

*The occurrence of radiation  
fog and mist at the SMJP  
airport in Suriname*

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# Problem statement:

- Fog is one of the most significant problems for pilots in Suriname.  
Airmen (pilots) in Suriname complain mostly about problems with early morning landing and take-off.

## Approach to the problem

- I did a research on the occurrence of fog and mist over a period of **12 years (2000 – 2011)**.
- Objectives:
  - 1) Construction of the Diurnal cycle (Preferred time of the day for formation and dissipation)
  - 2) Construction of the Annual cycle (Monthly evolution).
  - 3) Definition of visibility thresholds/limits for take off and landing.
  - 4) Study of a few special cases.

# Definitions:

- Fog: visibility < than 1000m.
- Mist: visibility 1000 – 5000m.

## GENERATION PROCESS

- Mist and fog created by the cooling of moist air to near or slightly below the dew point temperature.

## TYPES

• Radiation fog.

- Advection fog
- Ditch fog
- Sea fog

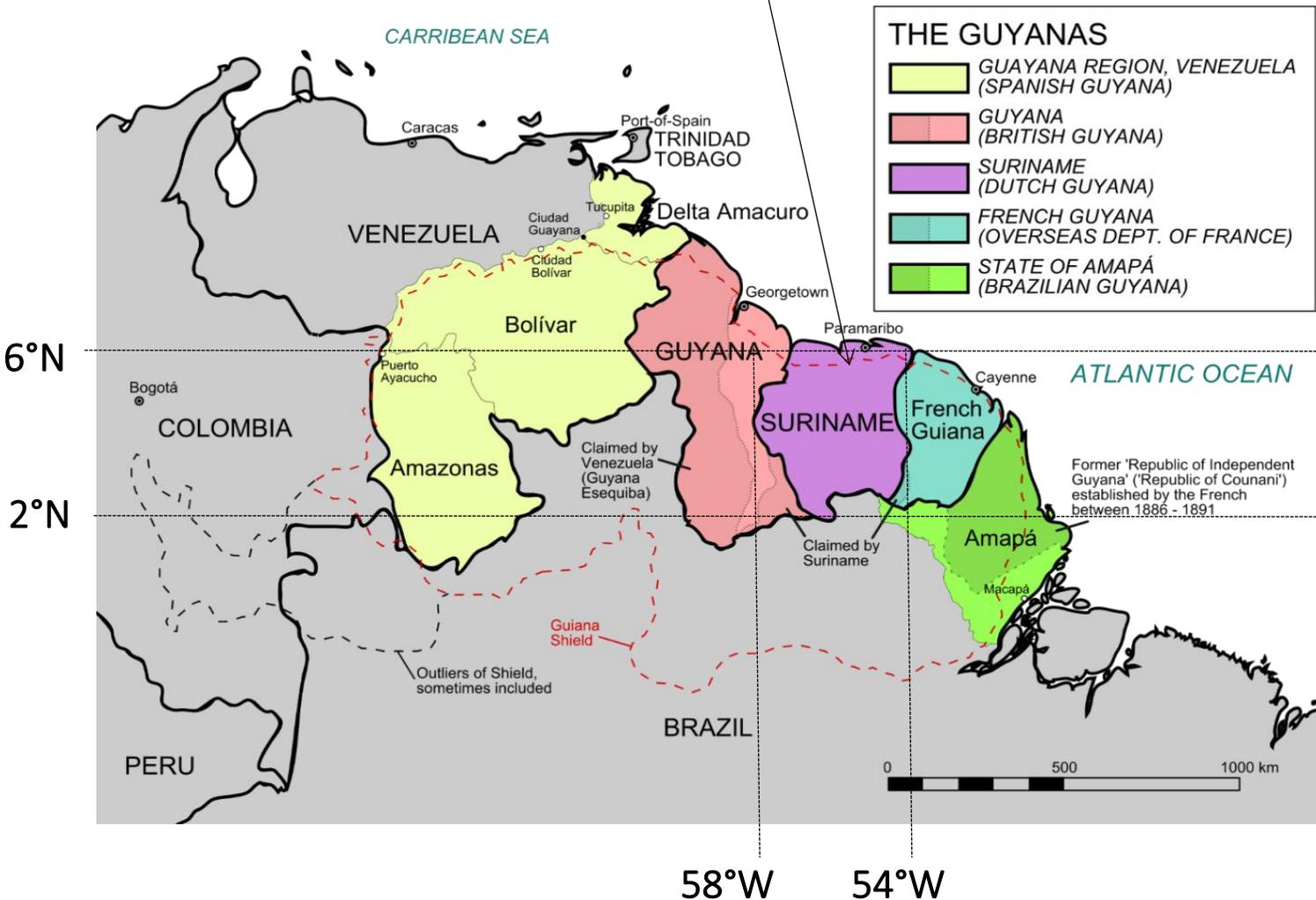
• Valley fog

- Rain fog
- Slope fog
- Stratus fog

- Rapid surface cooling in clear nights with weak winds and large moisture availability (e.g. after heavy showers)

# Geographical Background

SMJP: Zanderij Airport  
Lat: 5.27N Lon: 55.11W Alt:16mASL



## Relevant weather features

Trade winds:

- Tropical Waves
- Easterly Waves
- Induced Waves

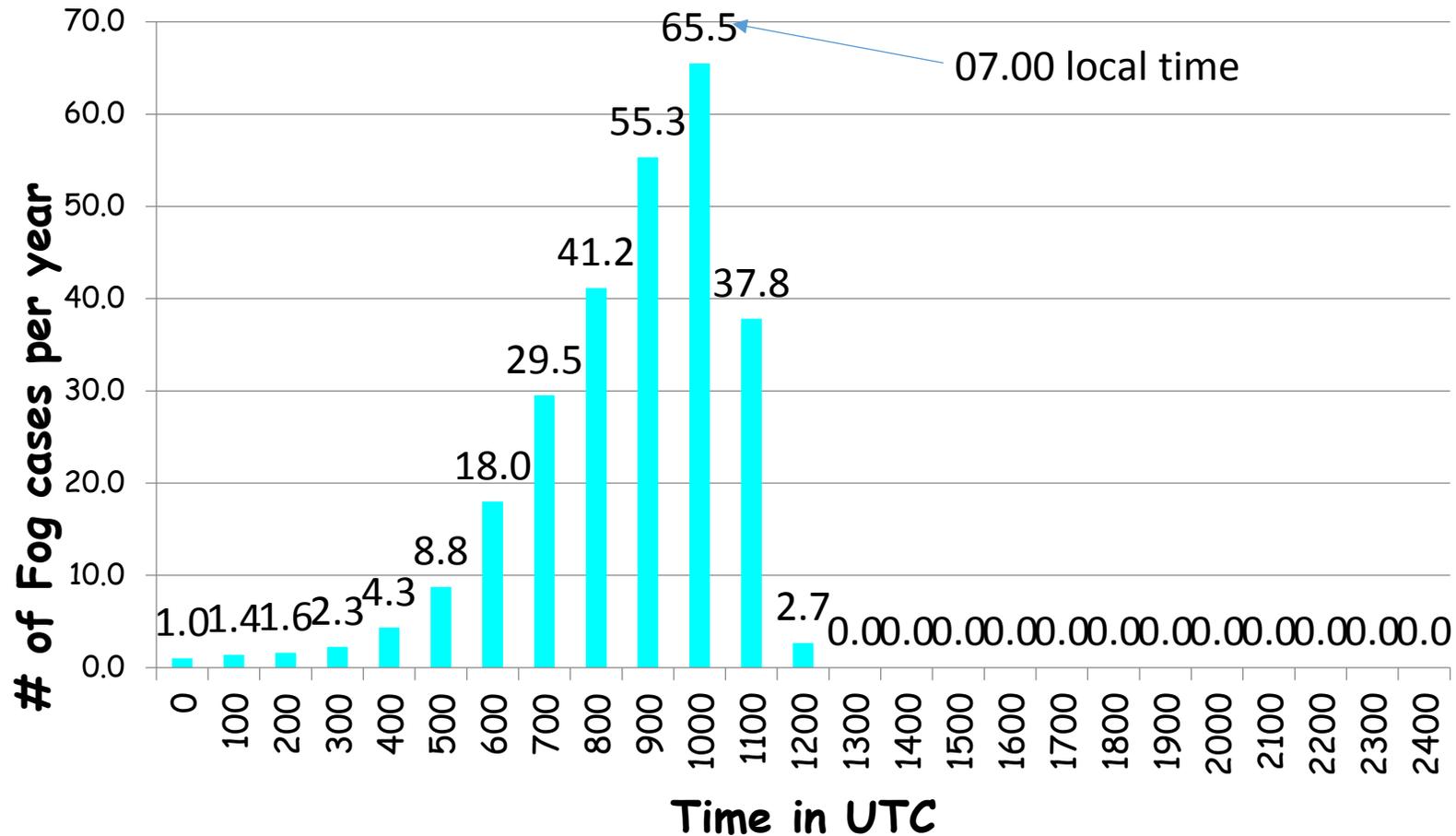
I.T.C.Z.

