Climatology of low-level clouds over western Equatorial Africa based on ground observations and satellites

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Pictures shot by Raffael Aellig in November 2021

Content

- Motivation – Introduction
- Goals – Objectives
- How to achieve – Data and Methods
- Present findings in the climatology – Result
- Summary

Interest in western Equatorial Africa

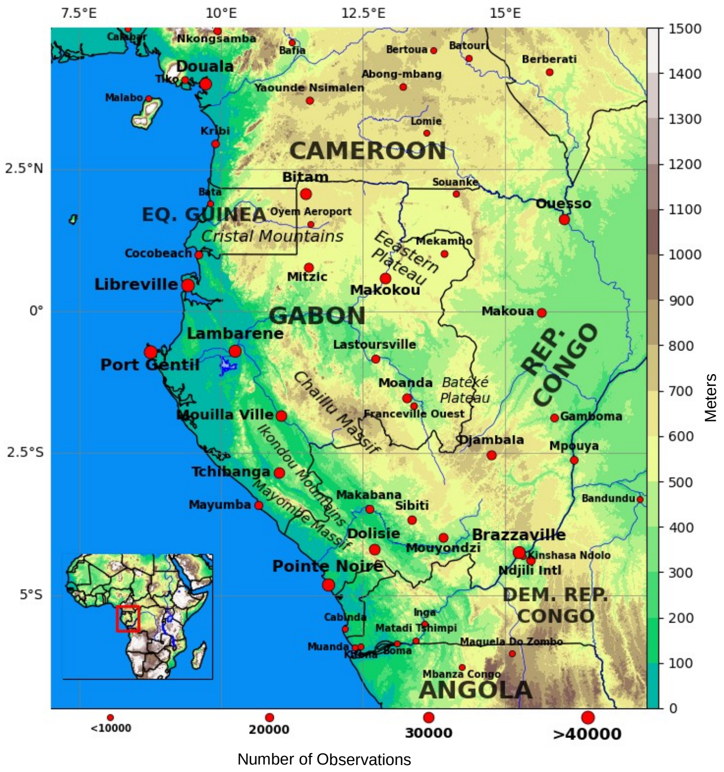
Climatology of the low-level cloud cover in western Equatorial Africa

Scarce data

Under-representation of low-level cloud cover in reanalysis data

Persistence of rain forest

Low-level cloud cover



Recent Studies

Cloud Climatology in WEA (Dommo et al, 2018)
- EECRA
- SAFNWC
- ERA-Interim

Cloud Climatology in SWA (v. d. Linden et al, 2015)
- ISD
- SAFNWC
- Night-microphysical scheme
- 2B-GEOPROF-LIDAR

Low-level Cloud Climatology in WEA during the long dry Season JJAS
submitted to Journal of Climate (O. Champagne and R. Aellig et al., 2022)
- EECRA, ISD, MIDAS
- SAFNWC
- Day-microphysical scheme and night-microphysical scheme
- 2B-GEOPROF-LIDAR

Surface Synoptic weather station reports

Concatenate source
- EECRA
- ISD
- MIDAS

Diurnal cycle climatology of low-level cloud fraction and cloud genus

SEVIRI – Geo-stationary satellite

Satellite Application Facilities Nowcasting SAFNWC (Derrien & Le Gleau, 2005)

