Karlsruhe Institute of Technology

Institute of Meteorology and Climate Research Atmospheric Trace Gases and Remote Sensing (IMKASF)

Arndt.Meier@kit.edu

Supplementary Site Evaluation Tool

Get some idea of the meteorological conditions at a given or potential observation site

- INTRODUCTION: I wrote a small Python tool that allows you to plot earth observation data and that you can download from https://gitlab.com/isbjoernen/observation-site-evaluation#. It reads hourly data from the “NASA Power” interactive website at https://power.larc.nasa.gov/data-access-viewer/and produces fortnightly climatologies for any chosen location.

- PLOTS: We we used a 10-years data record for the period 2016-01-01 to 2026-01-01 and created a **fortnightly climatology** thereof.
- **Overpass statistics:** The KT ratio is calculated on an hourly basis as in:

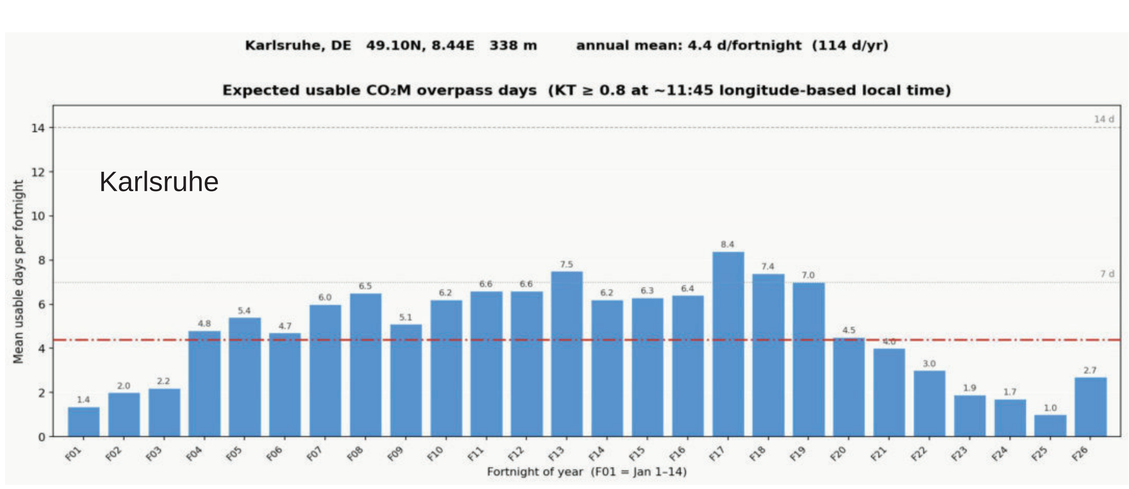
$$KT_{hourly} = \frac{All\ Sky\ Surface\ Shortwave\ Downward\ Irradiance}{Clear\ Sky\ Surface\ Shortwave\ Downward\ Irradiance}$$

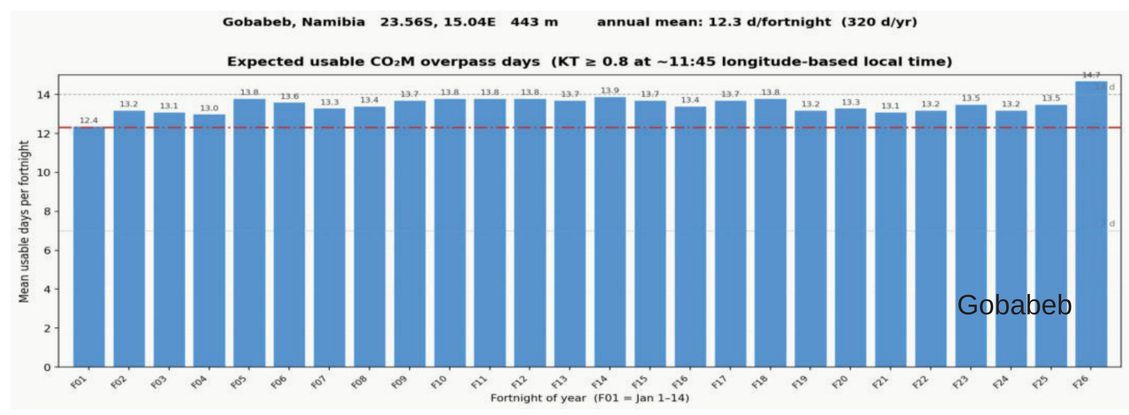
Then the nearest UTC hourly data available was selected for local 11:45am (local time based purely on longitude) and plotting those values as KT overpass statistics:

