

# Climatology of Surface Albedo at Camagüey Actinometric Station



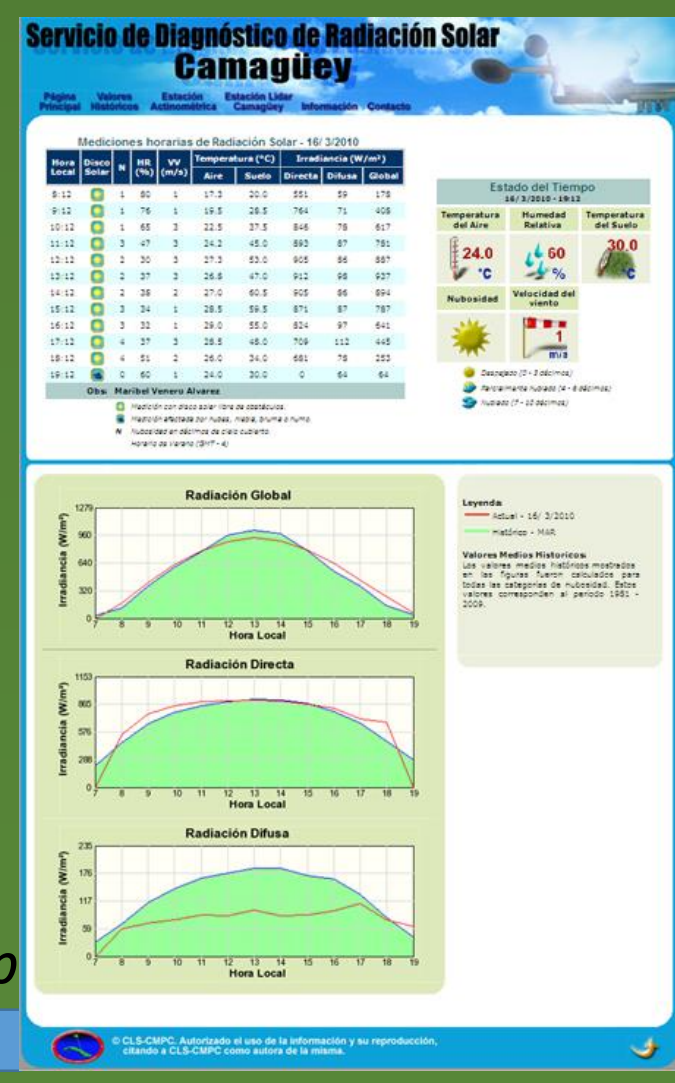
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## Abstract:

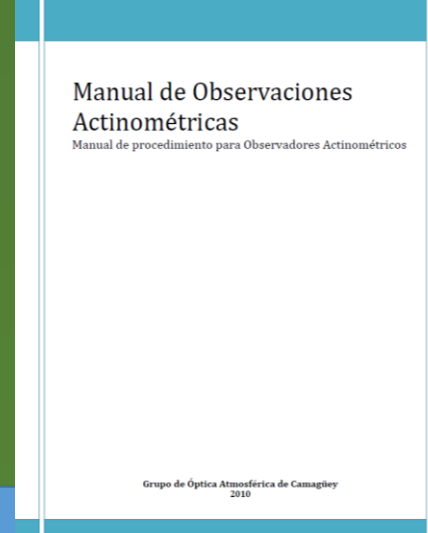
Employing 30 years of solar radiation dataset from Camagüey Actinometric Station, the surface Albedo climatology was determined for two solar disk state (Sun and Squared Sun). The mean value obtained for all period is 0.211 with a median 0.209 and standard deviation of 0.0422. To determine this climatology has been employed the WMO Guide to Climatological Practices. The employed dataset has been subjected to a meticulous quality control process, taking into accounts the criteria of Baseline Surface Radiation Network (BSRN). The annual and multiannual means was established, as well as, the monthly and hourly mean values for all sample. The frequency distribution was determined for different combination of active surface and their relation with albedo values.

Camagüey Actinometric Station (EAC) is located at 21.42°N, 77.87°W, 118 m ASL. The station is part of the Solar Radiation Diagnostic Service for Cuba (SDRS), supported by GOAC (A).