Low level troughs

Mid/upper troughs(TUTTS)

Sea breeze fronts

# Diurnal Cycle of Radiation Fog

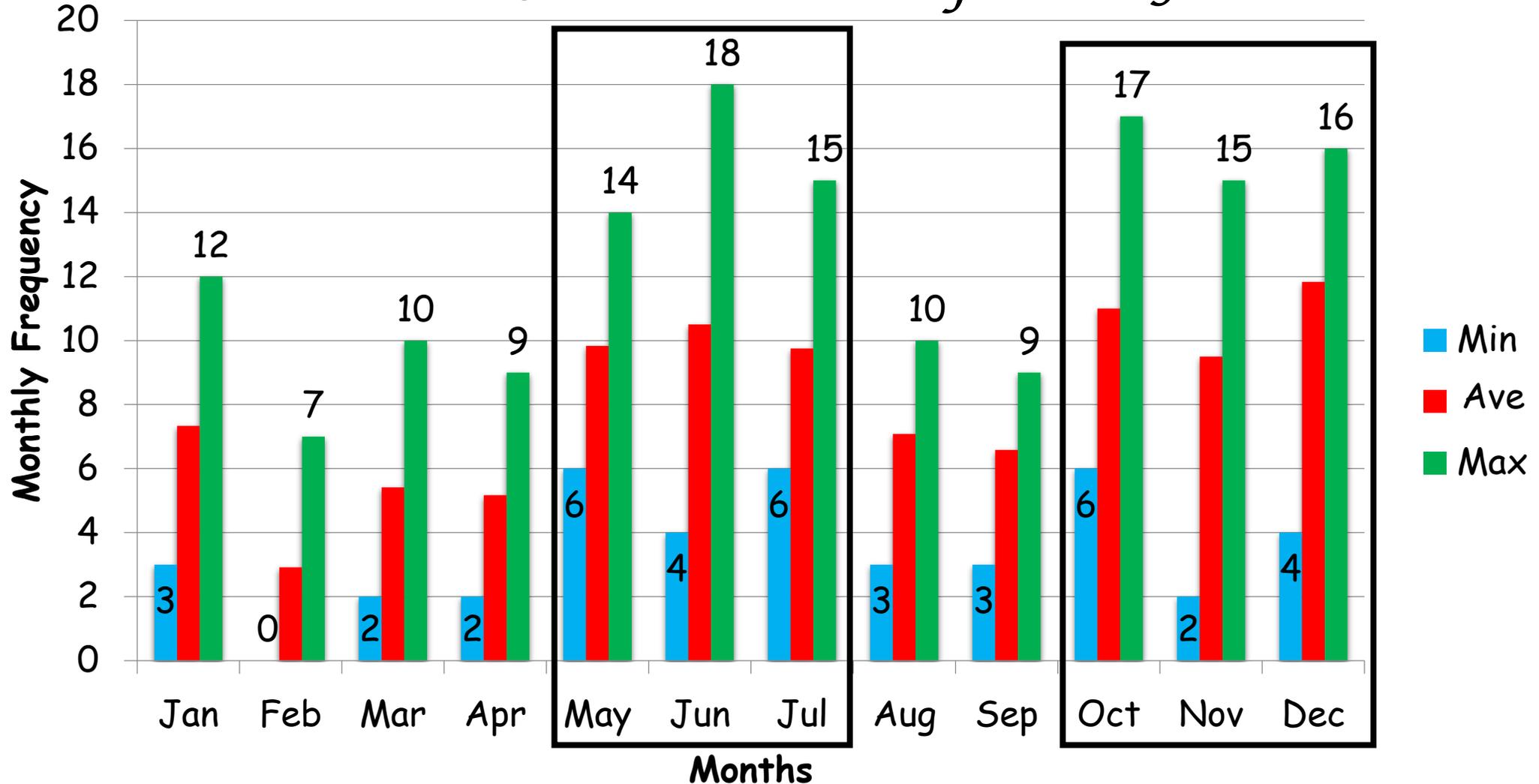


## Diurnal Cycle:

- Densest fog occurs in the morning between 6 am and 8 am .
- Can form as early as 9pm and dissipate as late as 9am.

# Annual Cycle of Fog and Mist

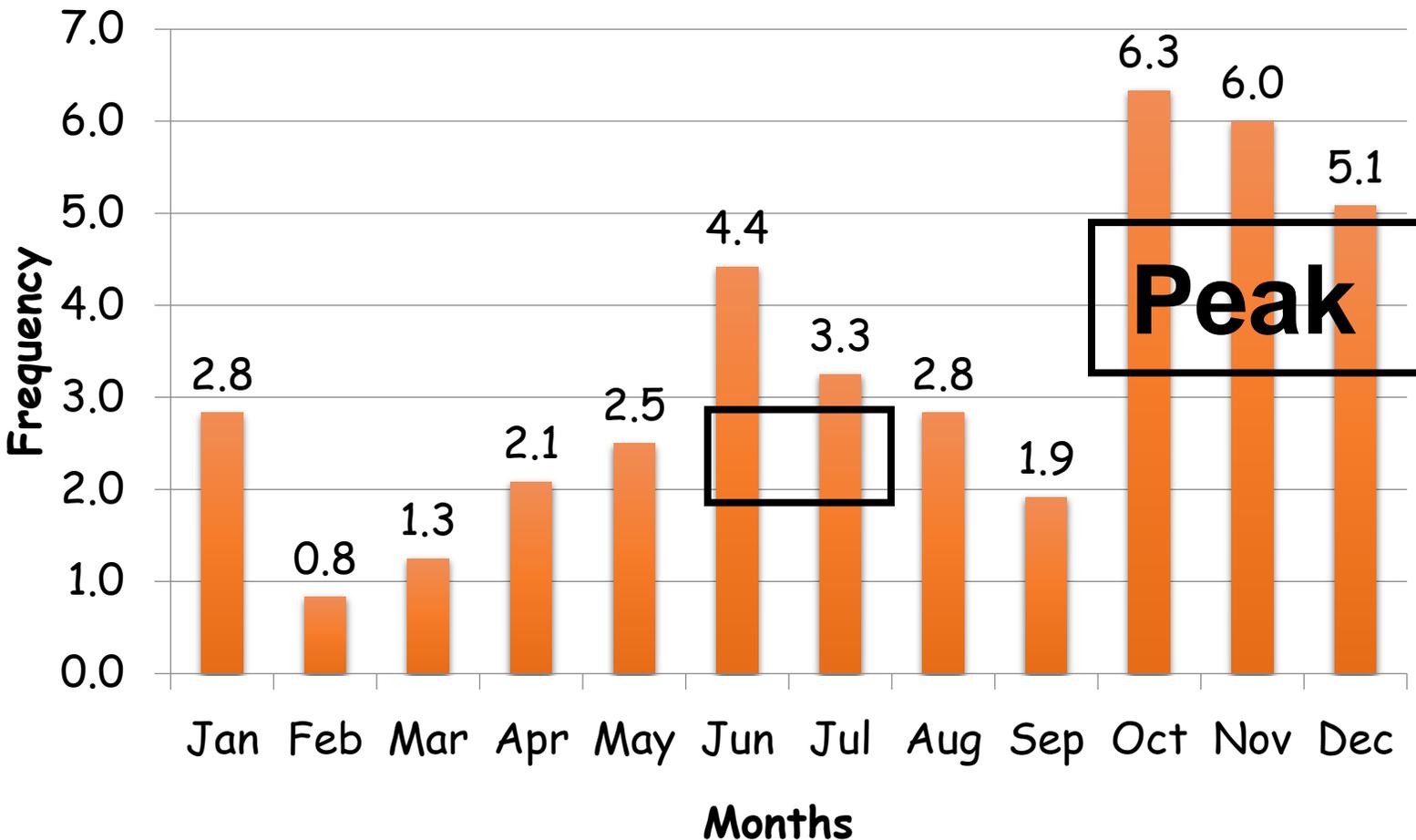
*Fog and mist monthly frequencies (2000-2011)  
Cases with visibility below 2500m*



