6th Annual Meeting of the European Meteorological Society / 6th European Conference on Applied Climatology. Ljubljana, Slovenia, 4-8 September 2006.

CLOUDINESS CLIMATOLOGY IN THE IBERIAN PENINSULA FROM THREE GLOBAL GRIDDED DATASETS (ISSCP, CRU TS 2.1, ERA-40)

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ABSTRACT: A description of total cloud cover (TCC) in the Iberian Peninsula is presented, based on three global gridded datasets: the International Satellite Cloud Climatology Project (ISCCP) D2 data, the ECMWF Re-Analyses (ERA-40) monthly data, and the TS 2.1 gridded data from the Climatic Research Unit (CRU). Important spatial and temporal differences appear when the three sources are compared.

OBJECTIVE and DATA

- The main **goal** of this study is to check the total cloud cover (TCC) from global datasets for the Iberian Peninsula (IP), and to detect spatial and temporal differences among them.
- **Data** was obtained from the International Satellite Cloud Climatology Project (ISCCP), the ECMWF Re-Analyses (ERA-40), and the gridded data from surface observations provided by the Climatic Research Unit (dataset TS 2.1).
- The analysis has been limited to the common **period** of the three data series , from July 1983 to June 2002 (19 years).

Figure 1. Location map. In red: Iberian Peninsula

RESULTS AND DISCUSSION

Iberian Peninsula total cloud cover (TCC)

The mean annual cloudiness in the IP is near 50% in the three datasets (Figure 1, Table 1), with maximum values in the north-northwest (60%-70%) and minima in the south (30%-45%). Seasonal evolution shows a very clear minimum of cloudiness in summer and a maximum in winter for CRU and ERA datasets, while for ISCCP similar values are obtained in winter and spring.

All time series, averaged for the whole IP (Figure 2), show an important intraannual and interannual variability (measured by the coefficient of variation, CV). The maximum values of the CV are obtained in summer, and the minimum values, in winter (Table 1).

Spatial and temporal differences between the three datasets

All correlations (R) among the three datasets are statistically significant at the 0.01 level (Table 1). The correlation in the cold season (autumn and winter) becomes higher between ISCCP and CRU, and between ERA and CRU, with the lowest value in summer. No annual course is obtained for the correlation between ISCCP and ERA, which on the other hand always present the highest correlations (≈ 0.90).

In all months for the IP, the IP CRU is +1.5% greater than ISCCP values, but the ERA is -16.5% lower (Table 1). Much greater differences are obtained for particular regions and seasons (Figure 3). In summer, ERA presents the largest mean bias respect to ISCCP (-34.7%), with the highest differences in the south of the IP. Contrarily, the largest mean bias between CRU data respect to ISCCP is found in winter (+8.3%), while in summer a clear opposite pattern is detected between the north (negative values) and south (positive values) of the IP.

Finally, important differences are also detected in temporal evolution of the TCC (Figures 2 and 4; Table 2). With all data, a negative trend (not significant at 95%) is detected for ISCCP (-7.3%) and ERA datasets (-5.3%), while the trend is positive (and significant at 95%) for CRU data. In spring, the highest trends are detected for all datasets (all significant at 95%), but again with negative sign for ISCCP (-10.6%) and ERA (-12.3%), and positive for CRU (+15.4%).

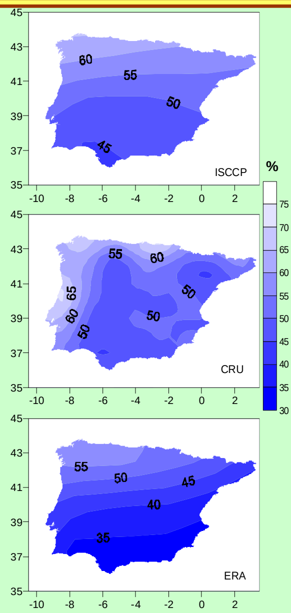

Figure 1. Annual TCC (%) in the IP with ISCCP, CRU and ERA data.

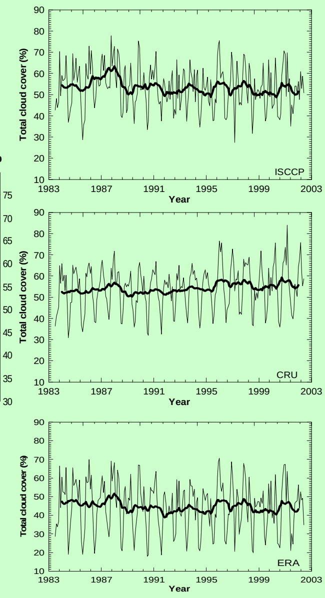

Figure 2. Area-averaged monthly TCC in the IP with ISCCP , CRU and ERA data and 12 months running mean.