EAC site:  
[www.goac.cu/actino/cmww.php](http://www.goac.cu/actino/cmww.php)

Only during observations between 10 and 15 hrs (Local Time) the Albedo is calculated. The proceedings for the SDRS actinometric stations was developed by GOAC (B)



Only observations with measurements of direct beam irradiance were used in the study. The observer describes the State of the Active Surface (SAS) and the Color of the Soil (CS) according to the used methodology.

SAS: Dry, Wet and Flooded  
 CS: Green, Dry and Yellow → 9 combinations



Analog Galvanometer (C) and pyranometer (D) as part of the EAC. The pyranometer is used to obtain Global (Q), Difuse (D) and Reflected (Rc) radiations. The Albedo (Ac) is calculated as the ratio between Rc and Q.

Data is automatic calculated by Actino 2.2 software.

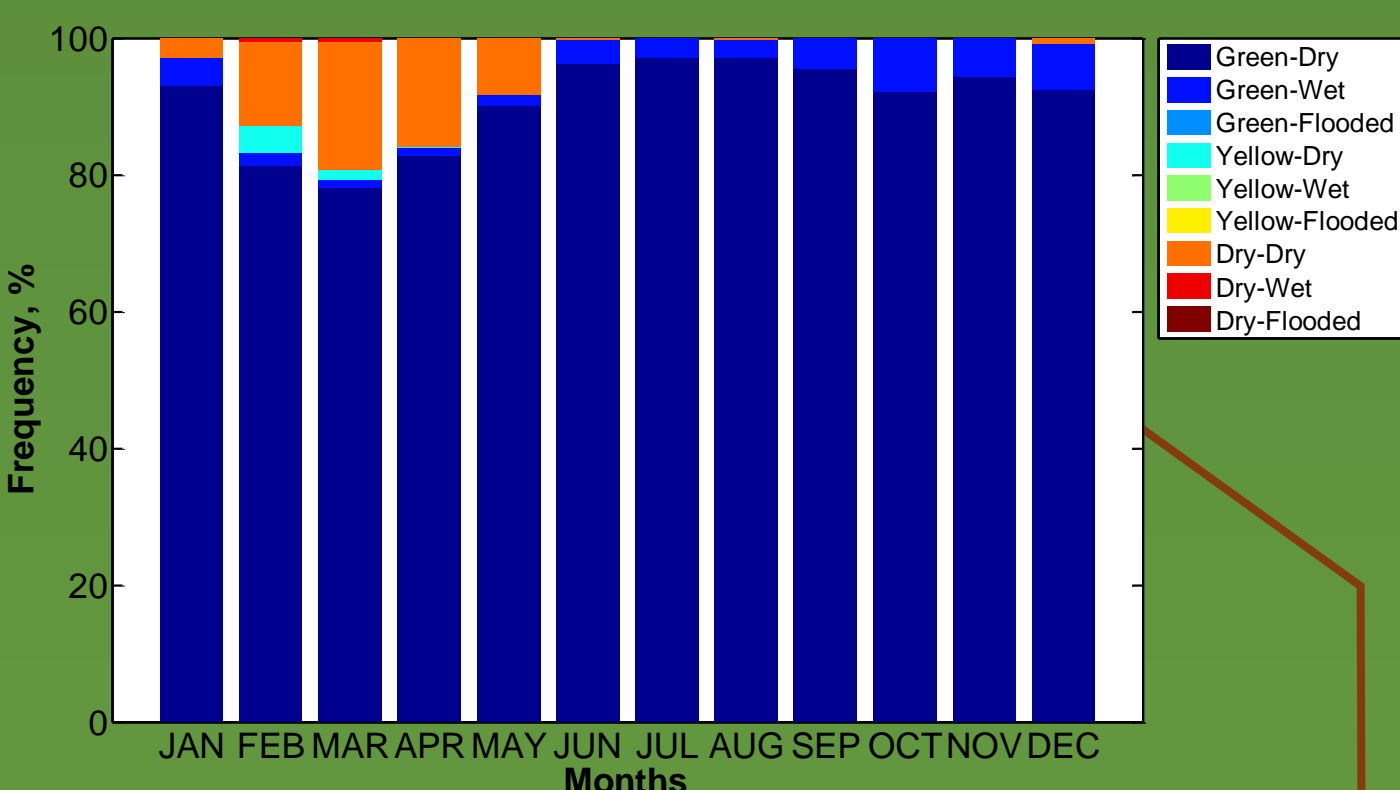
$$Ac = \frac{Rc}{Q}$$

	Dry	Wet	Flooded
Green	21553	841	-
Dry	1182	33	-
Yellow	111	-	-

Albedo values are centered around the 0.20, followed by values around 0.22. The 74.8% of the used sample in this study, fall between the mean ± 1 standard deviation.