# Annual Cycle of dense fog

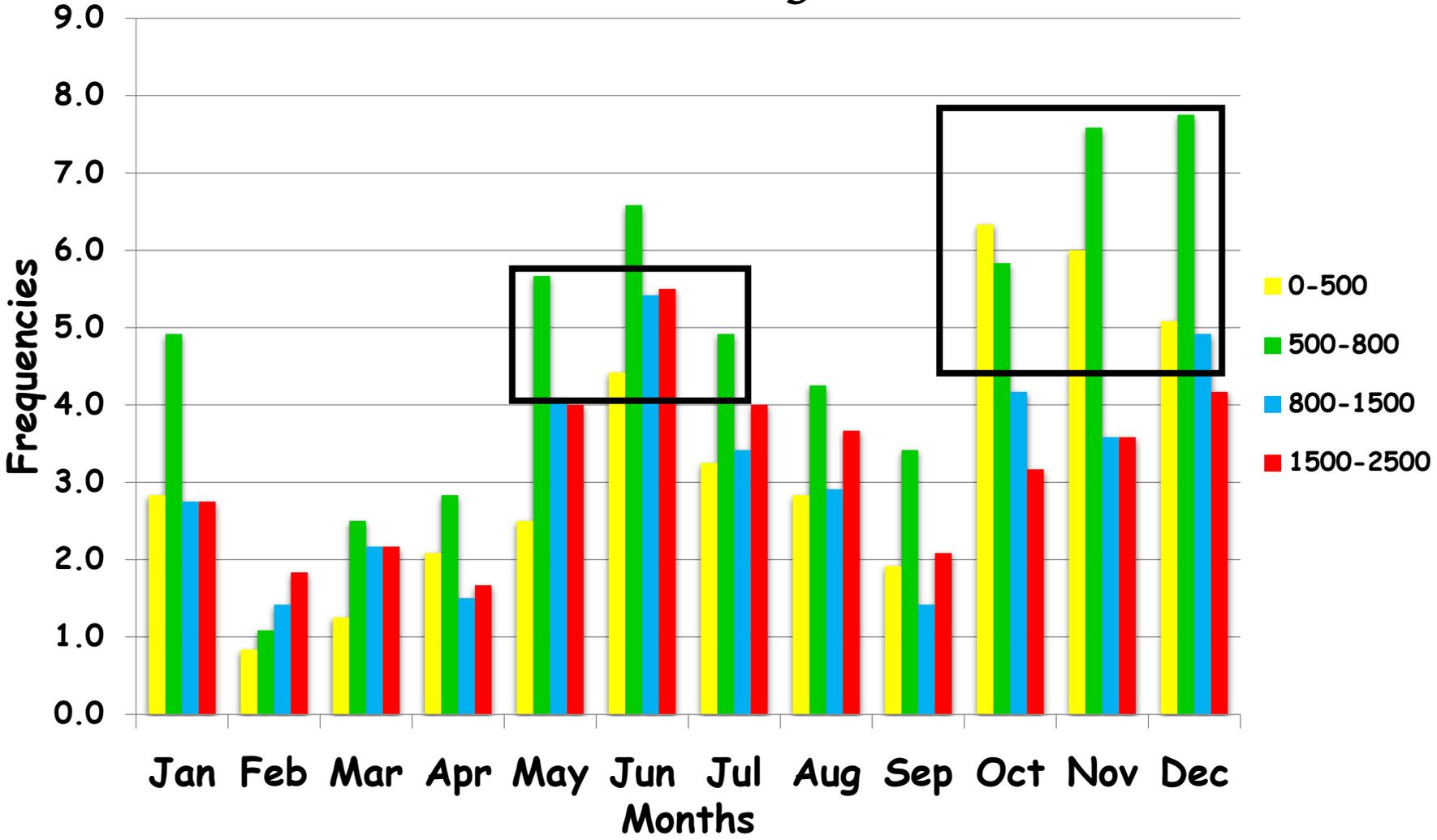
(Visibility < 500m)

*Average frequency of days with fog:  
2000-2011*



# Four different visibility ranges

*Average frequencies of different ranges:  
0-2500m*



# What drives the annual cycle?

- **Oct-Dec: Highest Frequency**

- ITCZ periodically over Suriname when retreating southward.

- ITCZ provides weak wind environment and high sfc dewpoints.

- Frequent cloud-free periods at night from stable/dry mid-levels.

- Cooler temps advected from the NE can increase relative humidity near sfc.

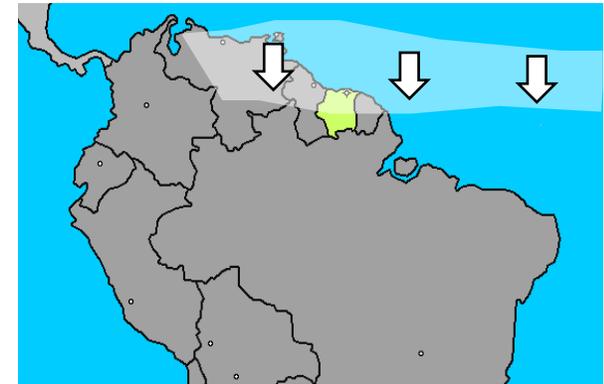
- **Ideal setup: Diurnal ITCZ rains increase sfc dewpoint, weak ITCZ winds, and clouds clear rapidly in the evening, setting a fast radiative cooling process.**

- **Jun-Jul: Secondary Max**

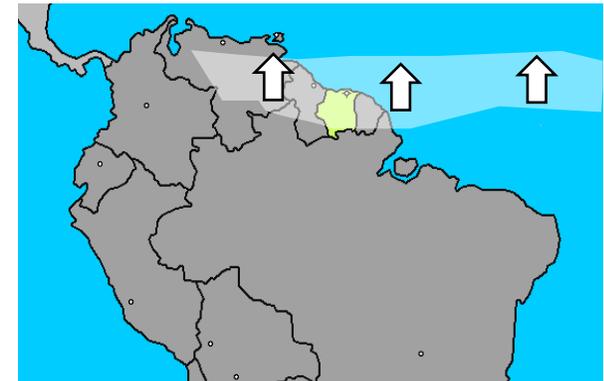
- Ill-defined ITCZ positions over Suriname as it migrates northward.

- Similar mechanism, but relatively less rad. cooling due to the high frequency of convection and clouds.

