Initial Atmospheric LiDAR Data Analysis over Songkhla, Southern Thailand

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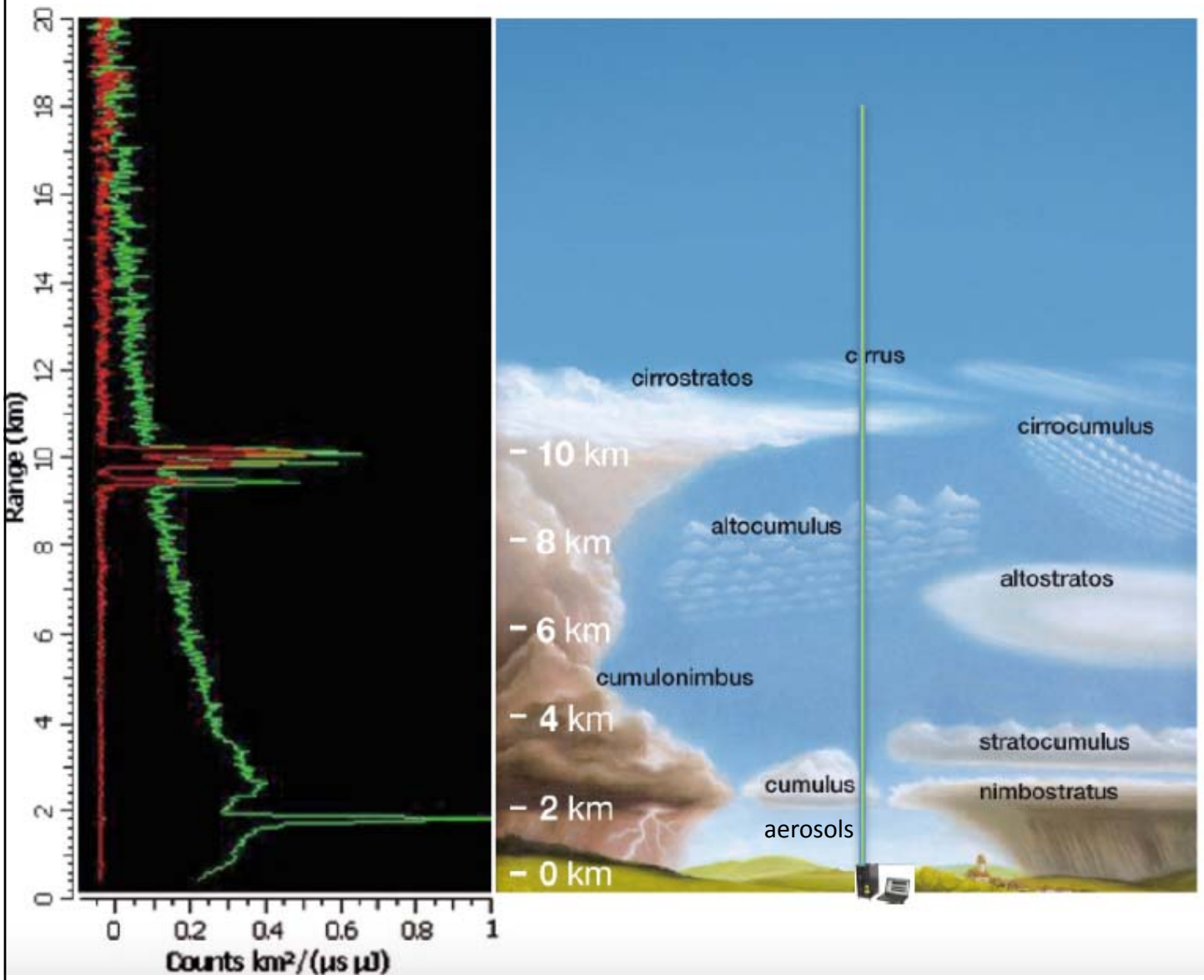
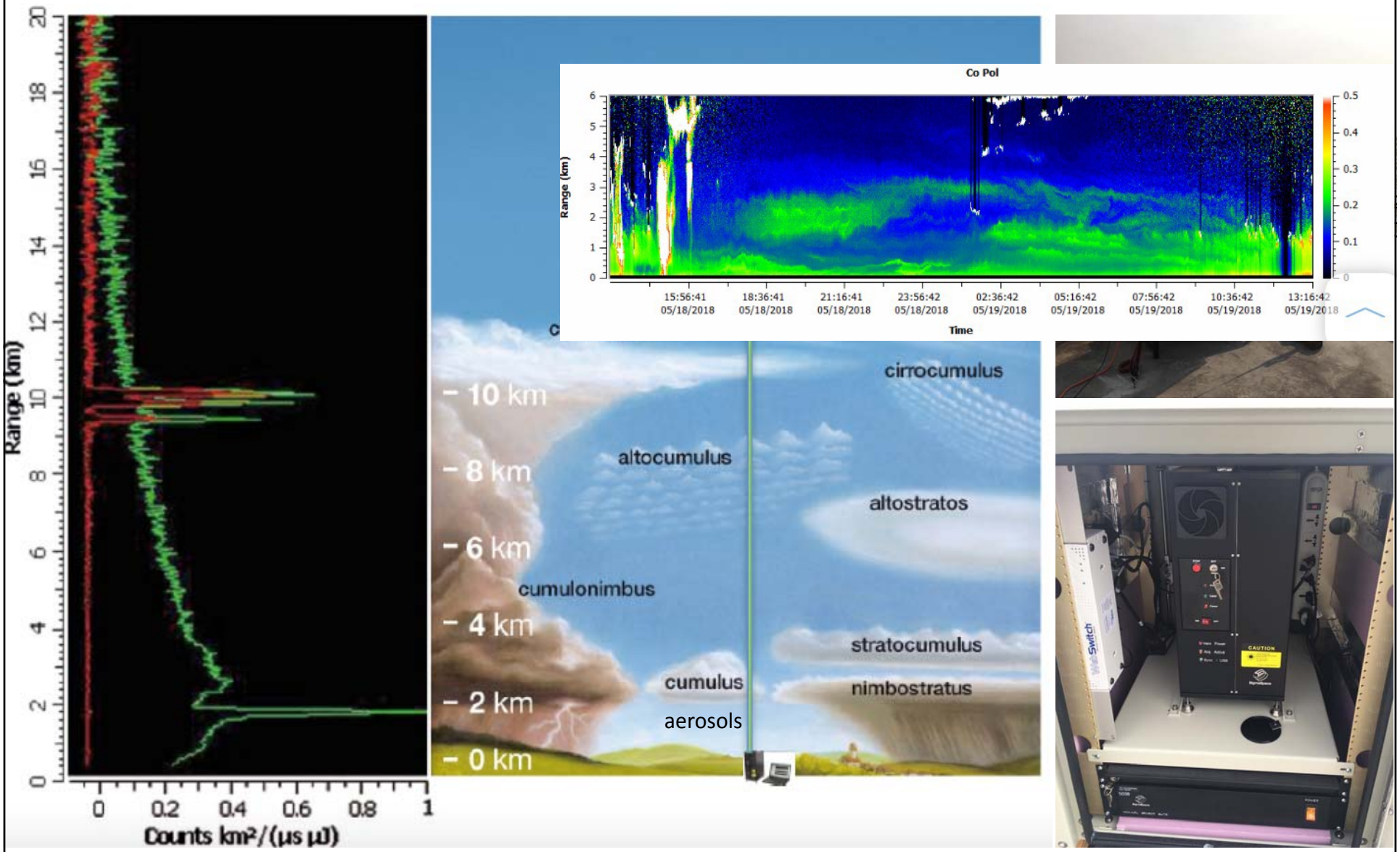
Director, Regional Observatory for the Public, National Astronomical Research Institute of Thailand, Songkhla, Thailand