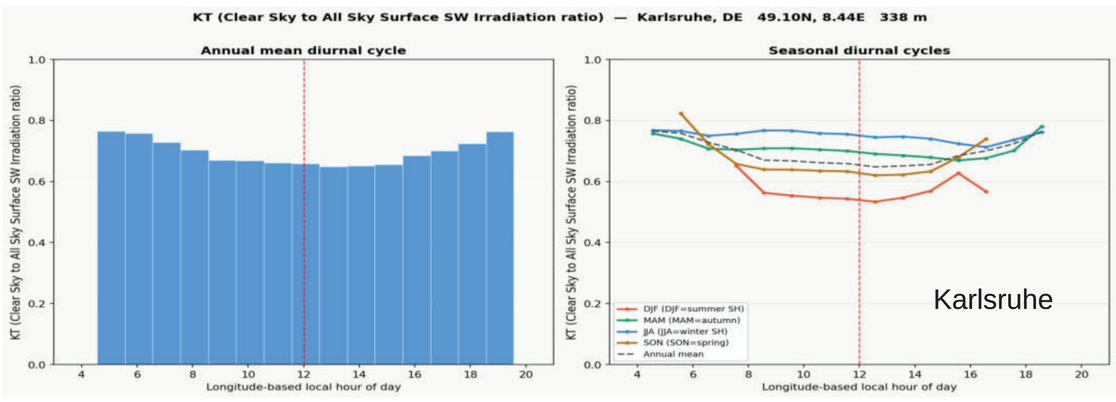
$$KT_{overpass} = nearest_{11:45\,h\,local}(KT_{hourly})$$

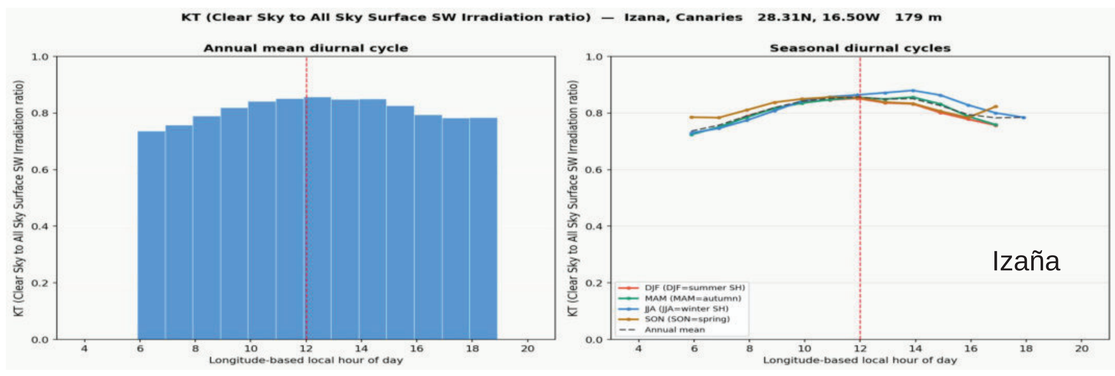
Thus, KT as defined here, represents the ratio between the All Sky Surface Shortwave Downward Irradiance divided by the theoretical maximum value, the Clear Sky Surface Shortwave Downward Irradiance and a cut-off of KT>=0.8 was applied, meaning if 80% or more of the sky appears “clear” then FTIR observations should be possible. The horizontal red line indicates the annual average value.