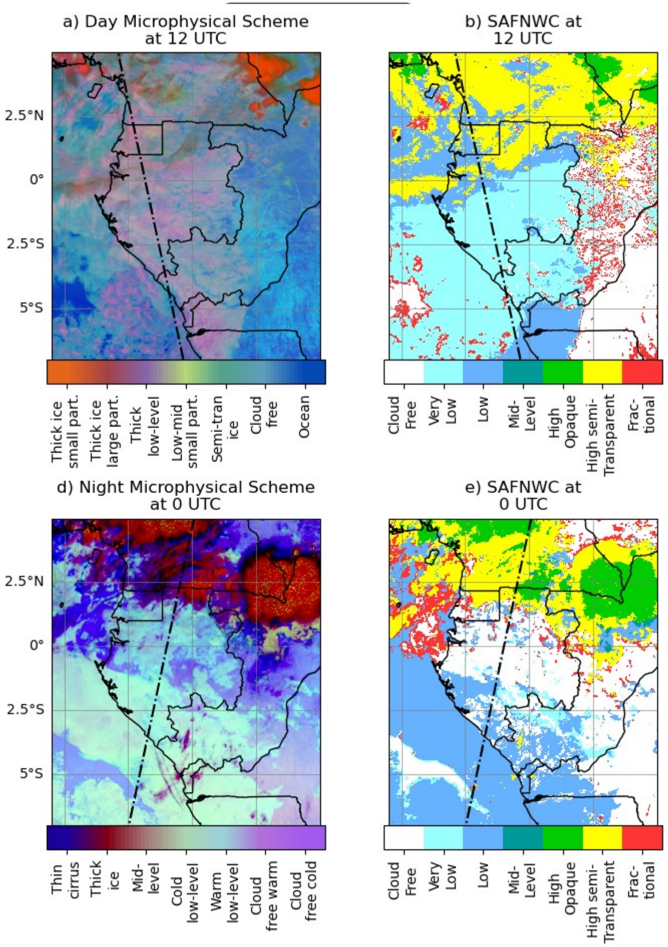
- Clear cloud types
- Insufficient low-level cloud detection at nightime
- High temporal resolution

Night microphysical scheme (Lensky and Rosenfeld, 2008)

- Diversified cloud phenomna in a RGB image
- No clear separation between clouds
- High temporal resolution

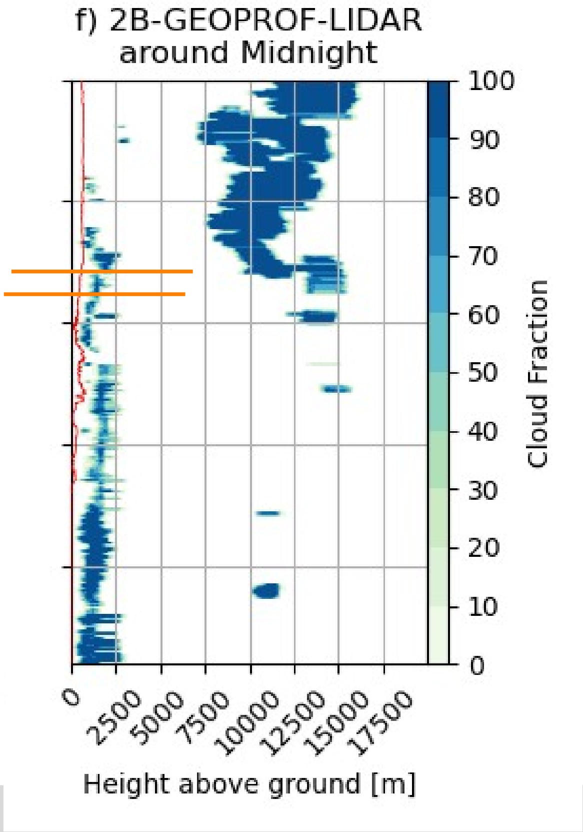
Climatology of:

