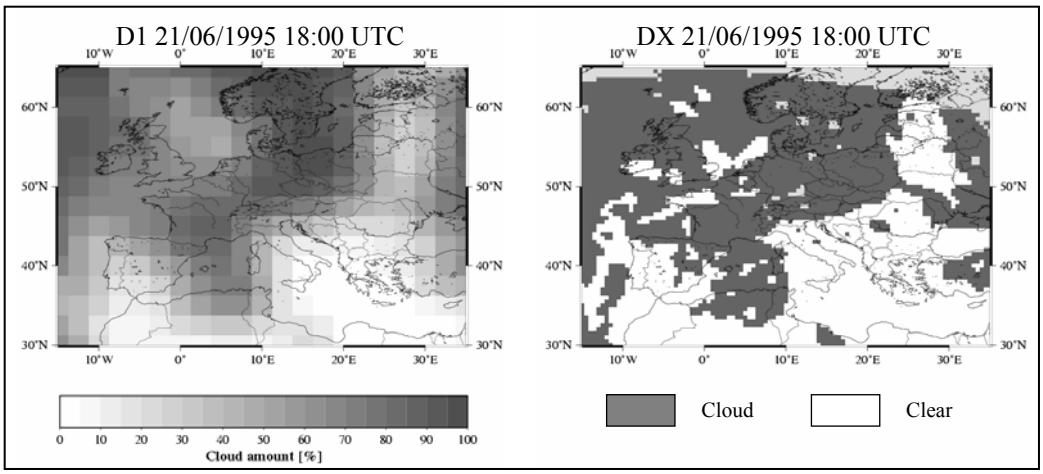


**Figure 1.** Cloud amount at 21/06/1995 18:00 UTC from ISCCP-D1/DX data

## 3 Principle results and Conclusions

Using the D2-dataset radiant flux densities at TOA and at surface are analysed for monthly and annually averaged data. Present analyses were especially done for net radiant flux densities. They show strong regional variability with independence of altitude (TOA, Surface). For example the means and standard deviations vary within the target area. Main important differences are between the Mediterranean See and the continent. Also very strong regional structures are visible inside the continent.

In addition the net radiant flux densities were evaluated for different components of trends. There was no long-term trend of the annual averaged data, but there are seasonal trend variations. In summer a weak positive trend exists, which is compensated in winter by a similar negative trend. Within the area of investigation these long-term trends show spatial variations. Especially in Scandinavia there is a strong positive trend, which is added at TOA. The reasons for this trend variability are not completely determined yet.

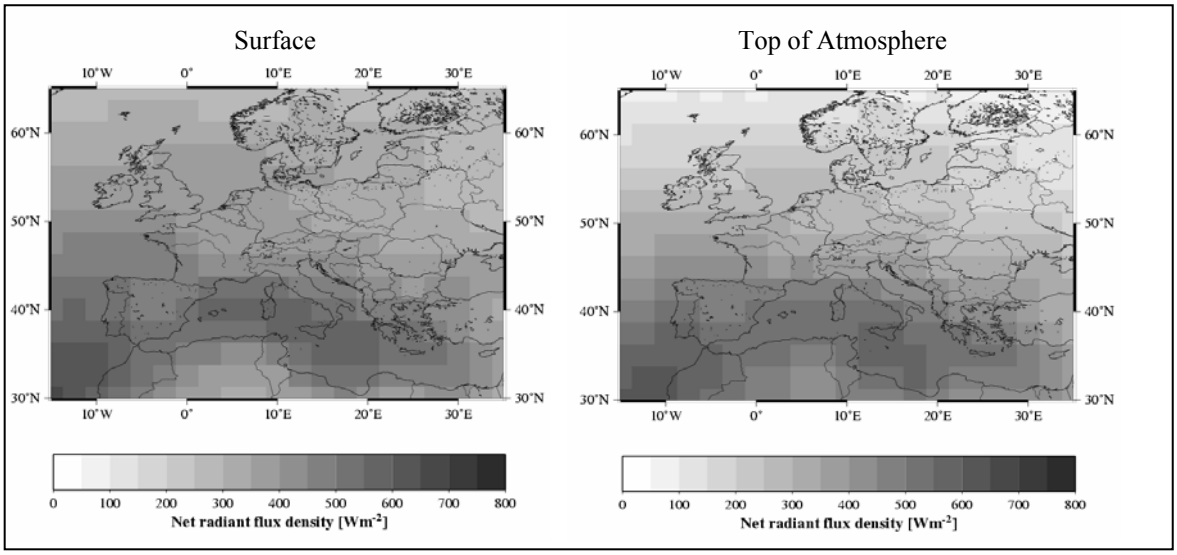


**Figure 2.** Long term annual net flux densities (1984 to 1998) at 12:00 UTC at surface and at TOA

## 4 Planned activities

The results of the D2-dataset are used to find reasons for the strong spatial and temporal variations and trends and to describe the changes of radiation components for Central Europe. Therefore relevant parameters from the D2-dataset and computed shortwave and longwave radiant flux densities from STREAMER should be compared. With these analyses a first overview of the radiation budget of Central Europe is given which can be compared with the results of the present-day climate simulations within QUIRCS. The computations and analyses of the DX-dataset with its high horizontal resolution prioritise further investigations. The results of STREAMER for all datasets should be compared among each other and must be evaluated. Additional comparisons will be based on ground measurements and satellite data with high resolution, e.g. NOAA-AVHRR.

## References

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NASA Langley Web Ordering Tool: http://eosweb.larc.nasa.gov/JORDER/

STREMER online: http://stratus.ssec.wisc.edu/streamer/