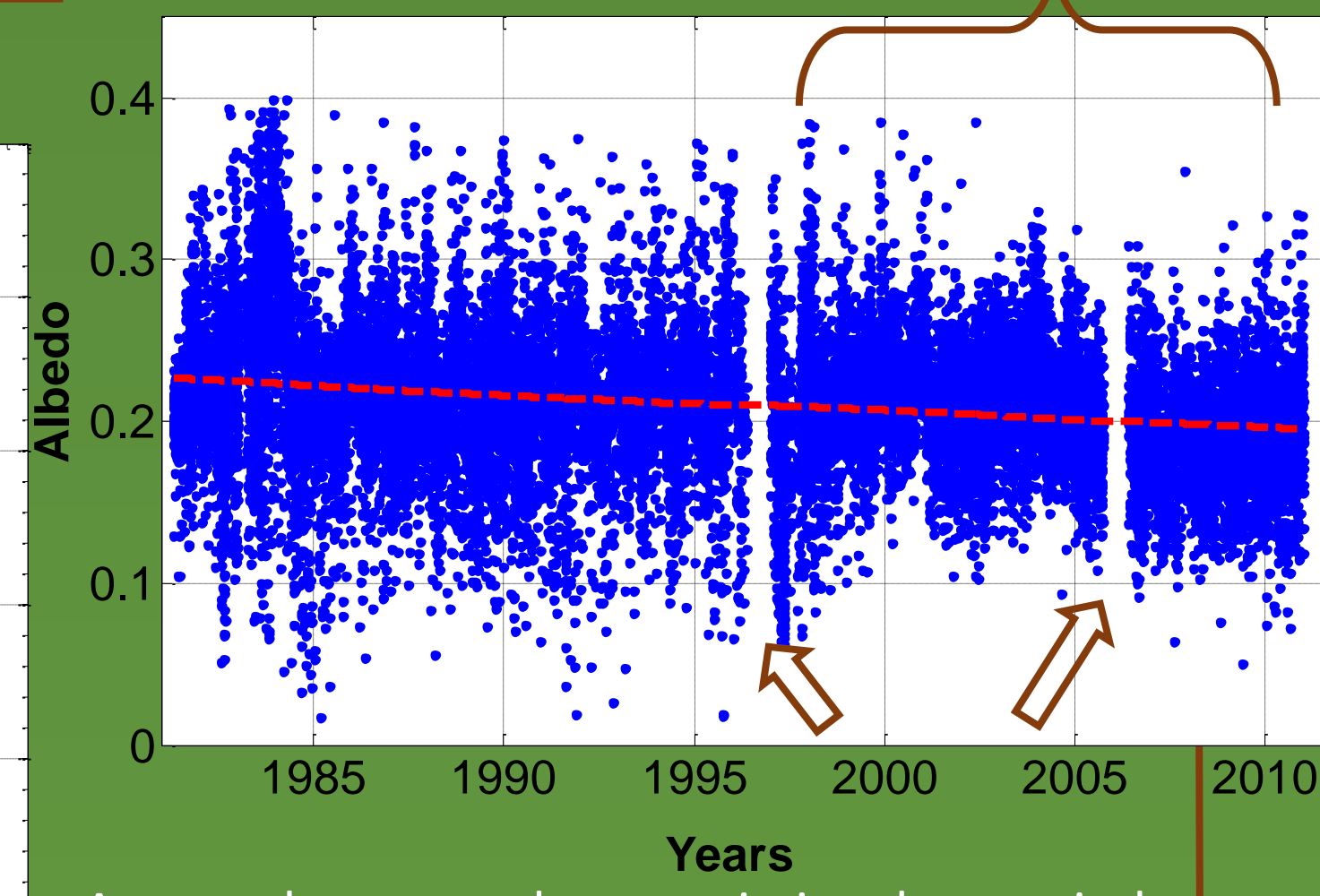
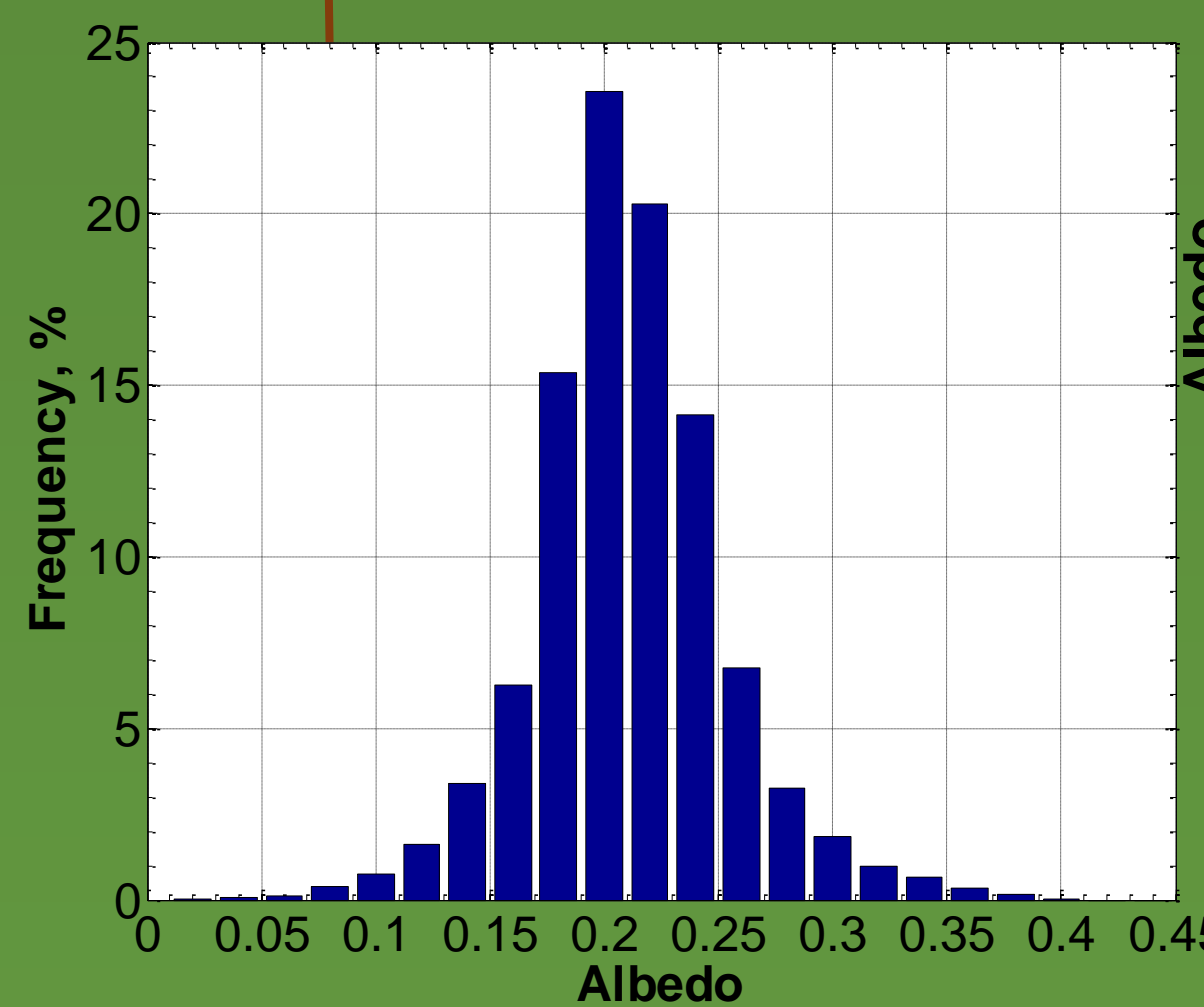
From 1981 to around 1998 a greater dispersion is shown in Ac values. From mid-1998 to 2010 period, the data is more clustered.