ITCZ Position Oct-Dec



ITCZ Position Jun-Jul



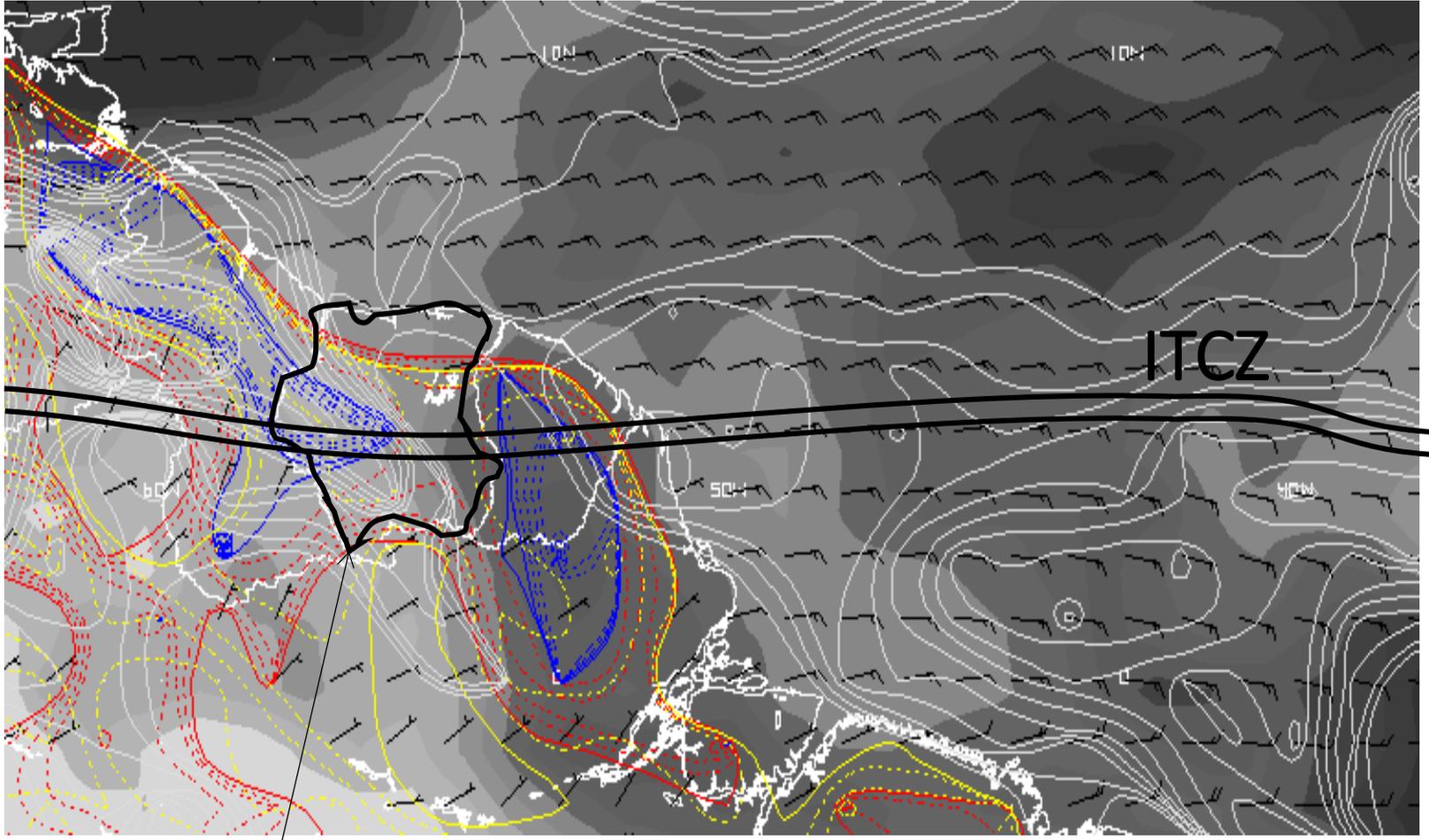
# *Special Cases*

Identification of predictors for fog formation.

Goal: Improve our forecasts.

# Charts we will use and what do they contain

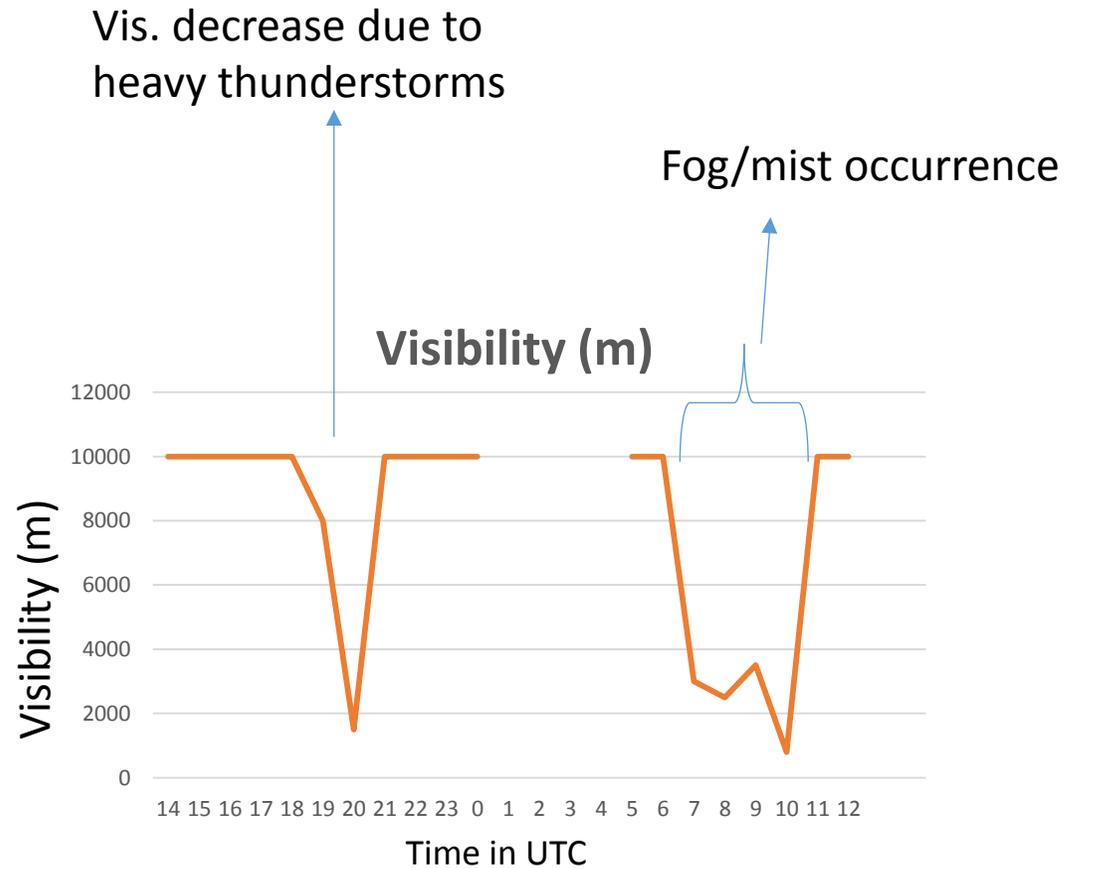
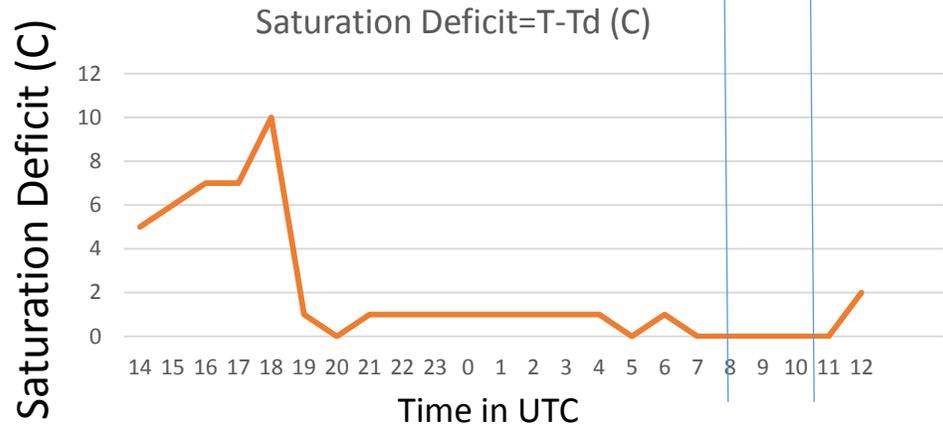
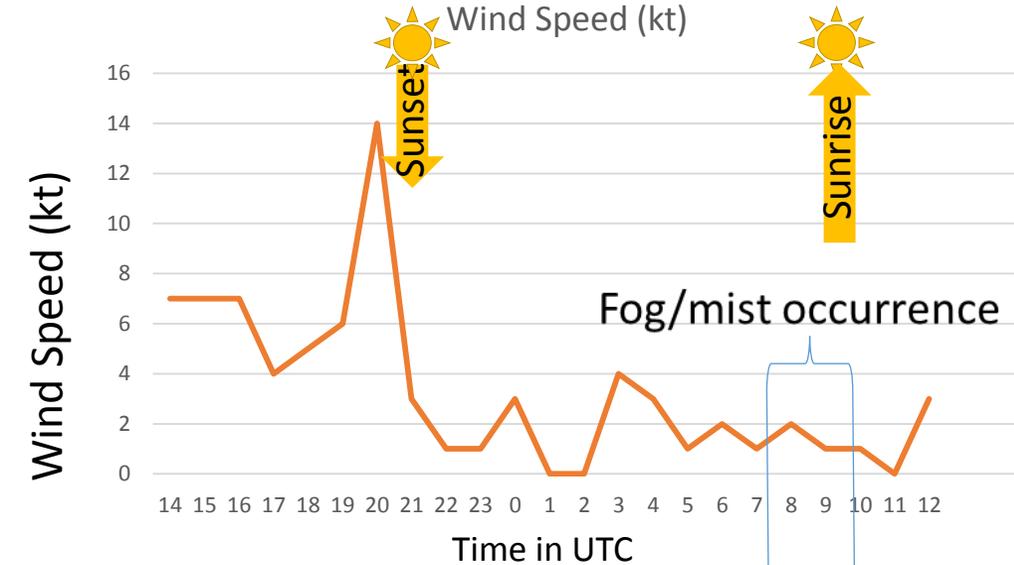
- SHADED: GDI (Stability)
- YELLOW: WINDS <4KT
- BLUE: RH > 99.5%
- WHITE: CLOUDS  
(AVR RH 925-850-700MB)
- RED: SAT DEFICIT