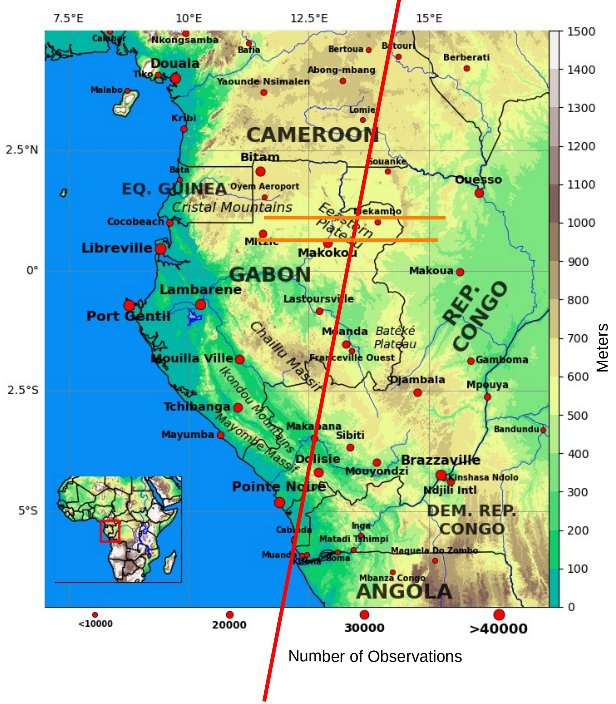
- Cloud types
- Cloud occurrence frequency
- In the diurnal cycle



Sun-Synchronous Satellites in A-Train

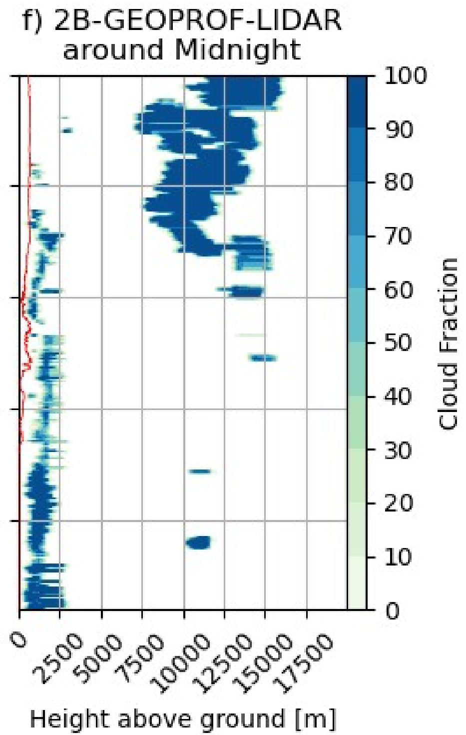
2B-Geoprof-LIDAR
- Radar on CloudSat
- LIDAR on Calipso

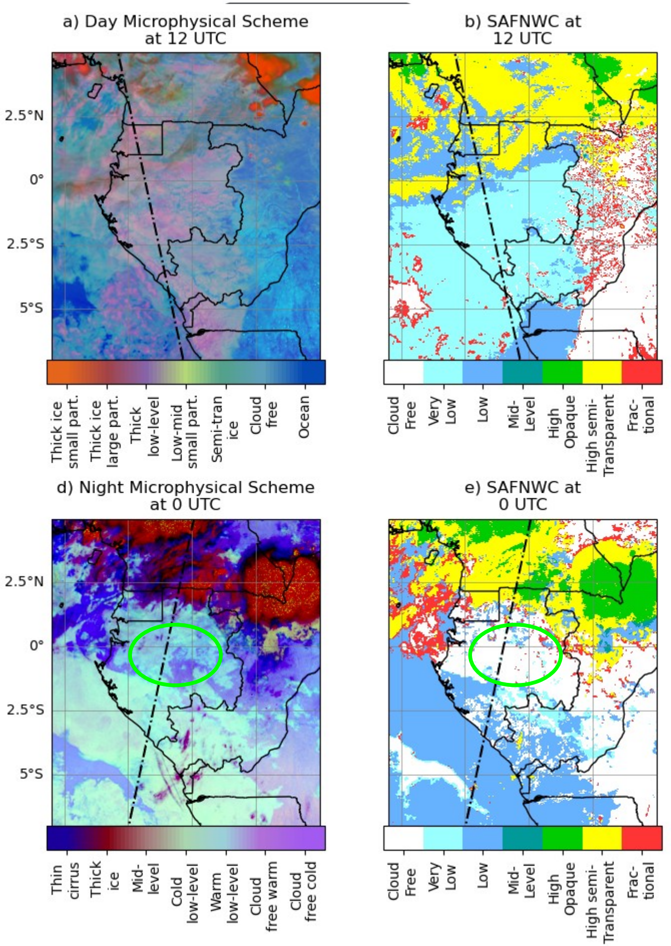




Climatology
- Maximum-Random-Overlap of swaths of 0.5°
- Vertical extension of clouds