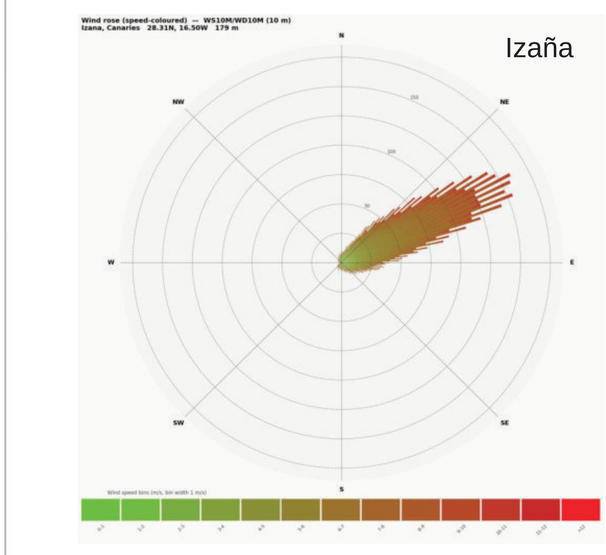
The **diurnal plots** show the mean KT values for each hour of the day either annually (left panel) or per season == 3-months mean (right panel). Please note that *values near sunrise/sunset are less reliable as we divide by small numbers with poor statistics.* Note also that the underlying data is binned by UTC hour, while the x-axis represents local time as defined purely by longitude and therefore the tic marks align differently between plots from different longitudes. The vertical red line indicates local midday (12:00h).