Suriname

# Special Case I: Dec 07/08, 2014

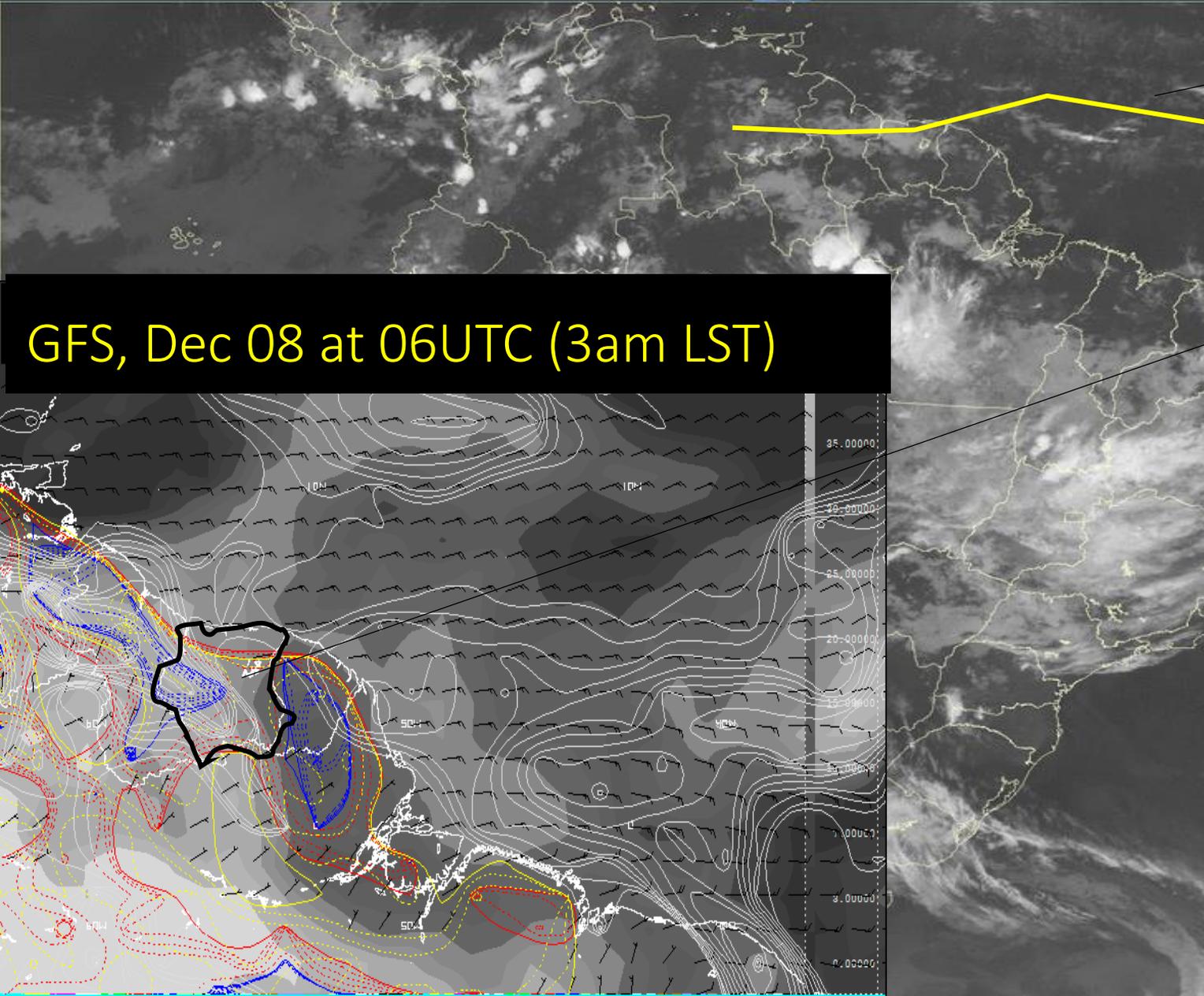
METAR SMJP 081000Z VRB01KT 0900 FG BKN002 23/23 Q1011 TEMPO 1500=



\*Local time = UTC-3

# SATELLITE ANIMATION DEC 08, 2014.

INPE/CPTEC/DSA NOAA GOES-13 CPTEC Canal - 4 IR



GFS, Dec 08 at 06UTC (3am LST)

→ **Ill-defined ITCZ**

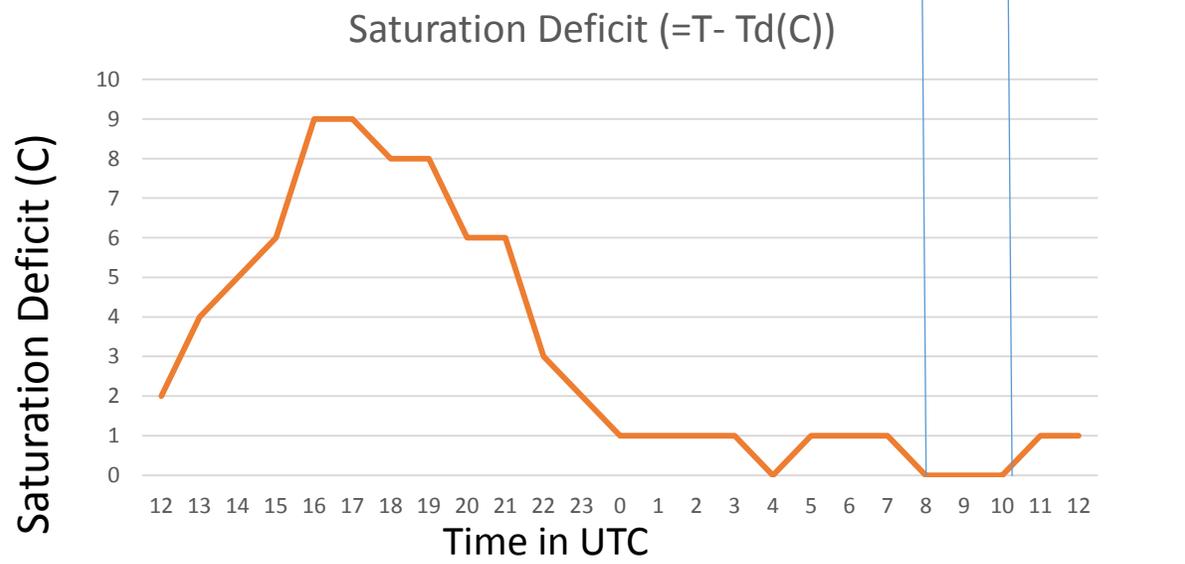
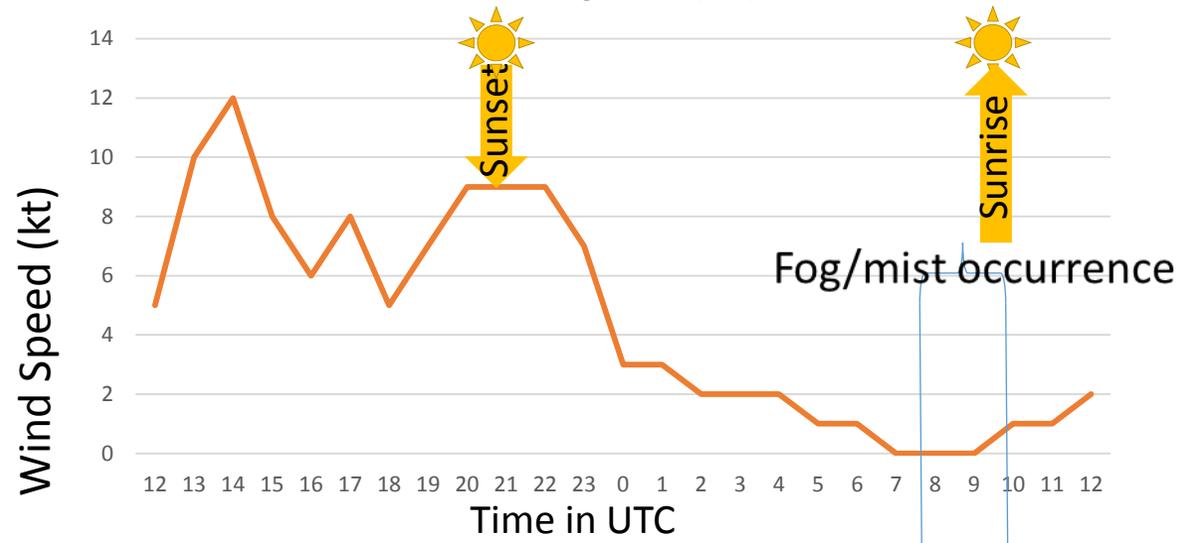
→ **Predictors**

- YELLOW: WINDS <4KT >> Almost calm.
- BLUE: RH > 99.5% >> close to.
- WHITE: CLOUDS >> Few clouds
- RED: SAT DEFICIT >> Yes.