Three different views



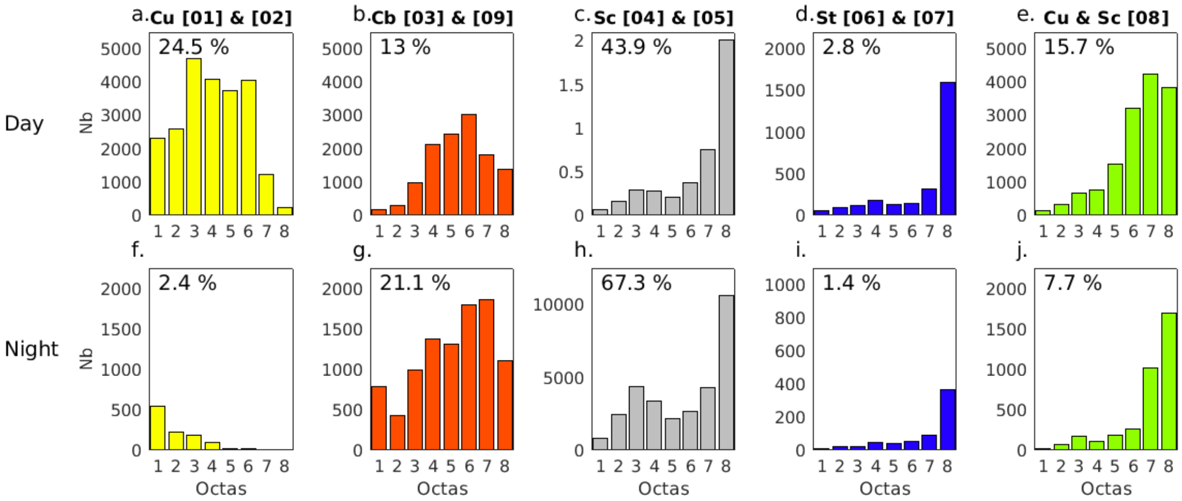


Cloud Type distribution

Stratocumulus most frequent clouds

Cumulus humilis and mediocris more often during the day

Stratus is rare



Stratiform clouds are most frequent and left skewed

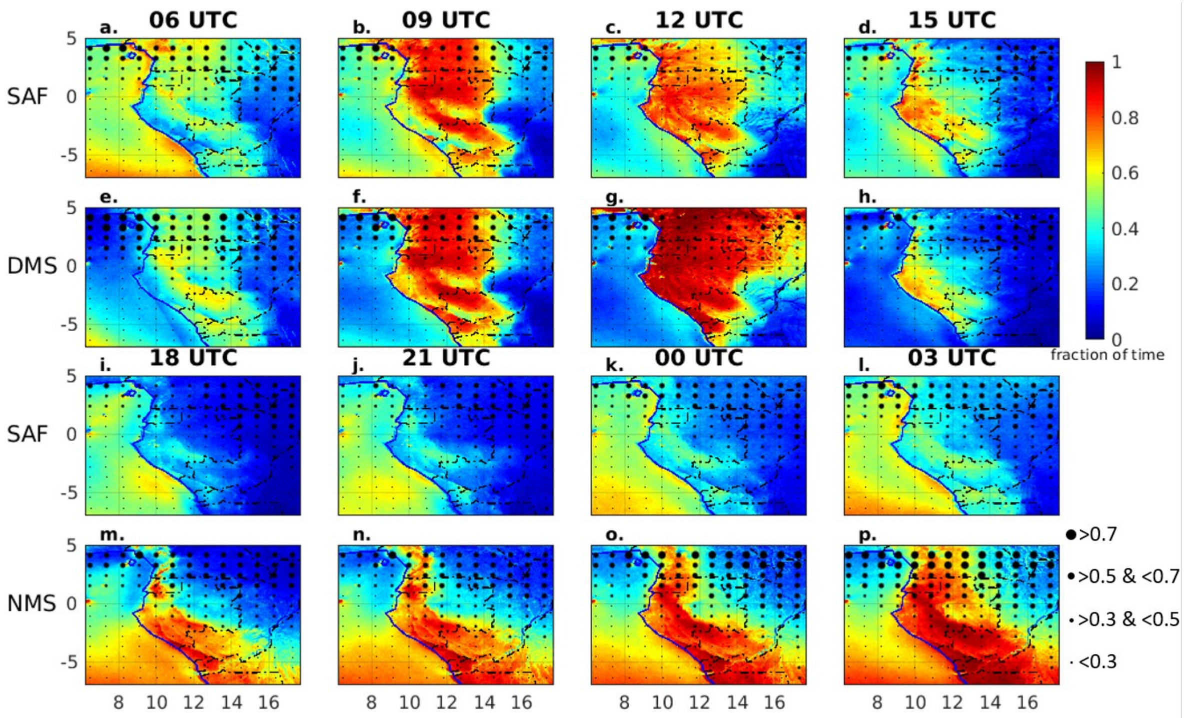
