Lifting the fog in the central Namib – where did it come from? (P-1-21)

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Introduction

Fog and stratus clouds (FSt) provide an important input of water to the biota of the coastal parts of the hyper-arid Namib [1,2]. Its climatology is relatively well understood but only recently observational evidence showed the role the marine stratus clouds which – dominantly advected from north-west – produce with its seasonal height variation and the interplay with the ascending terrain the distinct fog climatology of the central Namib [3,4]. This advection-dominated fog regime was questioned recently based on isotope analyses and led to the suggestion that it might be rather a radiation-dominated fog regime in the coastal Namib [5].

Assuming that radiation fog would occur on the local scale and would have no connection to the marine stratus clouds we here analyse the spatio-temporal distribution of FSt detected from FogNet data.

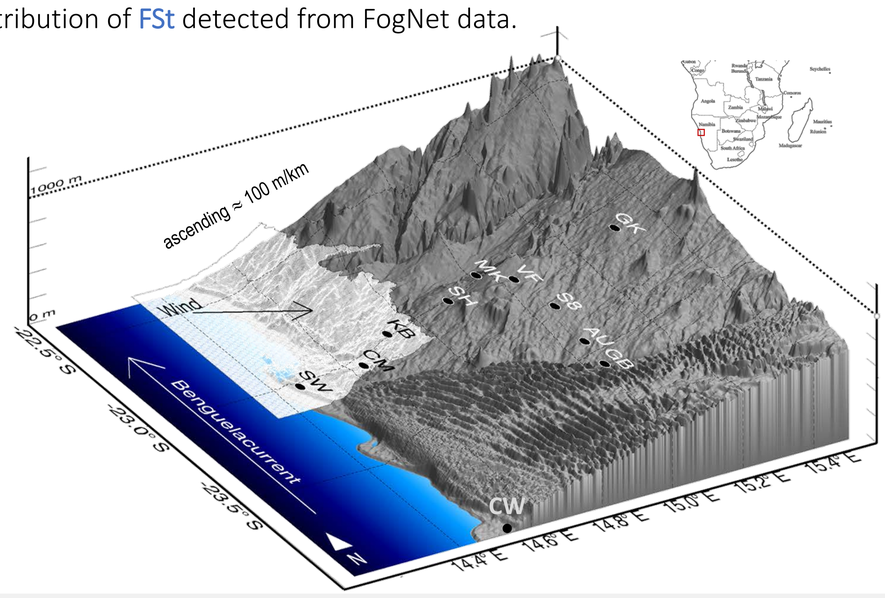

Figure 1: Overview on the FogNet stations in the central Namib. Digital elevation model derived from SRTM. Provided by Robert Spirig.
SW: Salt Works **CM**: Coastal Met **KB**: Kleinberg **SH**: Sophies Hoogte **MK**: Mable Koppie **GK**: Garnet Koppie
VF: Vogelfederberg **S8**: Station 8 **AU**: Aussinanis **GB**: Gobabeb CW: Conception Water
Start of data-set analysed: 07/2014 (except CW 03/2015 and SW 02/2016). End of data-set: 06/2019.

Fog/stratus detection

Fog/stratus clouds lead to sudden changes in the courses of certain meteorological variables. Automated algorithms did not work satisfactorily. Begin and end of FSt–events were determined by eye using two-day synopsis graphs of the relevant normalized variables. The temporal uncertainty is estimated to ±30 min and false or missing event detection to ±5%. If possible, results were cross-checked with satellite images.

Fog was discerned from stratus clouds by using fog precipitation measurements from the FogNet.