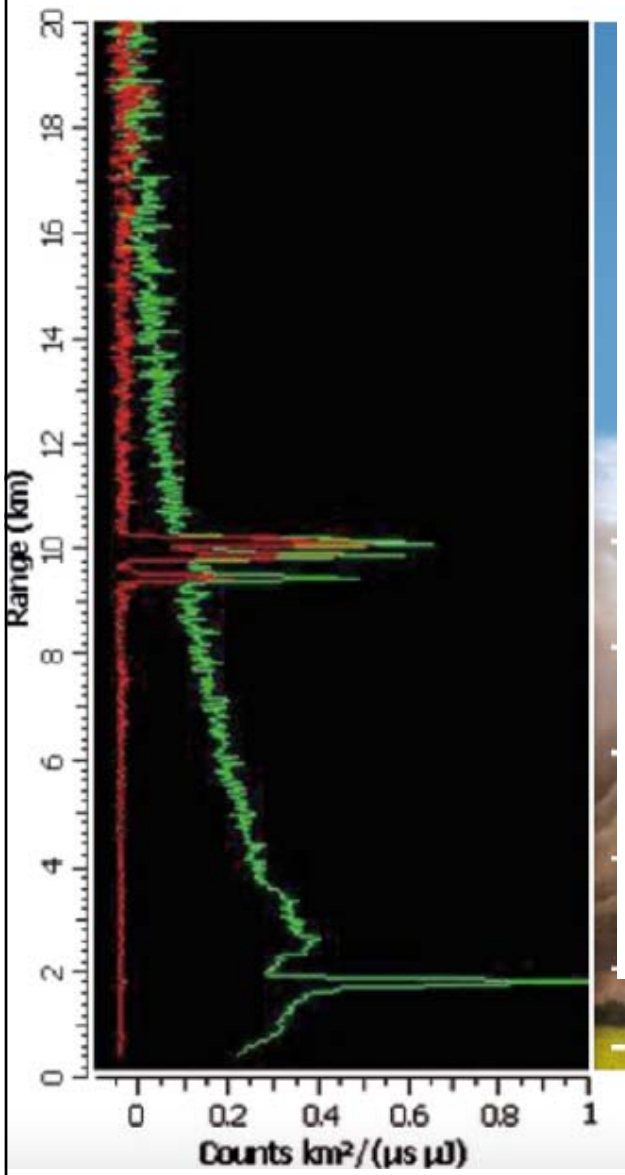
mini-Micropulse LiDAR Signals (Backscatter Signal)