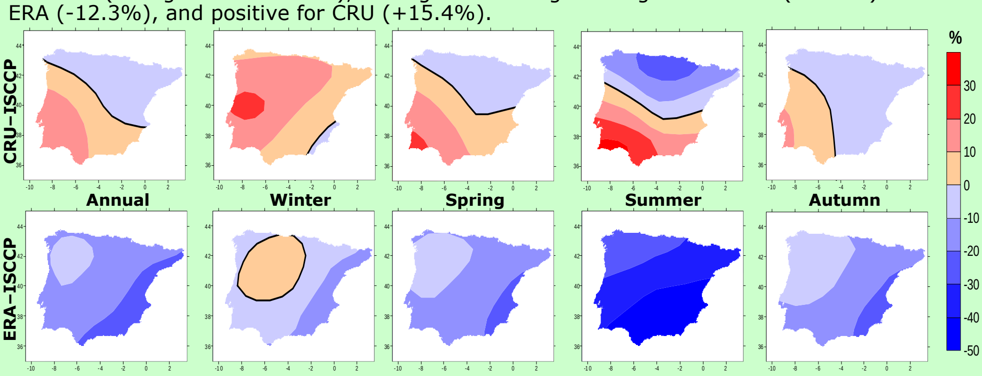

Figure 3. Spatial and temporal differences (%) between CRU and ERA respect to the ISCCP data.

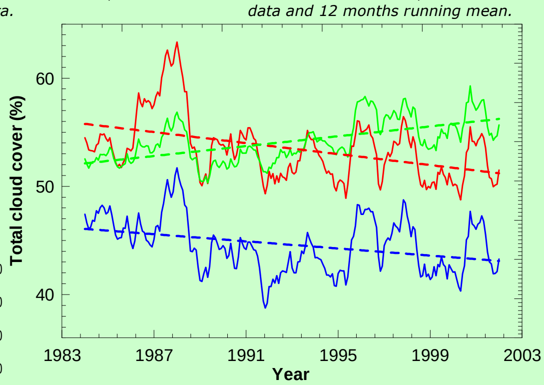

Figure 4. Area-averaged monthly TCC in IP with ISCCP (red), CRU (green) and ERA (blue) data. Solid line are the 12 months running mean. Dashed lines are linear regression lines.

	$ISSCP_{TCC}$	ERA_{TCC}	CRU_{TCC}	$ISCCP_{CV}$	ERA_{CV}	CRU_{CV}	ISCCP-ERA_R	ISCCP-CRU_R	ERA-CRU_R	100%(CRU-ISCCP)/ISCCP	100%(ERA-ISCCP)/ISCCP
Annual	53.4	44.6	54.2	26.7	38.3	24.0	0.90	0.70	0.79	+1.50	-16.5
Winter	57.5	53.5	62.3	22.8	26.9	18.8	0.89	0.67	0.76	+8.3	-7.0
Spring	57.8	49.4	59.2	20.9	26.5	16.2	0.90	0.47	0.55	+2.4	-14.5
Summer	43.5	28.4	42.2	31.3	49.1	23.4	0.91	0.57	0.58	-3.0	-34.7
Autumn	55.0	47.1	53.2	24.1	31.9	20.2	0.89	0.78	0.84	-3.3	-14.4

Table 1. TCC is the mean of total cloud cover (%), CV is the coefficient of variation (%) and R is the correlation coefficient between the datasets. In the last two columns mean differences (%) between CRU and ERA respect ISCCP data.

	Data	ISCCP	ERA	CRU
All months	228	-7.3	-5.1	**+9.7**
Anual	18	**-9.2**	-7.8	**+6.8**
Winter	19	-7.7	-6.4	+3.8
Spring	19	**-10.6**	**-12.3**	**+15.4**
Summer	18	-14.9	-9.9	+10.2
Autumn	19	-2.3	+2.1	+2.7

Table 2. Total relative (respect mean) trend (%). Statistically significant at the 95% in boldface.

CONCLUSIONS

- Important spatial and temporal differences are detected between the three sources of data. Particularly relevant are the lower values of TCC from the ERA dataset and the positive trend from CRU data.
- This work has shown the necessity of improving the knowledge about these differences for a more definitive climatic analysis of cloudiness in the IP. Probably, a detailed analysis of the original cloud observations from the surface could help in this direction.

Acknowledgments: *This research was supported by the Spanish Ministry of Education and Science (MEC) project NUCLIER (CGL2004-02325). The second author was granted a predoctoral scholarship by the same MEC. The ISCCP data was obtained via the Internet from the NASA Langley Atmospheric Sciences Data Center, the ERA data was provided by the ECMWF, and Dr. David Viner kindly helped us to obtain the CRU data.*