Cloud Climatology

Low solar angle problems

Low-level Cloud dissolves during the day

NMS and SAFNWC diverge during the night

Cloud deck on windward side



Higher clouds closer to the rain belt

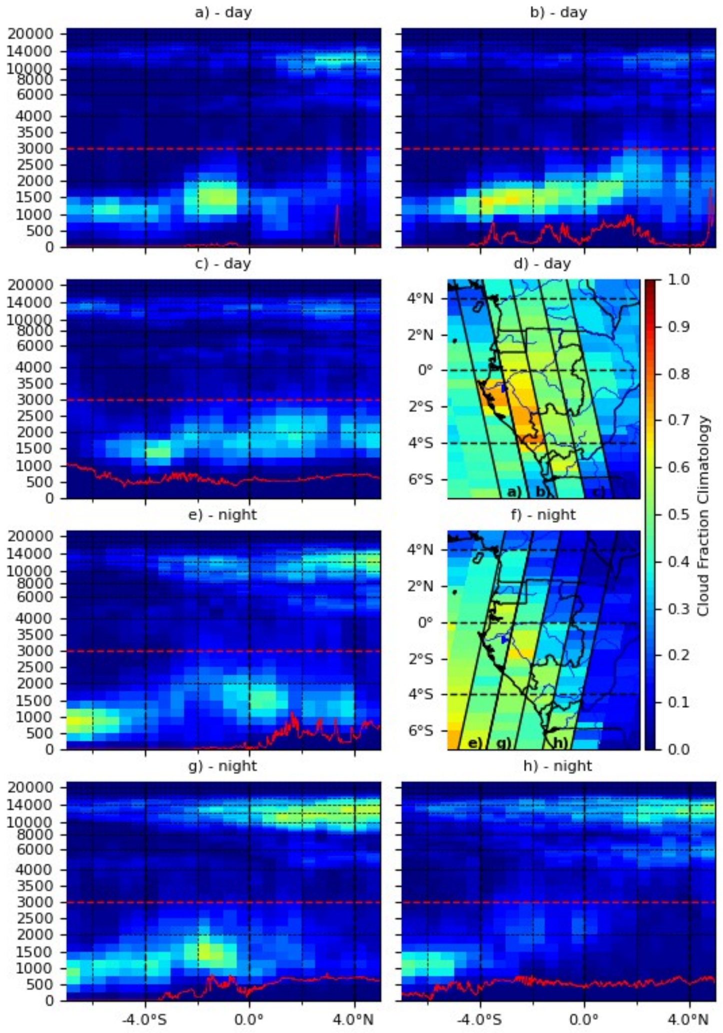
Cloud Climatology and its vertical profile