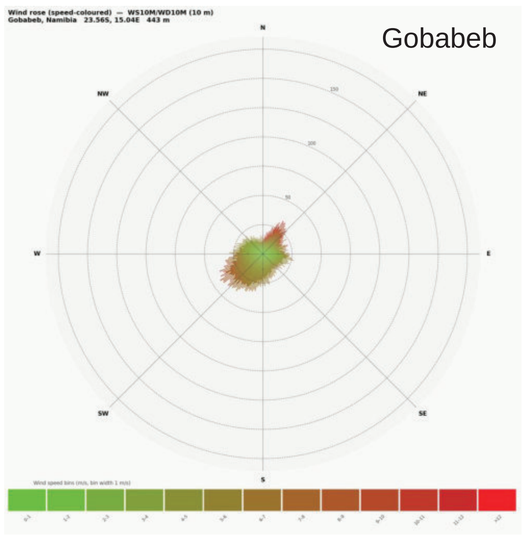


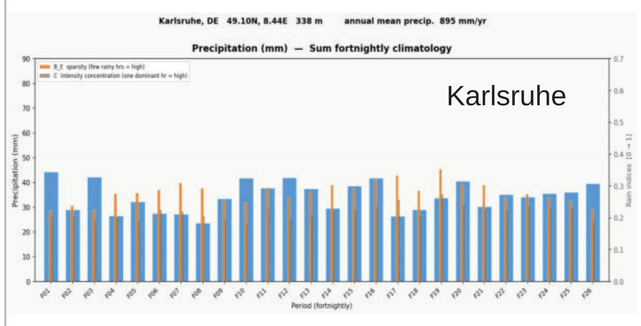


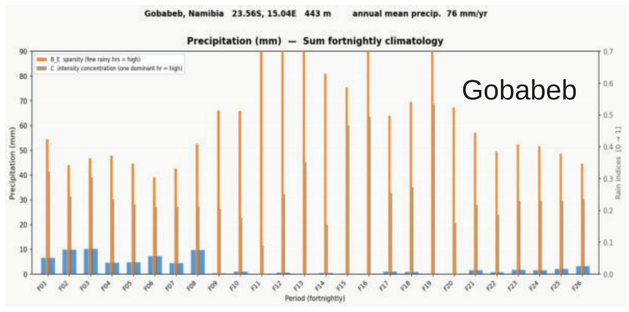


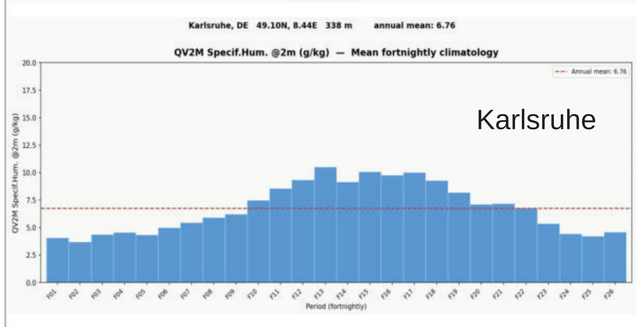


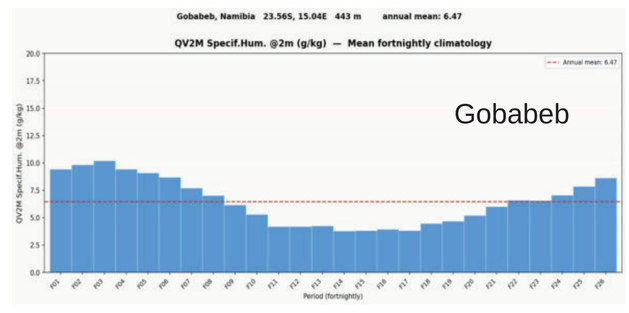


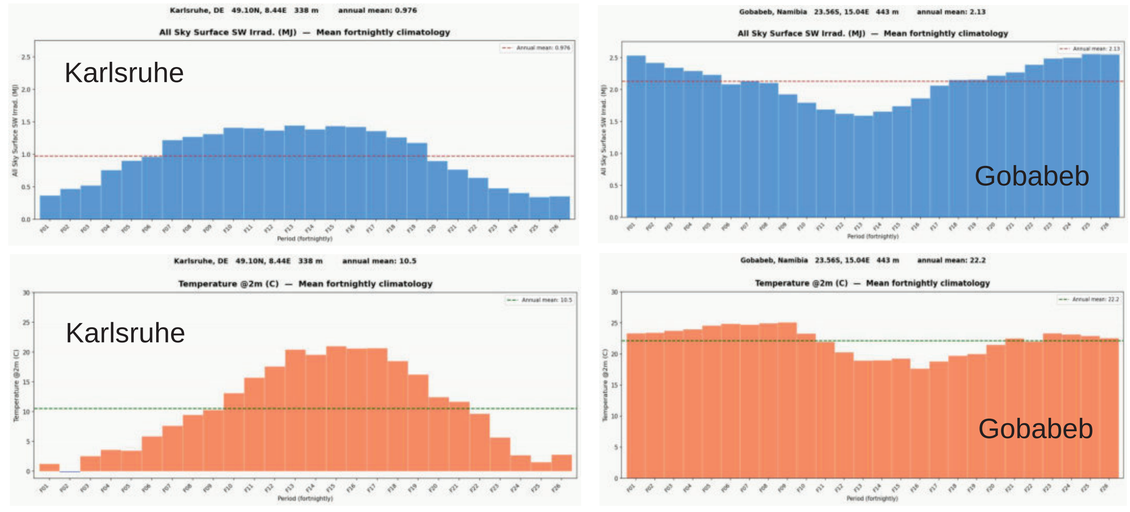












DATA: The **NASA** website portal features the **CERES SYN1deg** data set (see Rutan et al. 2015, DOI: 10.1175/JTECH-D-14-00165.1). It is a well-documented and scientifically solid data source. It is a **radiative transfer model product driven by satellite observations**.
The chain is:Satellite observations → cloud/aerosol properties → radiative transfer model → surface fluxes on a global 1°×1° grid. Specifically, surface fluxes are computed using the Langley Fu-Liou radiative transfer model, with inputs from MODIS and geostationary satellite cloud properties along with atmospheric profiles from NASA's Global Modeling and Assimilation Office (GMAO). The CERES SYN1deg products use 1-hourly radiances and cloud property data from geostationary imagers to model variability between CERES observations (NASA ASDC).
The CERES instruments themselves have been flying since 2000 (FM1 and FM2) and (FM3 and FM4) since May 2002, and FM5 since October 2011. It is fair to say that the 2016–2026 data used here is from a mature, multi-instrument constellation.

Spatial resolution: The solar data are produced on a global 1° latitude by 1° longitude grid. Thus a typical grid cell captures the regional cloud climatology, not the microclimate of any specific observation site.