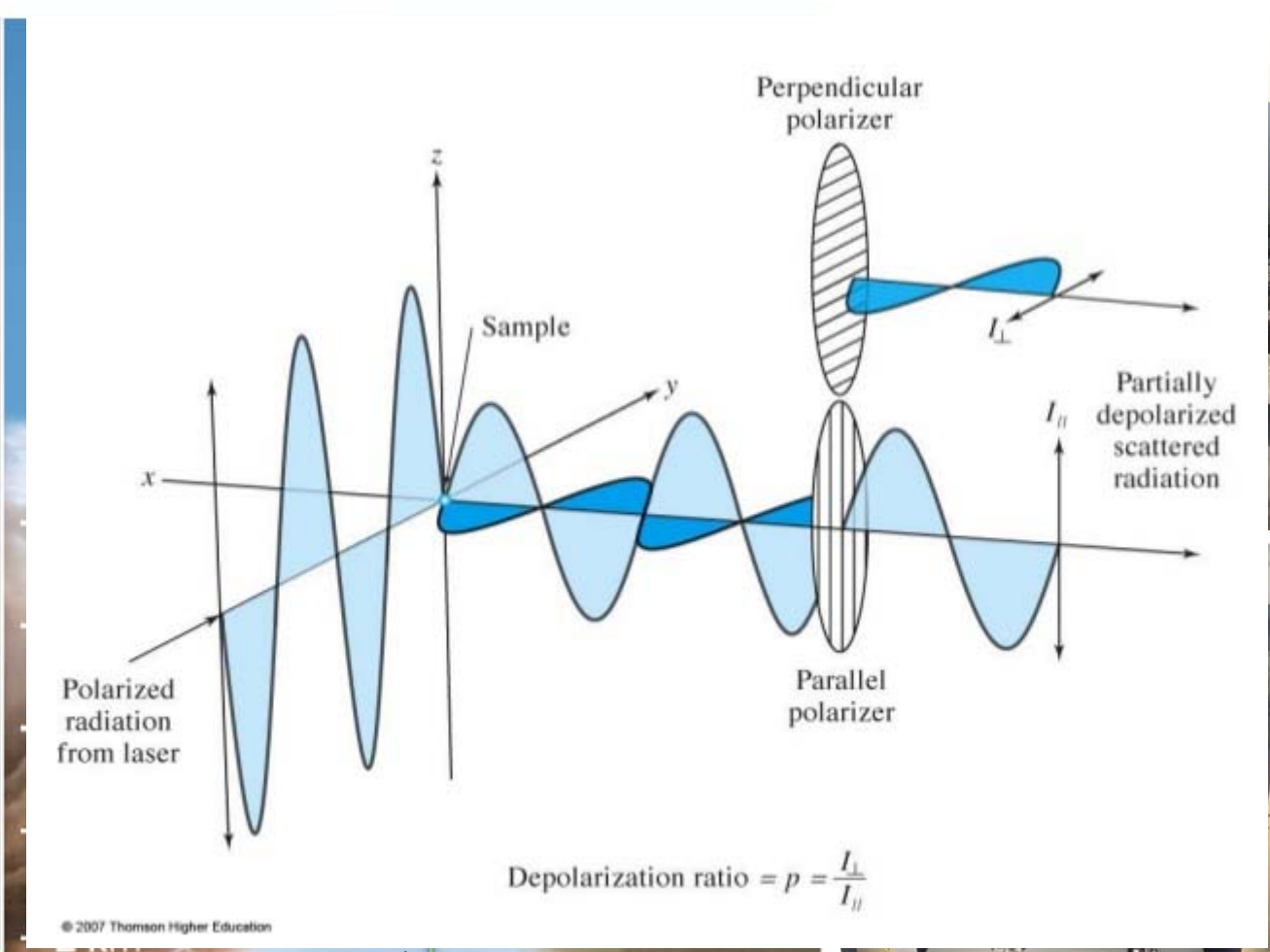


Normalized Relative Backscatter (NRB)