The predominant surface combination is Green-Dry with (90.9%) of occurrence, followed by Dry-Dry (5%) and Green-Wet (3.5%).



Frequency distribution for each of the 9 combinations of SAS and CS for the entire period and for each month. The Dry-Dry and Yellow-Dry combinations appear in the months of the dry season. Green-Dry is the most frequent combination in the entire period

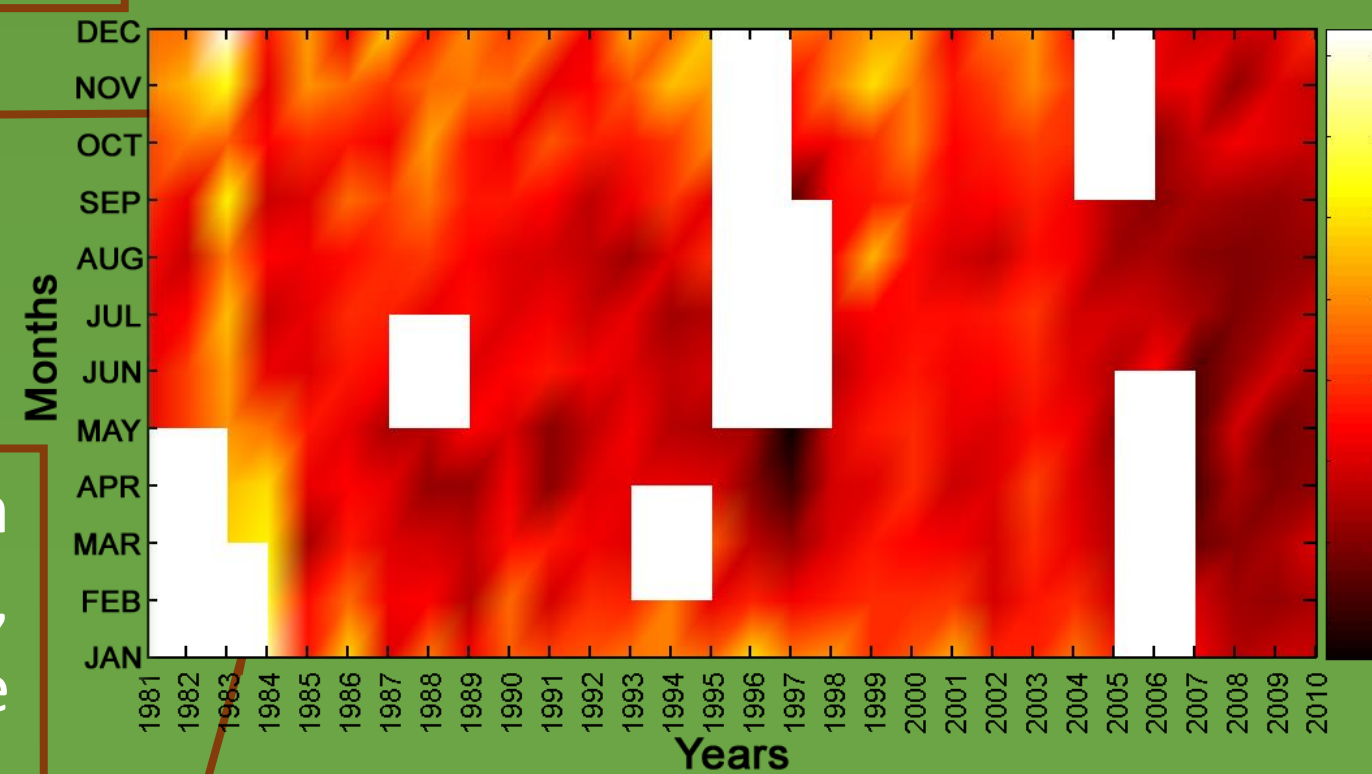
The maximum value of the mean monthly Ac is reached at the end of the year. Max: DEC (0.23)  
 The minimum values took place in the middle of the year. Min: APR (0.20)  
 Orange line shows monthly mean values of Global Irradiance, which is the best correlated variable to Ac.