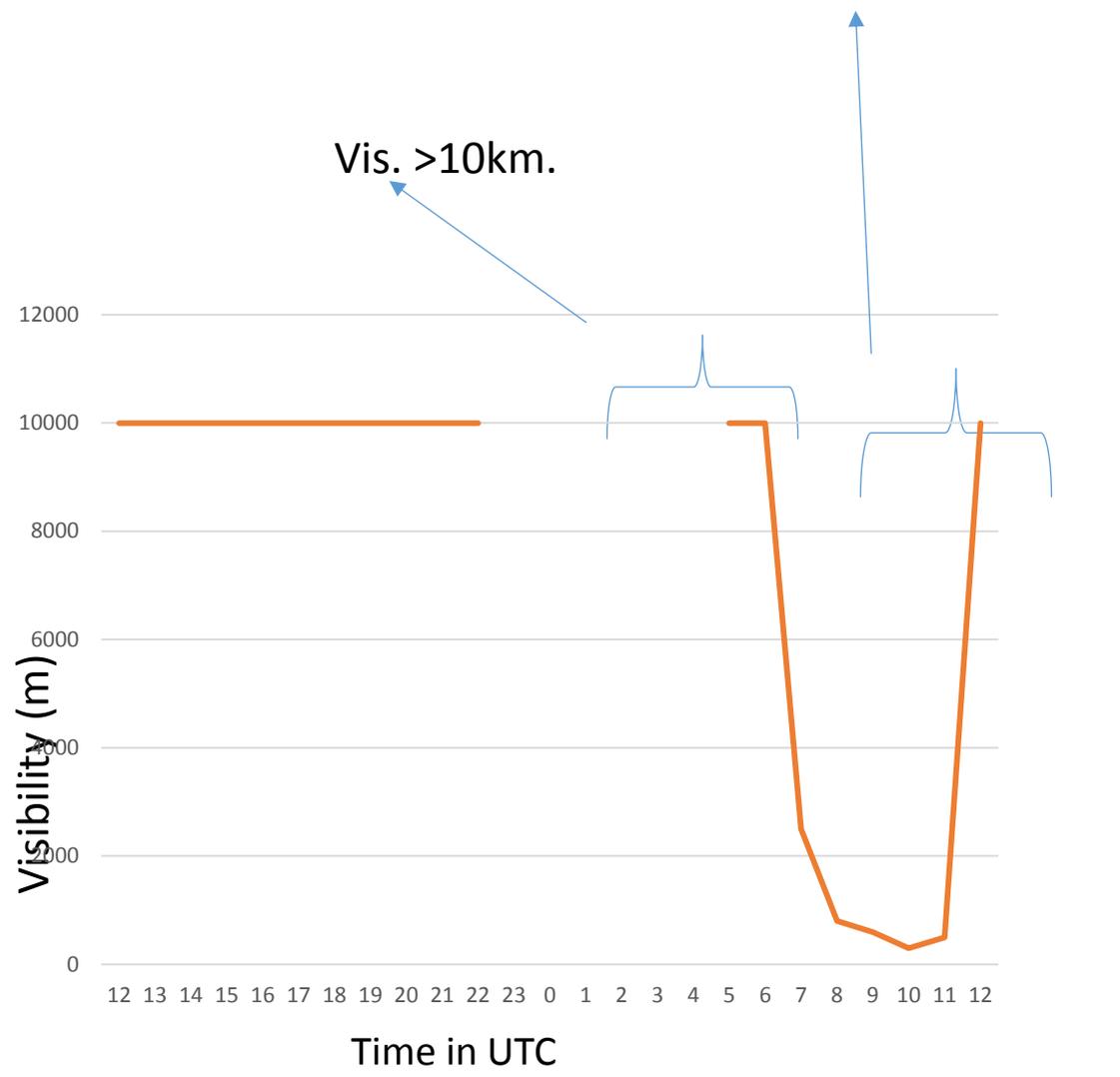
# Special Case II: Dec 17/18

METAR SMJP 180700Z 0000KT 2500 BKN002 23/22 Q1011 TEMPO 0800 FG=

### Wind Speed (kt)

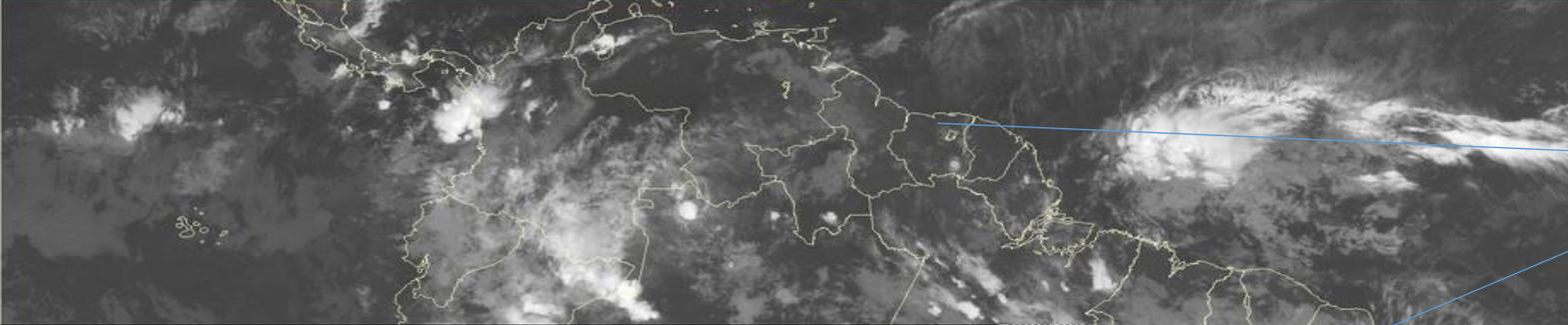


### Fog/mist occurrence



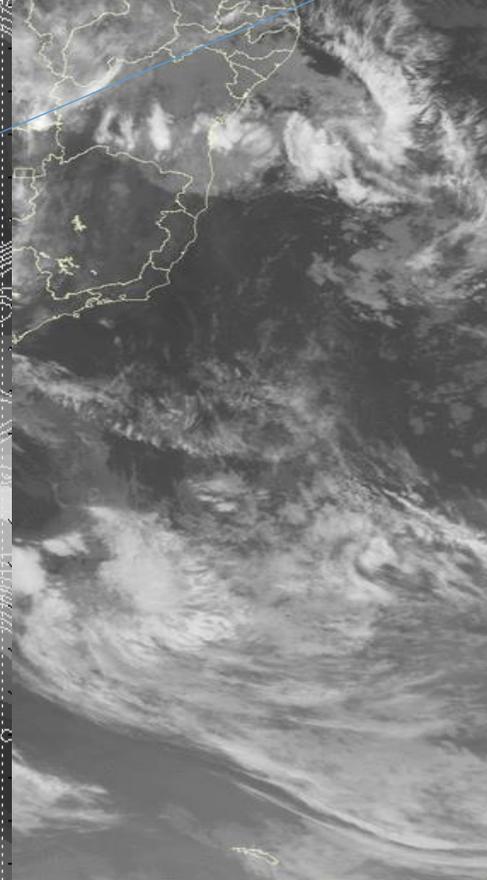
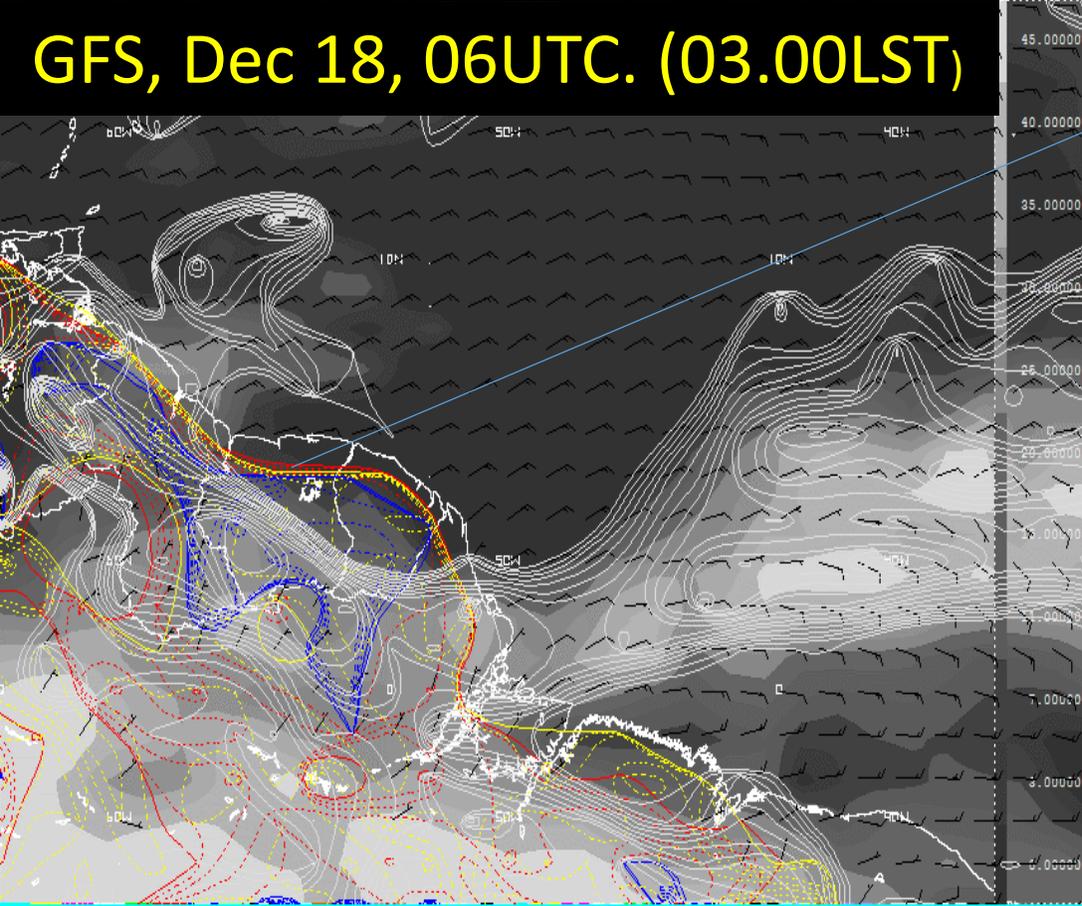