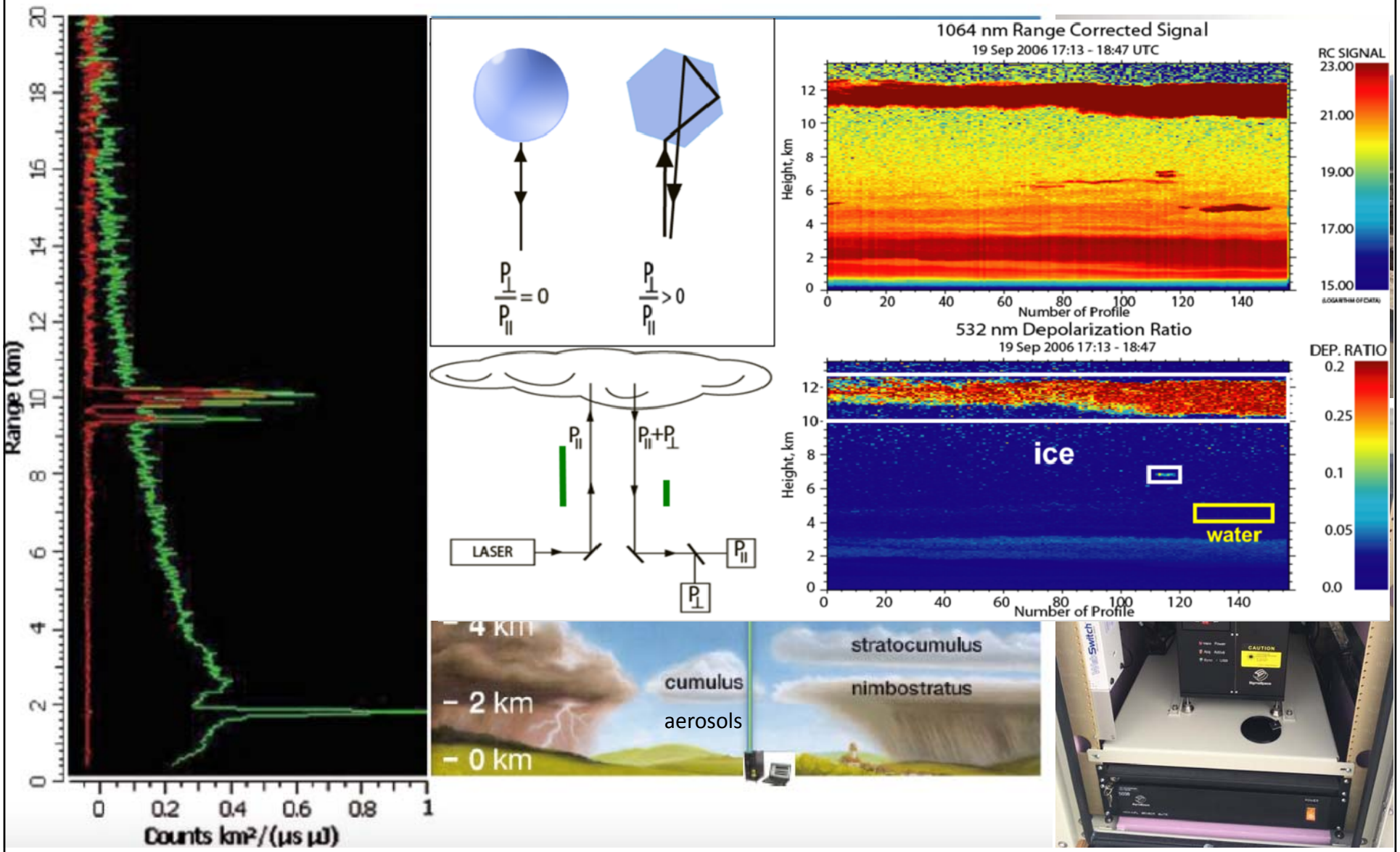


Polarization

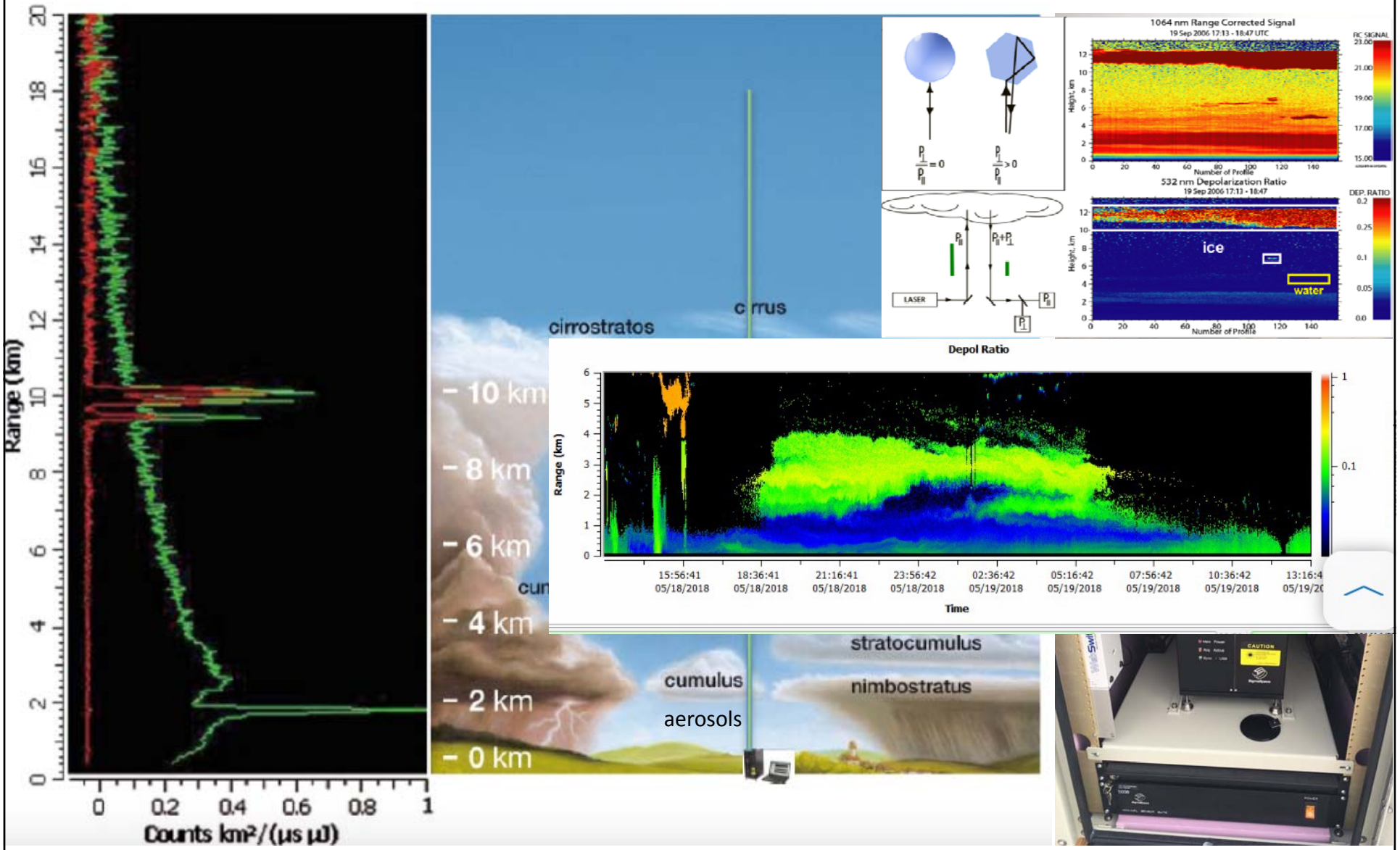




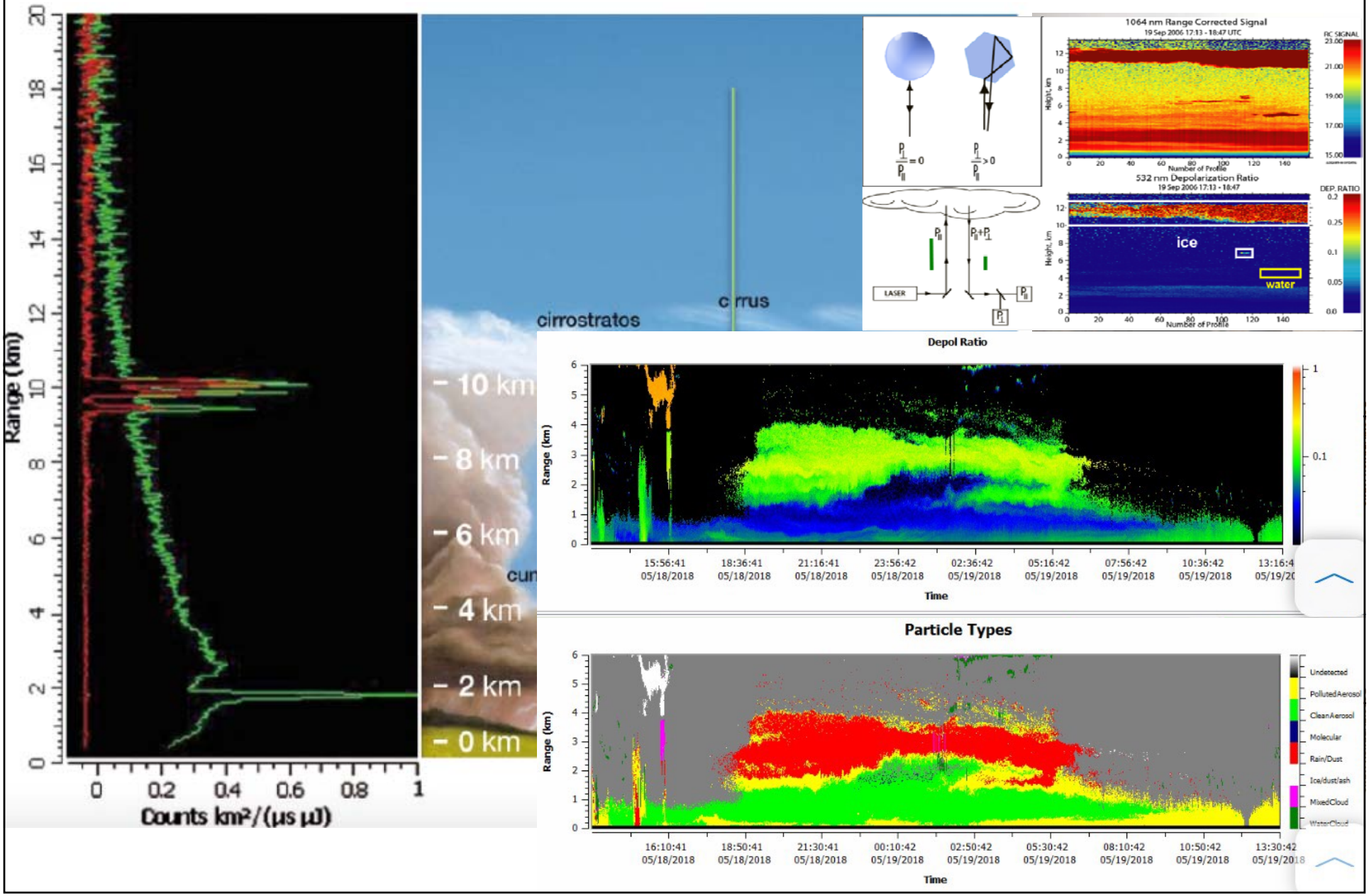
Depolarization



Depolarization Ratio



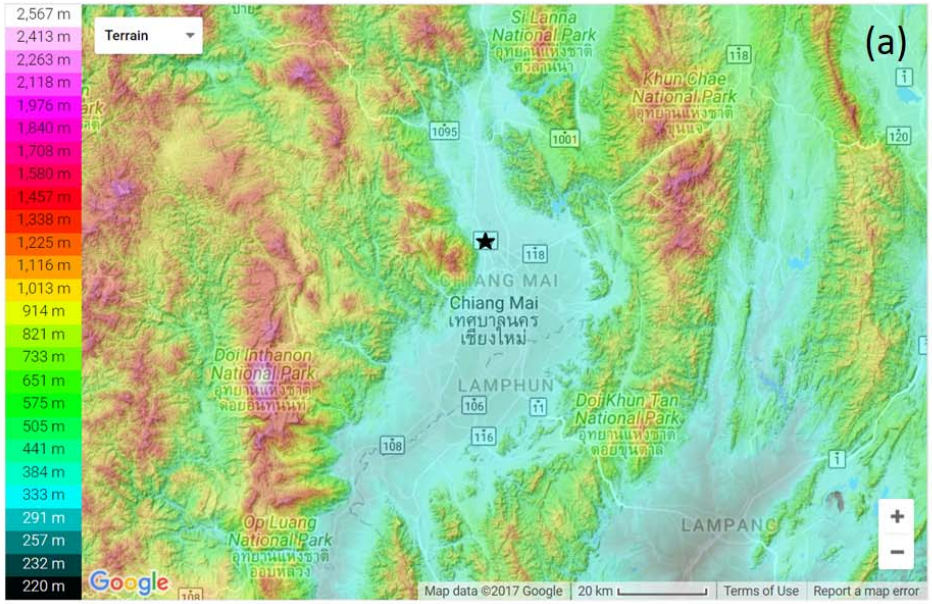
Depolarization Ratio to Particle Types (Aerosols and Cloud Phase)