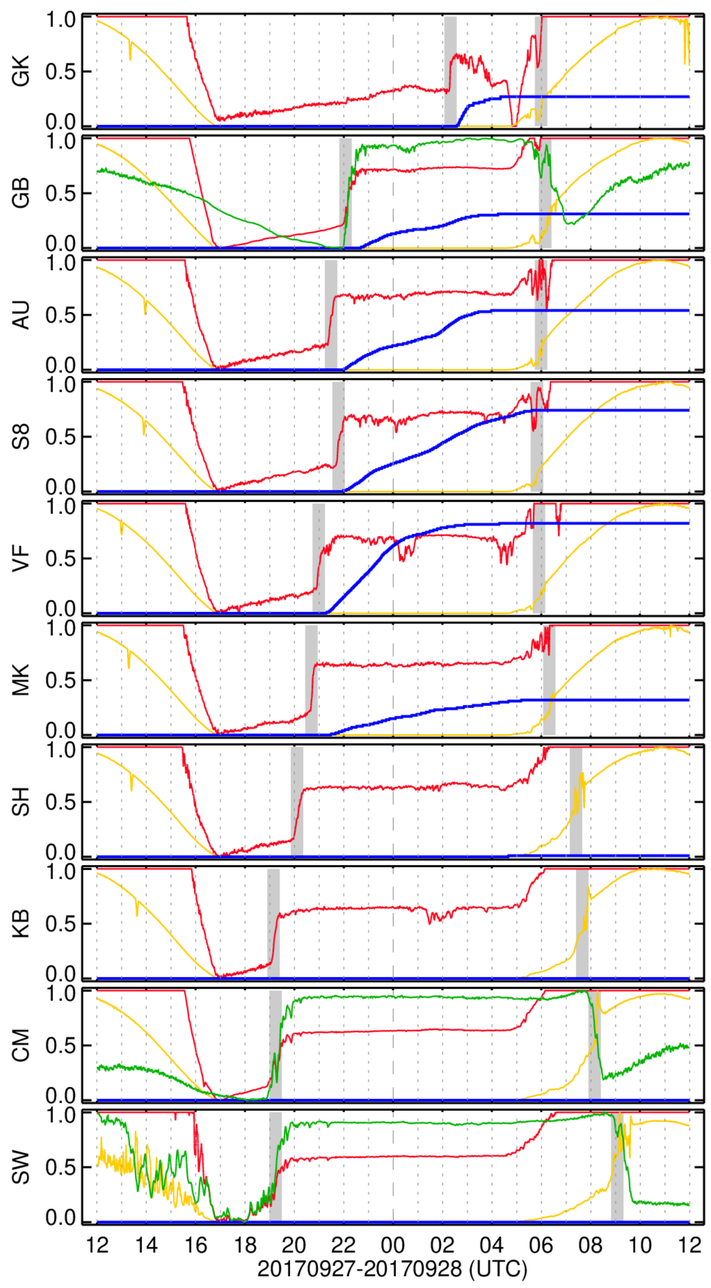

Figure 2: Example for an „easy going“ manual fog/stratus (FSt) detection. Normalized values of global radiation, net radiation, long-wave downward radiation, cumulative fog precipitation (max.= 10mm). Grey areas mark begin and end of the FSt event.