# SATELLITE ANIMATION DEC 17/18, 2014

INPE/CPTEC/DSA NOAA GOES-13 CPTEC Canal - 4 IR 201412180600



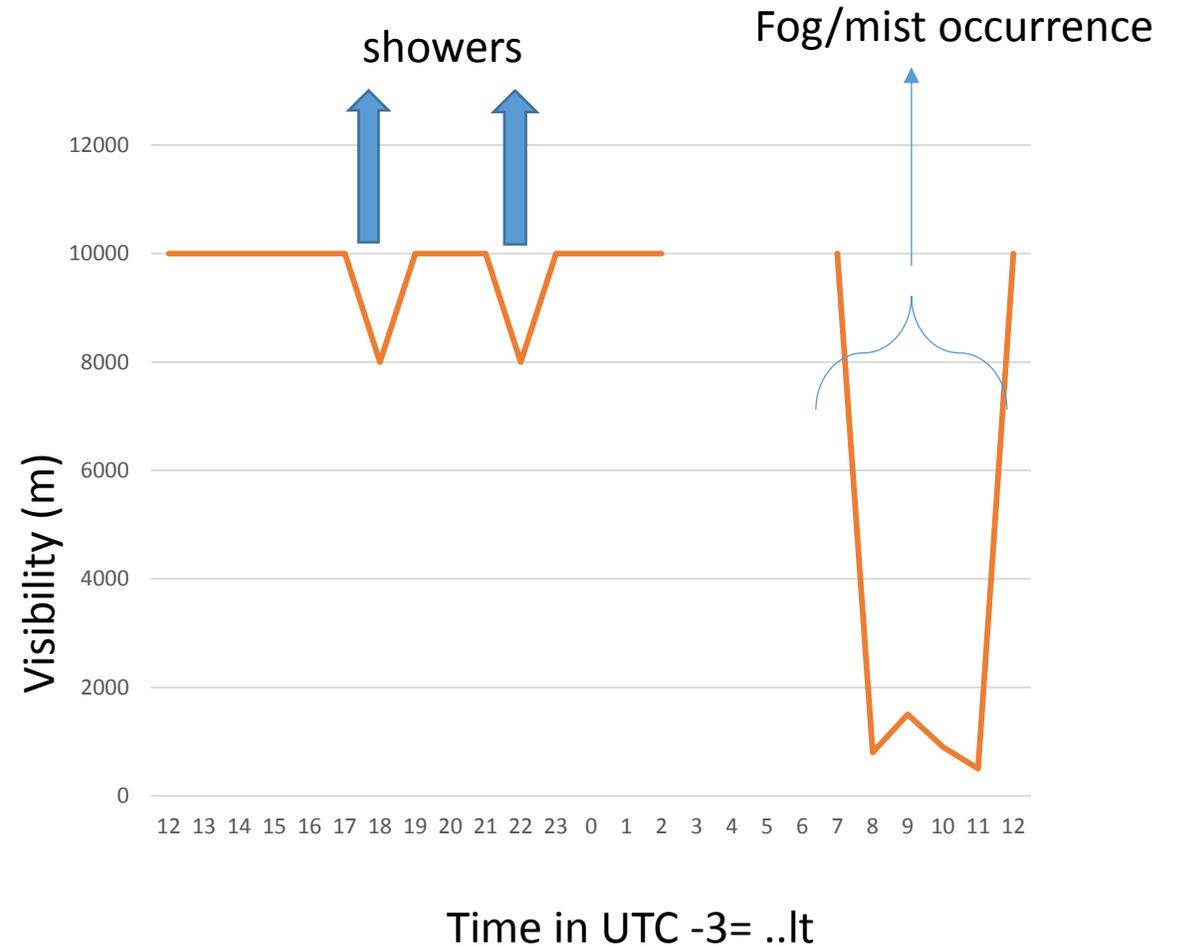
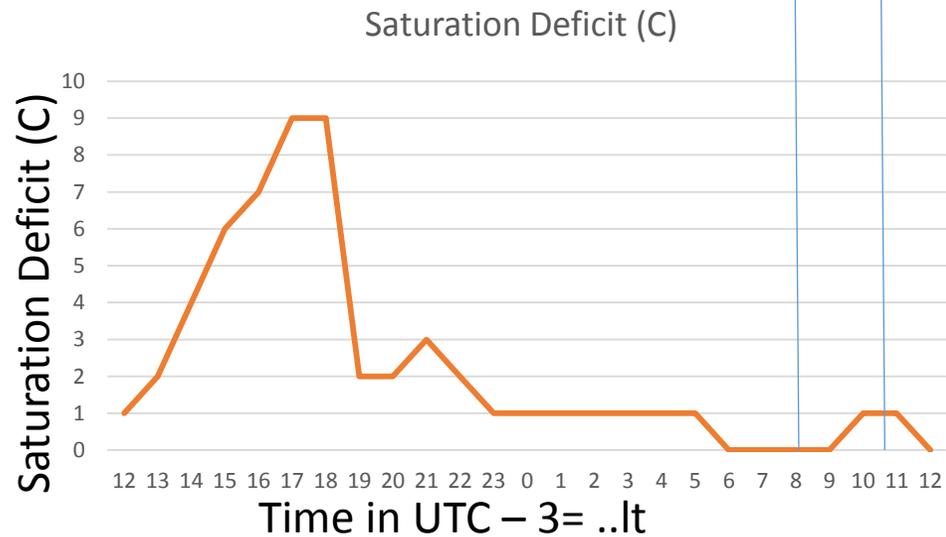
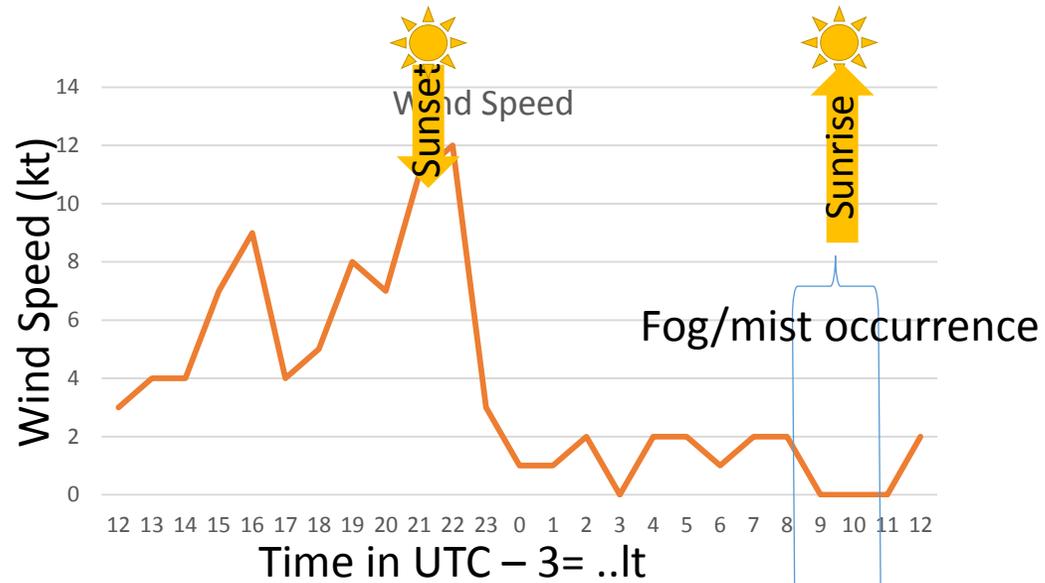
YELLOW: WINDS <4KT>> Yes  
BLUE: RH > 99.5% >> Yes  
WHITE: CLOUDS>> Clear  
RED: SAT DEFICIT>> Yes