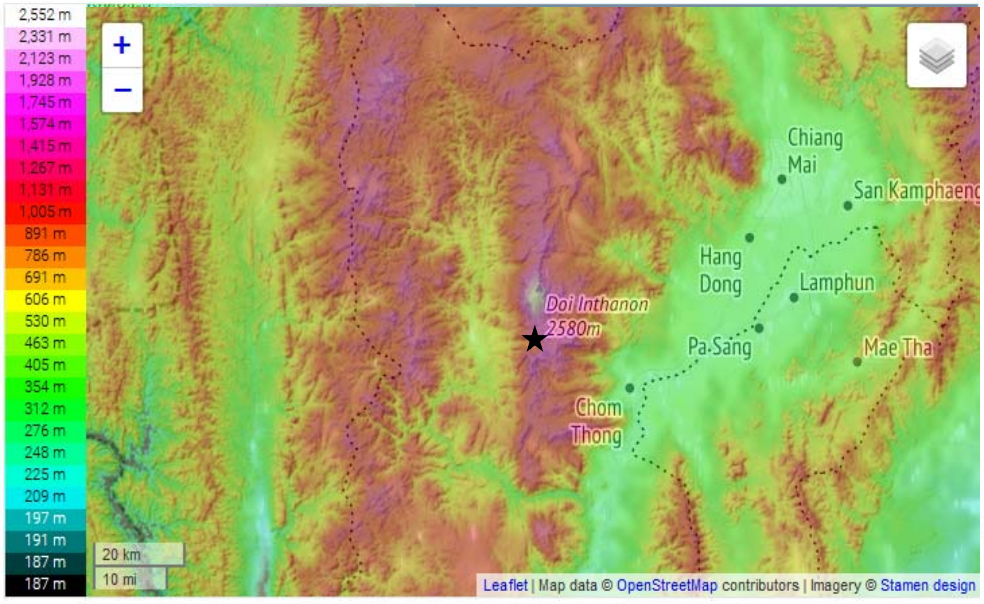


NARIT's Mini-Micropulse 24/7 LiDARs (now part of NASA's MPLNET streaming in near-real-time since August 1, 2018)

(a) "Phoon" = "Dust" at the Princess Sirindhorn AstroPark / TNO (Atmospheric Characterization) / Rangsee Vittaya School, Fang (7SEAS)