Results

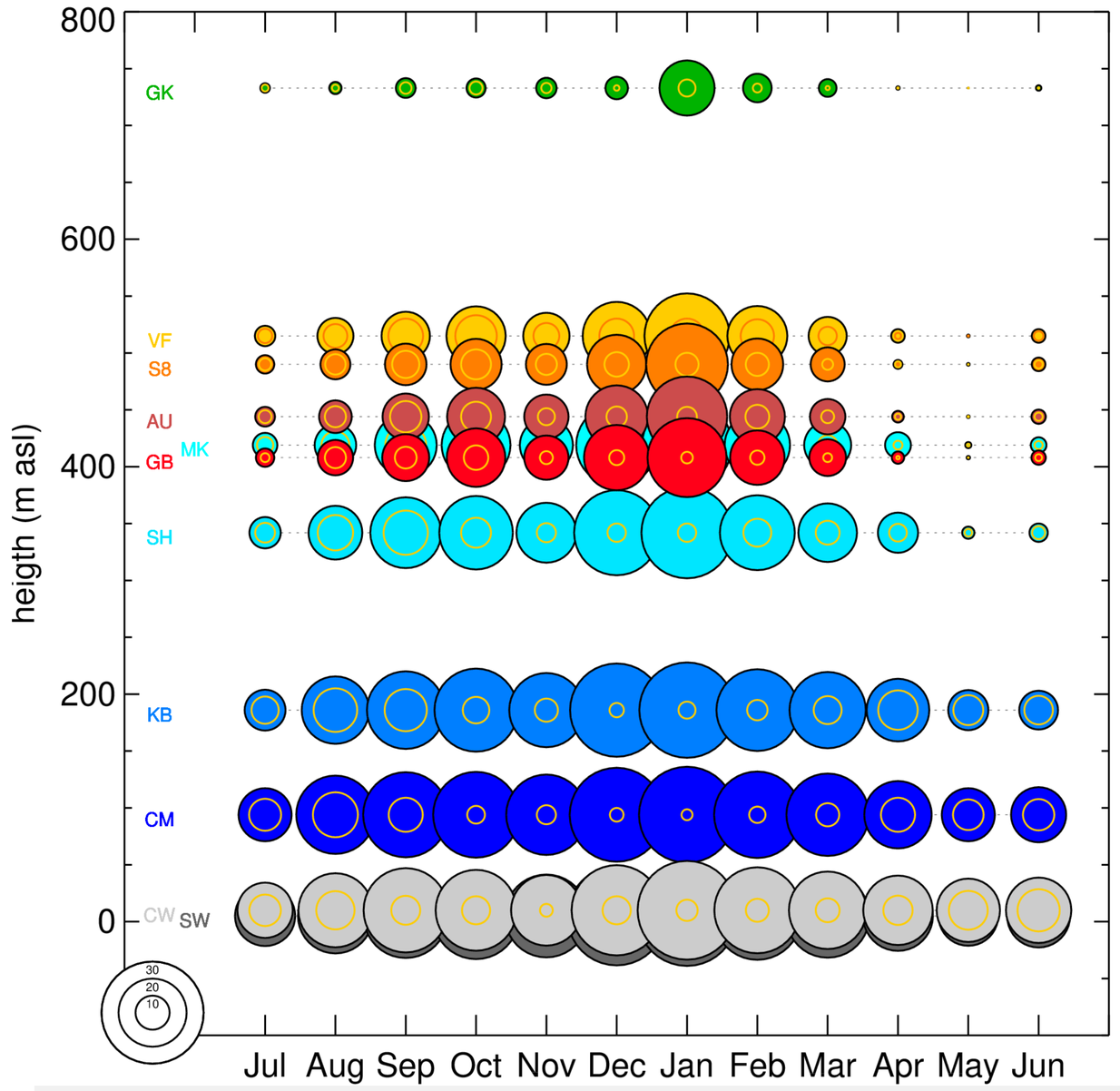

Figure 5: Mean monthly number of days with FSt-occurrence versus station height. Yellow circles: Mean monthly number of days with fog occurrence detected via fog precipitation measurement.

Seasonality of FSt

Maximum in Jan — Minimum in May-Jun-Jul
Secondary Maximum in Sep — Secondary Minimum in Nov
Seasonal courses at the coast and inland are similar, except: absolute Min in May above 300 m asl

Seasonality of Fog

At the coast (<200 m asl) Minimium Dec-Jan. Above 300 m asl secondary Minimum Dec-Jan.

Absolute Minimum: May. From Oct to Feb St base is higher, more days with fog >300m asl.