GFS, Dec 18, 06UTC. (03.00LST)

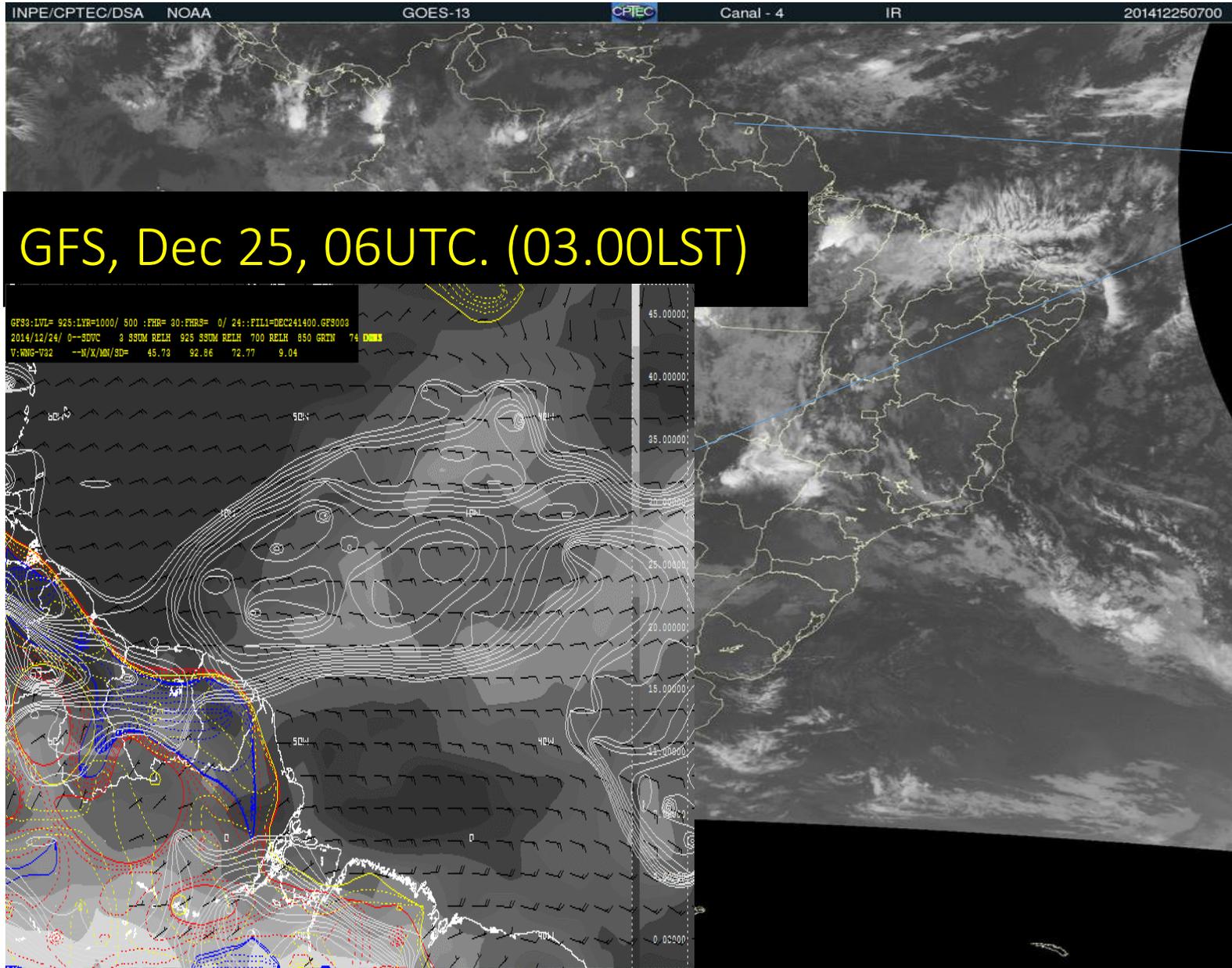


# Special Case III: Dec 24/25, 2014

SPECI SMJP 251034Z 26002KT 0600 FG BKN002 21/21 Q1013 FM1115 2000 BR=



# SATELLITE ANIMATION DEC 24/25, 2014



YELOW: WINDS <4KT>> Yes  
BLUE: RH> 99.5% >> Almost  
WHITE: CLOUDS >> Clear  
RED: SAT DEFICIT >> Yes

# Summary

1) Construction of the Diurnal cycle  
→ Dense fogs develop ~3am LST, their peak starts at ~7am and they dissipate by 8-9 am.

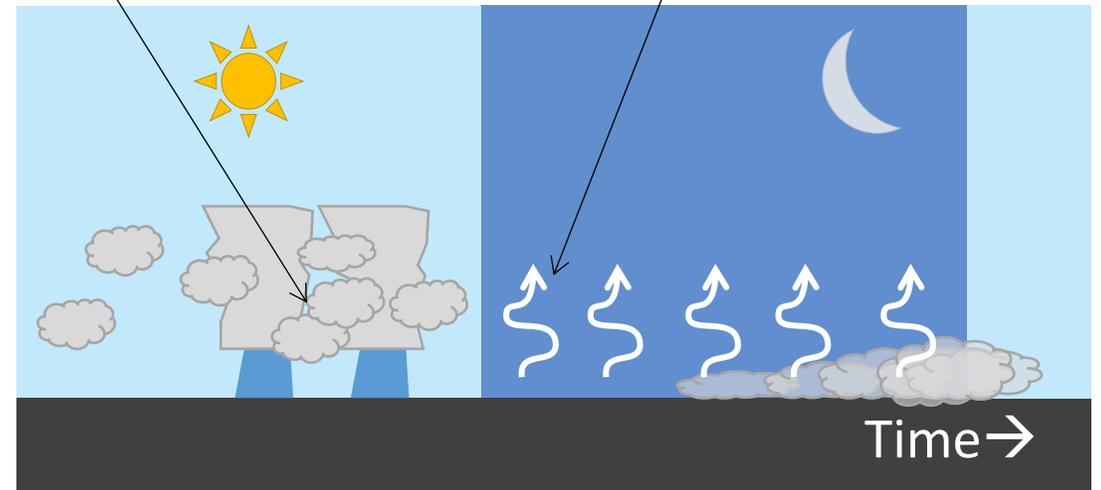
2) Construction of the Annual cycle  
→ Peaks when ITCZ positions over Suriname. May-Jul and Oct-Dec. Major peak Oct-Dec also influenced by strong radiational cooling from frequent clear skies at night.

3) Definition of visibility thresholds/limits for take off and landing.  
→ 800m with instruments  
→ 2300m without instruments

4) Ideal weather evolution for fog formation

Afternoon ITCZ showers / Tstorms increase dewpoint /saturation

Ill-defined ITCZ= spotty to isolated convection → rapid clearing after sunset sets up radiational cooling process



ITCZ convergence provides synoptic environment of weak winds

thank you for your attention

*Thank you for  
your attention*

*Questions??????*