(b) "Fon" = "Rain" at the Songkhla Regional Observatory, southern Thailand





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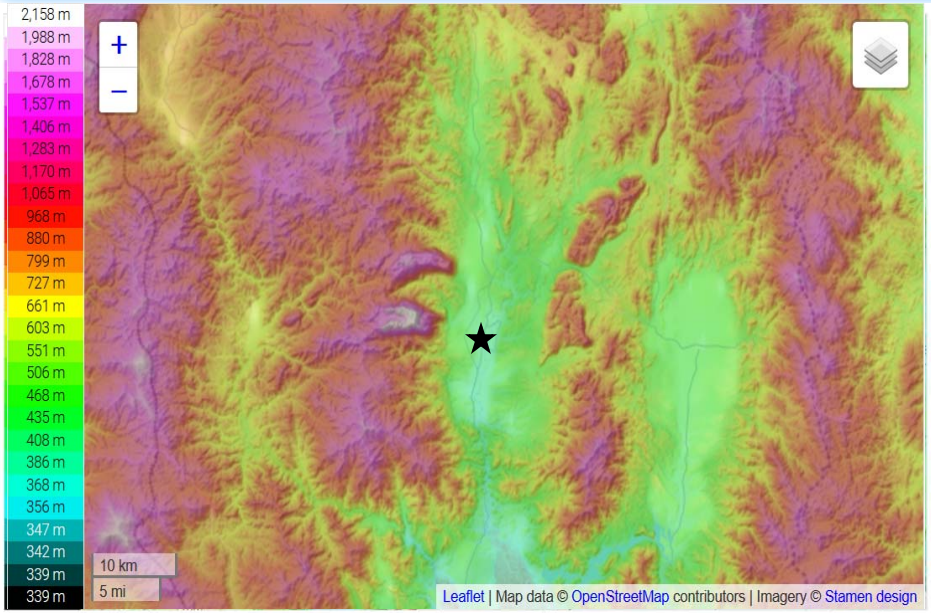
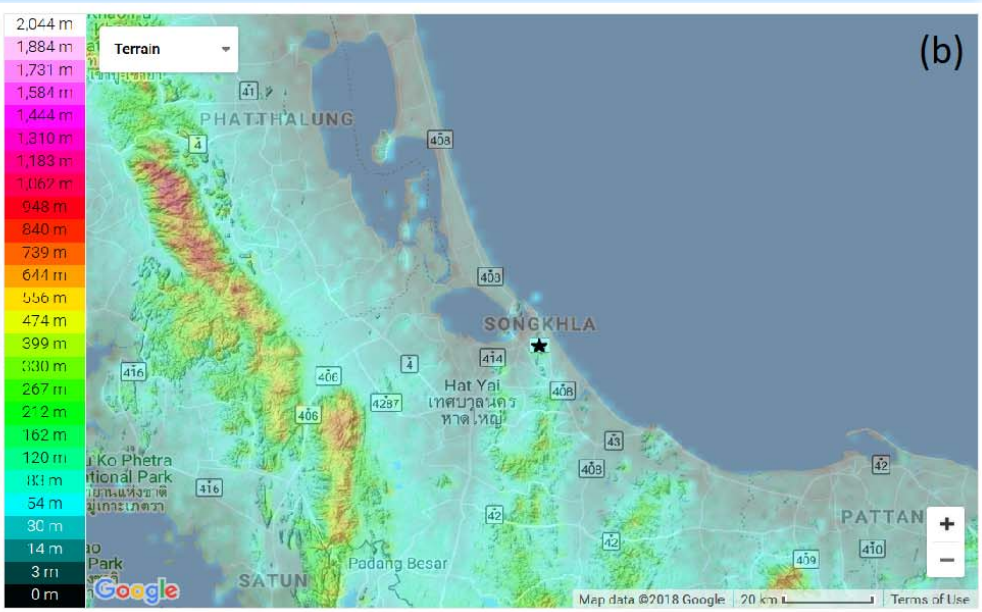
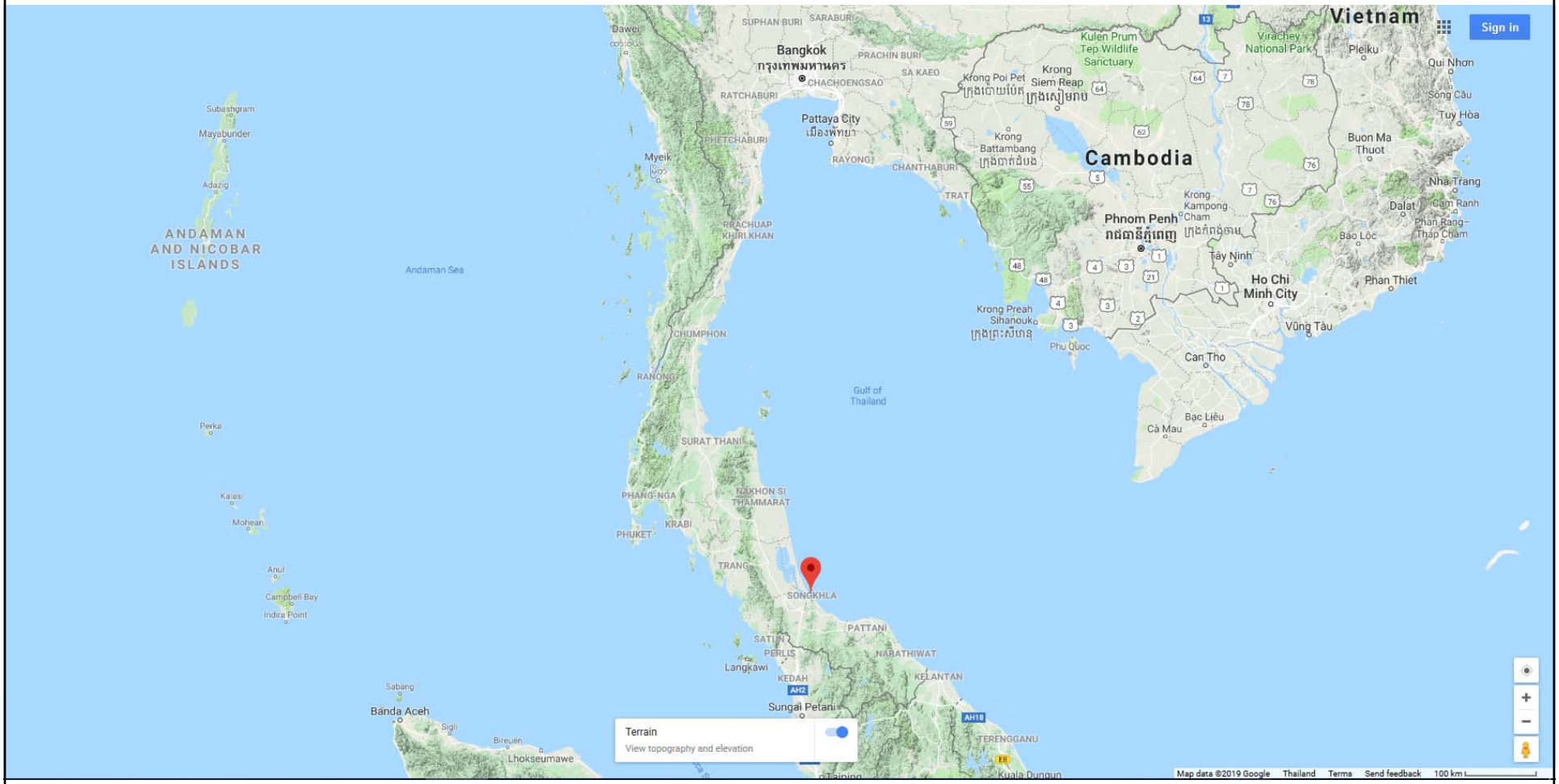