Arrows show gaps due to missing data periods

Relatively high Ac values between 1983 and 1984 and low Ac concentration values during the first part of 1997. In the latter case, the first occurrence in the series of Yellow-Dry combination with the consequent decrease in the frequency of Green-Dry one, could be related to lower values.

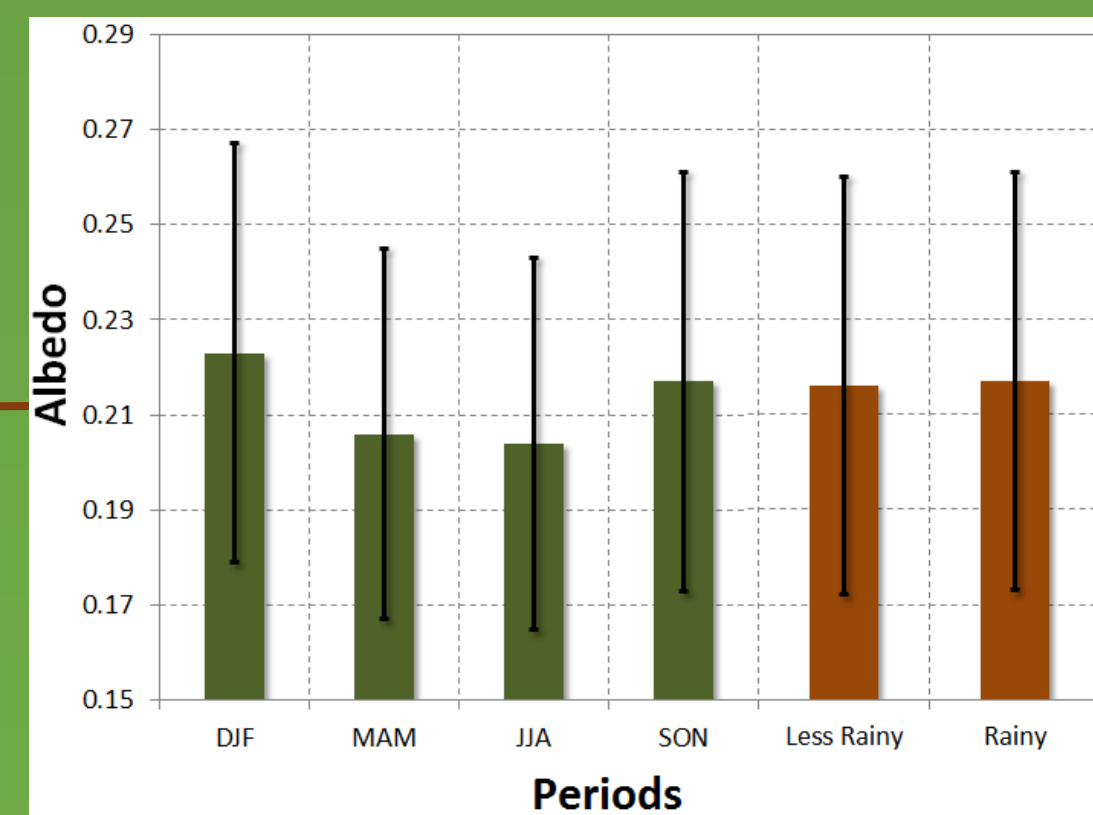
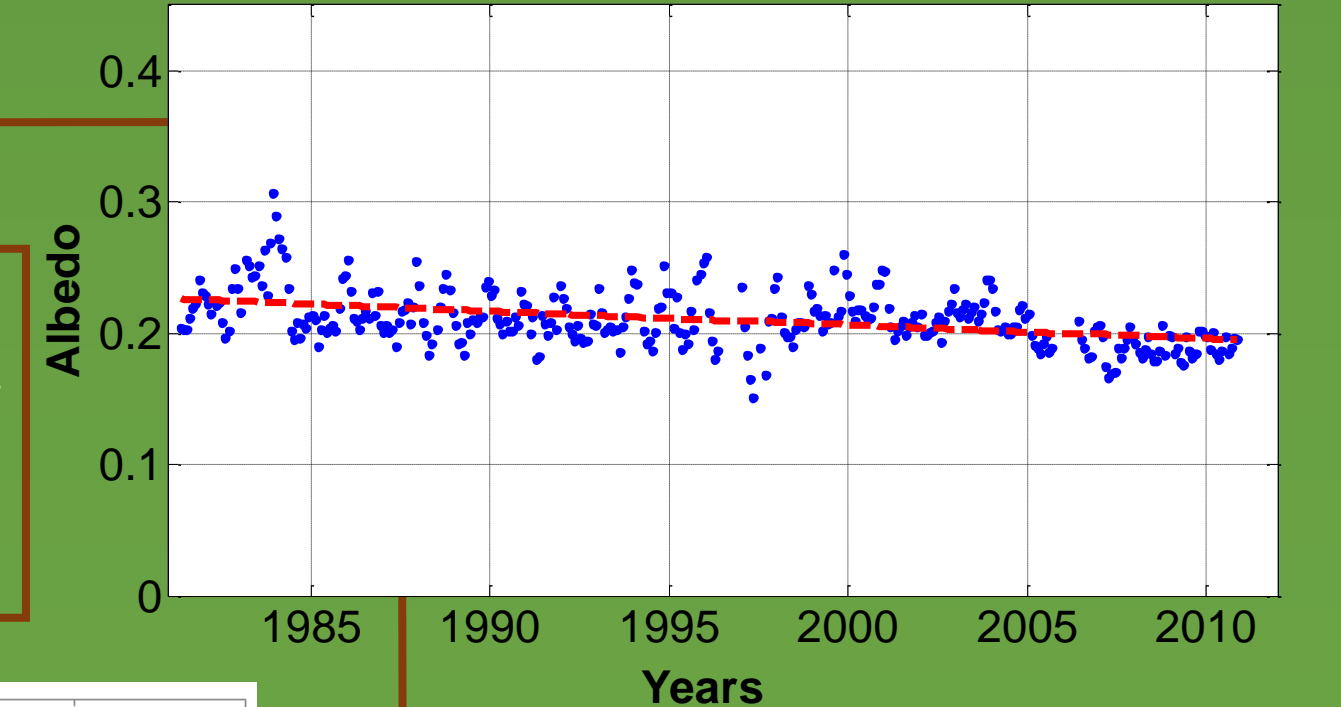
Highlights the minimum of 1997 between the months of April and May. Significant maximums in 1983 and 1984.



Blanks represent the months in which due to lack of observations, it was not possible to calculate the corresponding mean values. Minimum values of albedo are located at the ends of the years. Maximums take place at the ends of the years.

Maximum is located in summer (JJA) with 0.20 (±0.038). There is no direct relationship between Rainy Season and Less Rainy Season.

Most of monthly mean values are in the range between 0.25 and 0.15, with a clear downward trend.



During the last seven years (2005 – 2012 period) virtually all monthly mean albedo values are equal to, or less than, 0.20. In 1997, a significant decrease in albedo is clearly seen, compared to the trend of the values of this variable

## Conclusions

- This is the first albedo climatology for the AEC and for the country.
- The decreasing trend of surface albedo agree with the same trend of global solar radiation determined in previous studies.
- The annual maximum mean value correspond to 1983 with 0.256, both years, 2007 and 2008, registered the annual minimum mean value of albedo with 0.188.
- The maximum monthly mean value of albedo occur on December (0.23) meanwhile minimum correspond to April (0.201), both cases in counterphase with global irradiance extreme values.
- In the case of hourly mean values, the minimum take place at 12:14 with 0.203 and maximum at 15:14 with a magnitude of 0.228.