Widespread cloud deck

Stronger cloud deck in the coastal region

Gradient to the east

Consistency with other products



Cloud Type evolution

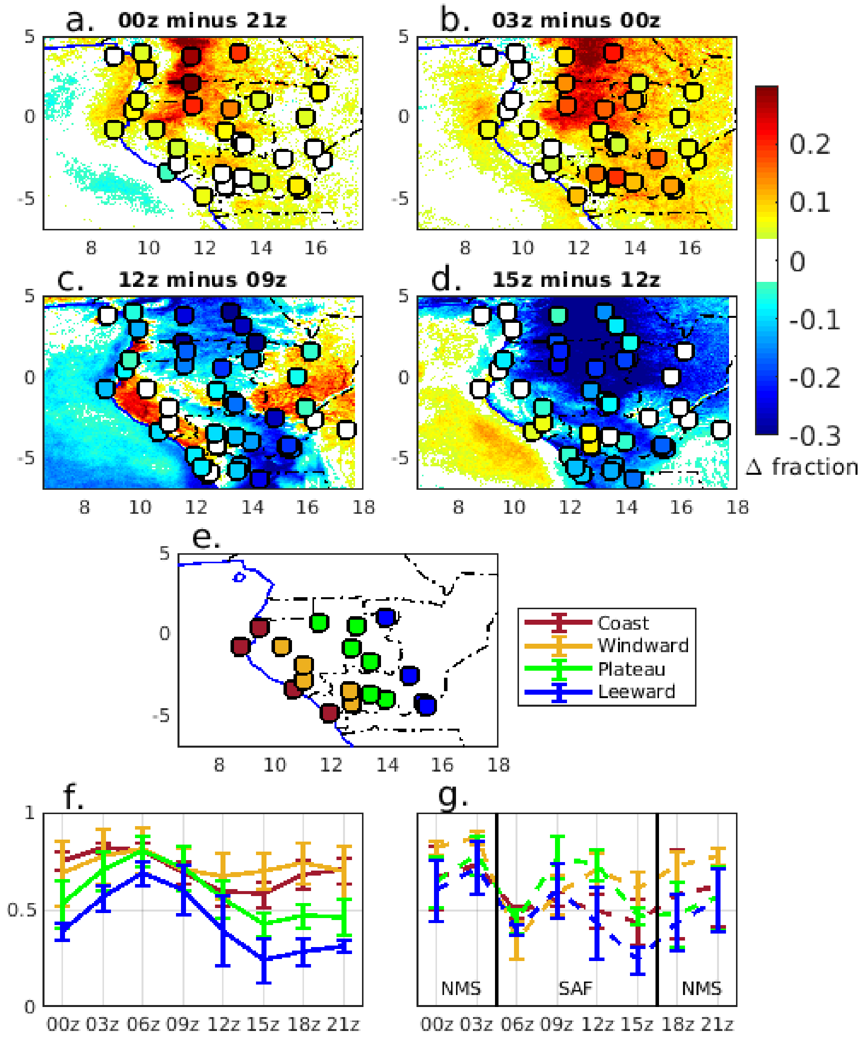
Low-level cloud occurrence frequency increase in the night

Change from Stratocumulus to Cumulus during the day

Windward side most cloudiest

Consistent evolution between SAFNWC (day) and NMS (night) and surface observations

High Amplitude behind Chaillu massif



Raffael Aellig

Summary and Conclusion

Long comprehensive climatology of various different datasets

Deficit of cloud detection by SAFNWC

Windward side most cloudiest

High Amplitude on the plateau

Transition from Stratocumulus
to Cumulus during the day