Southern Thailand and the Maritime Continent

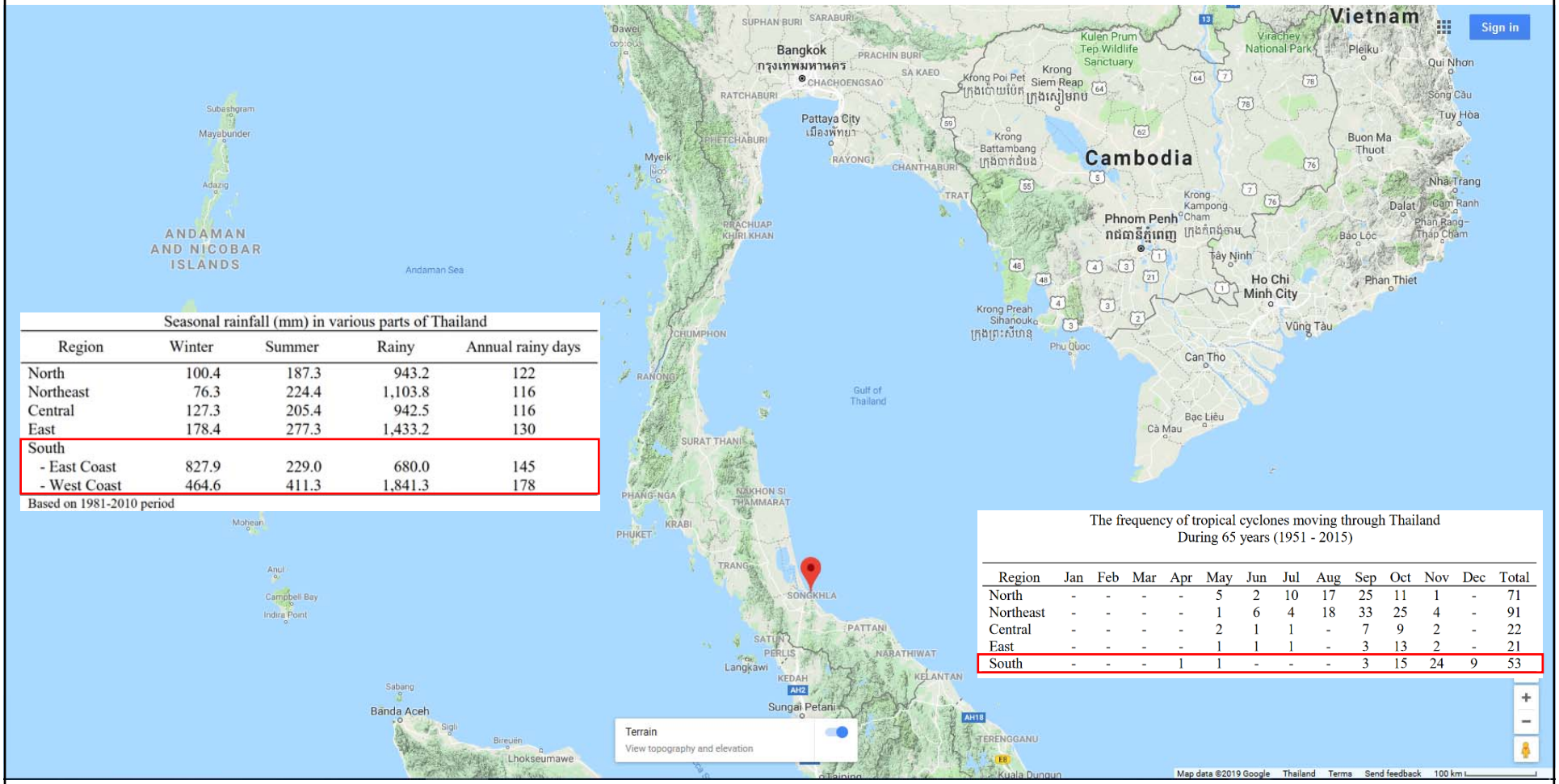
Southern Thailand and the Maritime Continent



Southwest Monsoon (May-October): September – October (ITCZ)
Northeast Monsoon (October-February): November – January (Tropical Cyclone)

Climatology from the Thai Meteorological Department

Southern Thailand and the Maritime Continent



Seasonal rainfall (mm) in various parts of Thailand

Region	Winter	Summer	Rainy	Annual rainy days
North	100.4	187.3	943.2	122
Northeast	76.3	224.4	1,103.8	116
Central	127.3	205.4	942.5	116
East	178.4	277.3	1,433.2	130
South				
- East Coast	827.9	229.0	680.0	145
- West Coast	464.6	411.3	1,841.3	178

Based on 1981-2010 period

The frequency of tropical cyclones moving through Thailand
During 65 years (1951 - 2015)

Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
North	-	-	-	-	5	2	10	17	25	11	1	-	71
Northeast	-	-	-	-	1	6	4	18	33	25	4	-	91
Central	-	-	-	-	2	1	1	-	7	9	2	-	22
East	-	-	-	-	1	1	1	-	3	13	2	-	21
South	-	-	-	1	1	-	-	-	3	15	24	9	53

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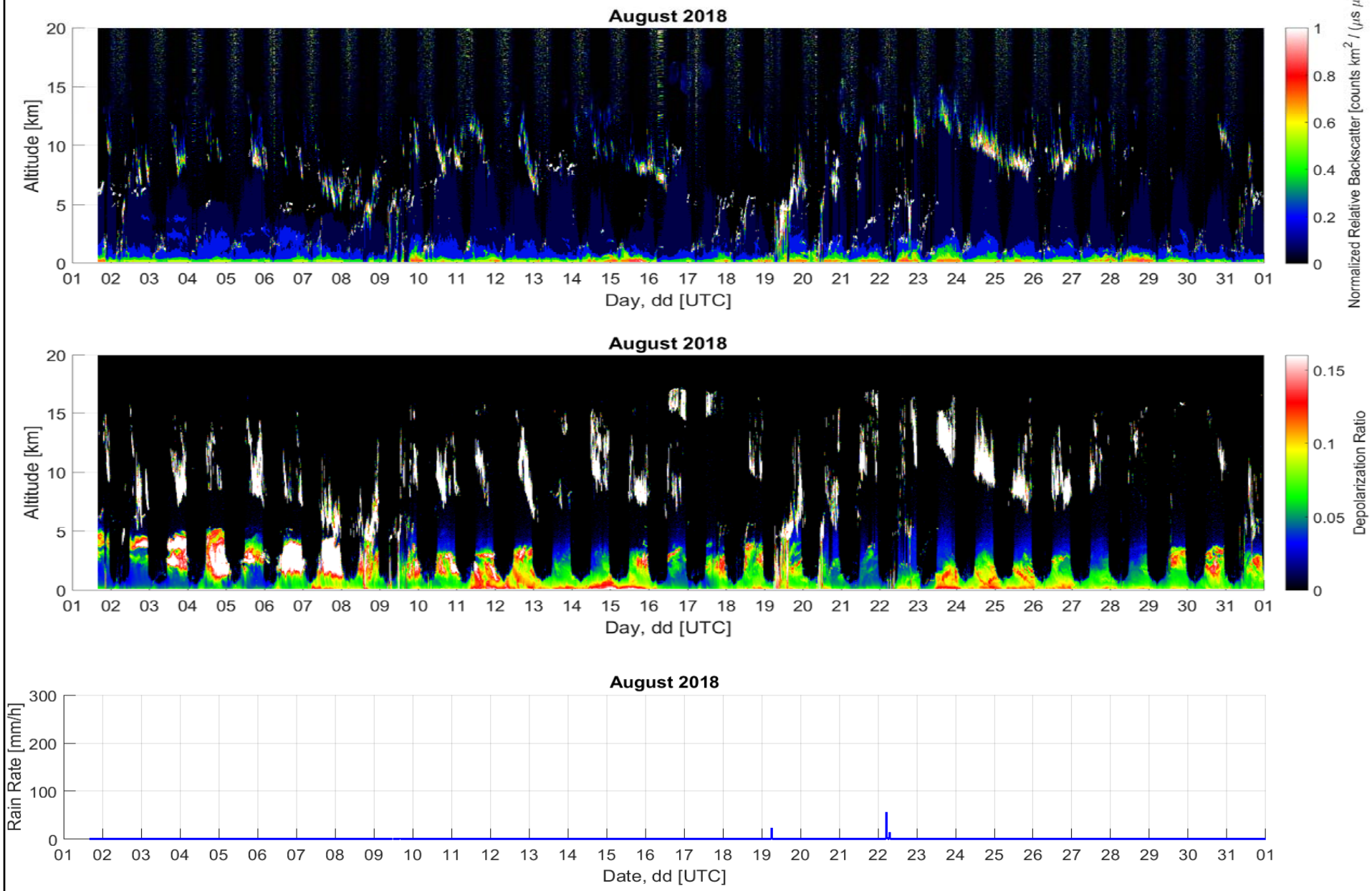
NRB, Depolarization Ratio and Rainfall