Monthly FSt-day frequency and daily FSt duration decreases inland

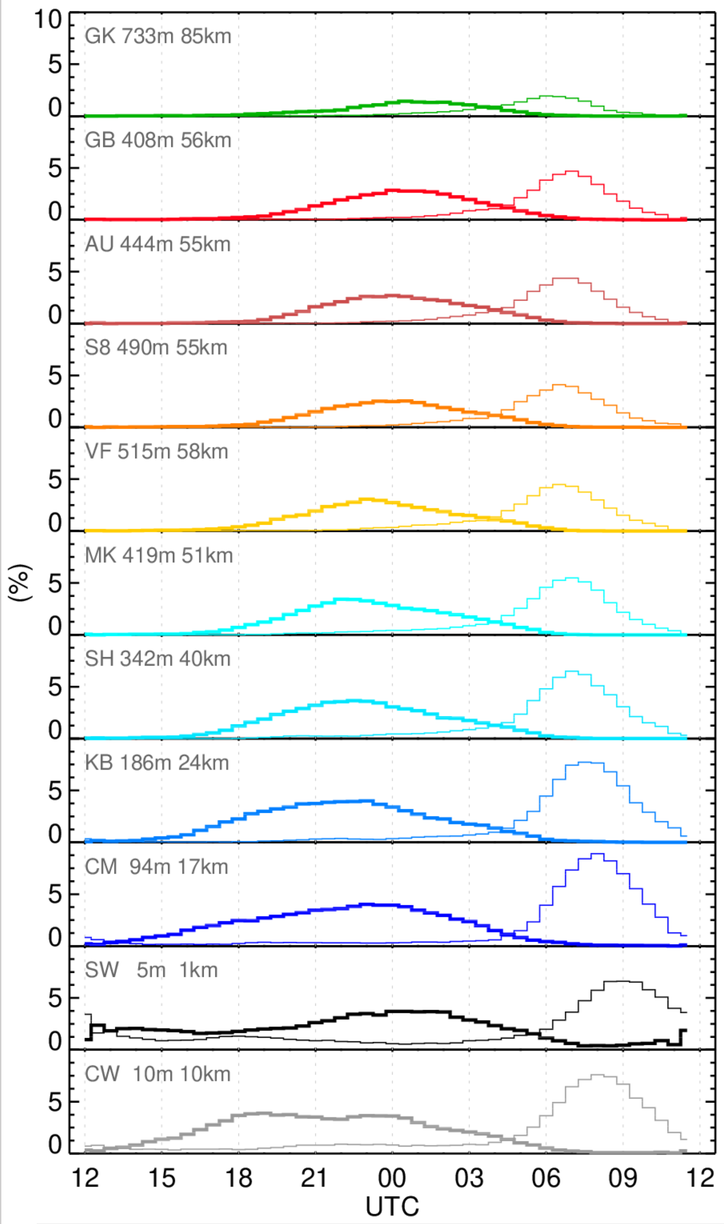

Figure 3: Detected begin (thick) and end (thin) times of FSt-events. Bin size 30 min. Histograms are smoothed applying a ± 1h centered moving average.

FSt start in NS transect MK-GB supports advection component from N. FSt-end occurs on average simultaneous → sun rise.

A stratus deck is advected from NW. The seasonality of its base/top height determines the spatio-temporal variation of FSt occurrence in the central Namib.

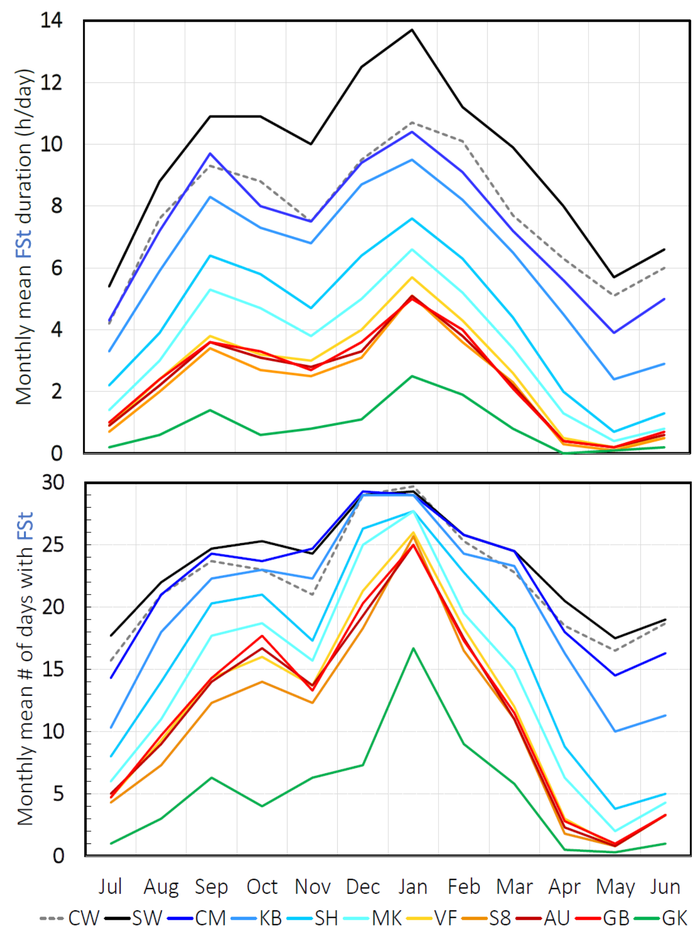

Figure 4: Top: Mean monthly daily means of duration of FSt-events. Bottom: Mean montly number of days with FSt-occurrence

References

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