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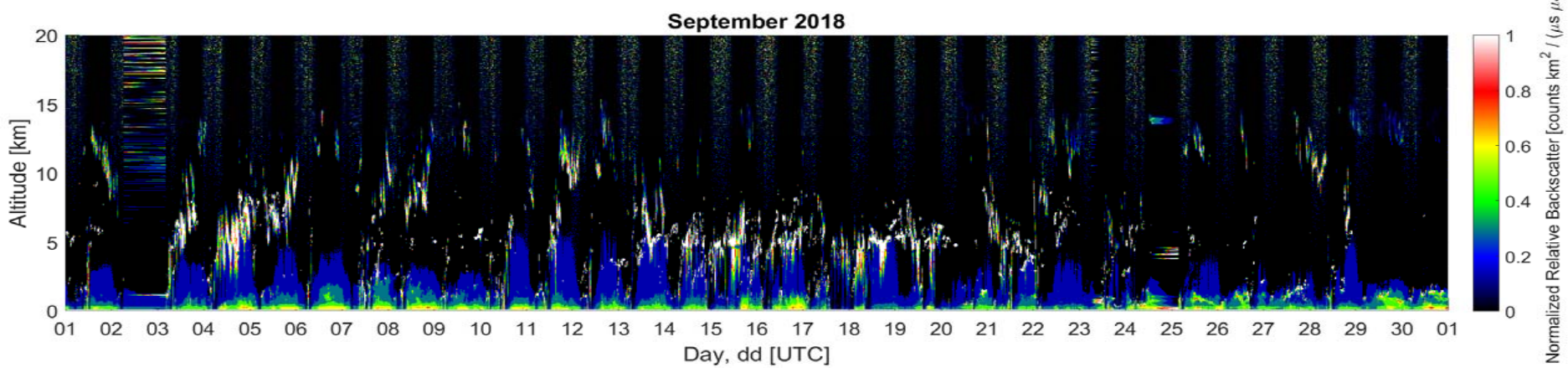

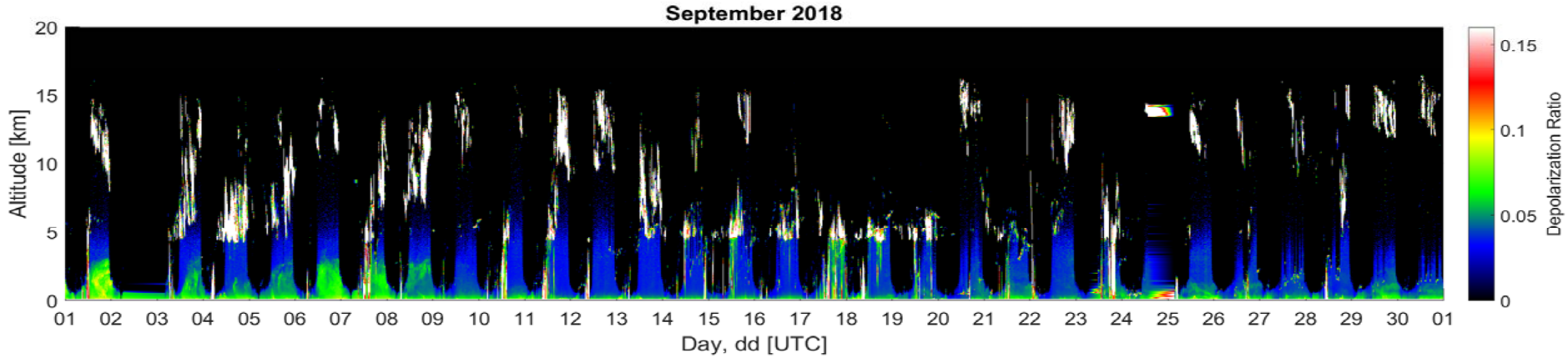

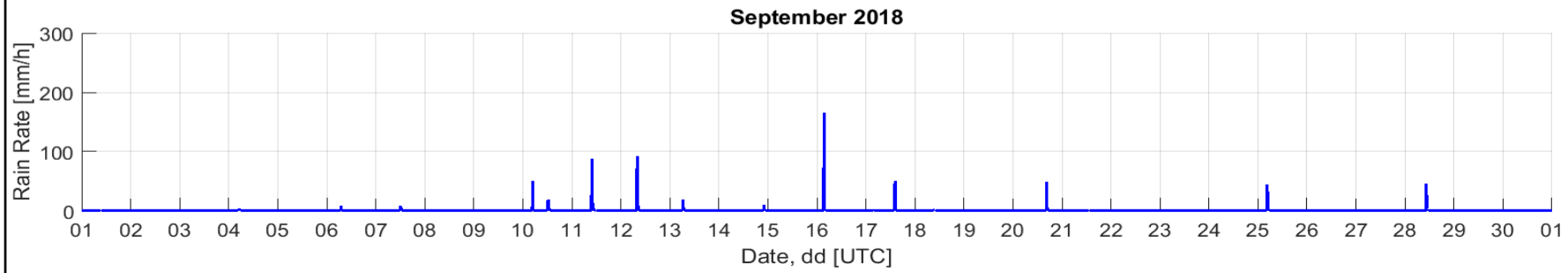

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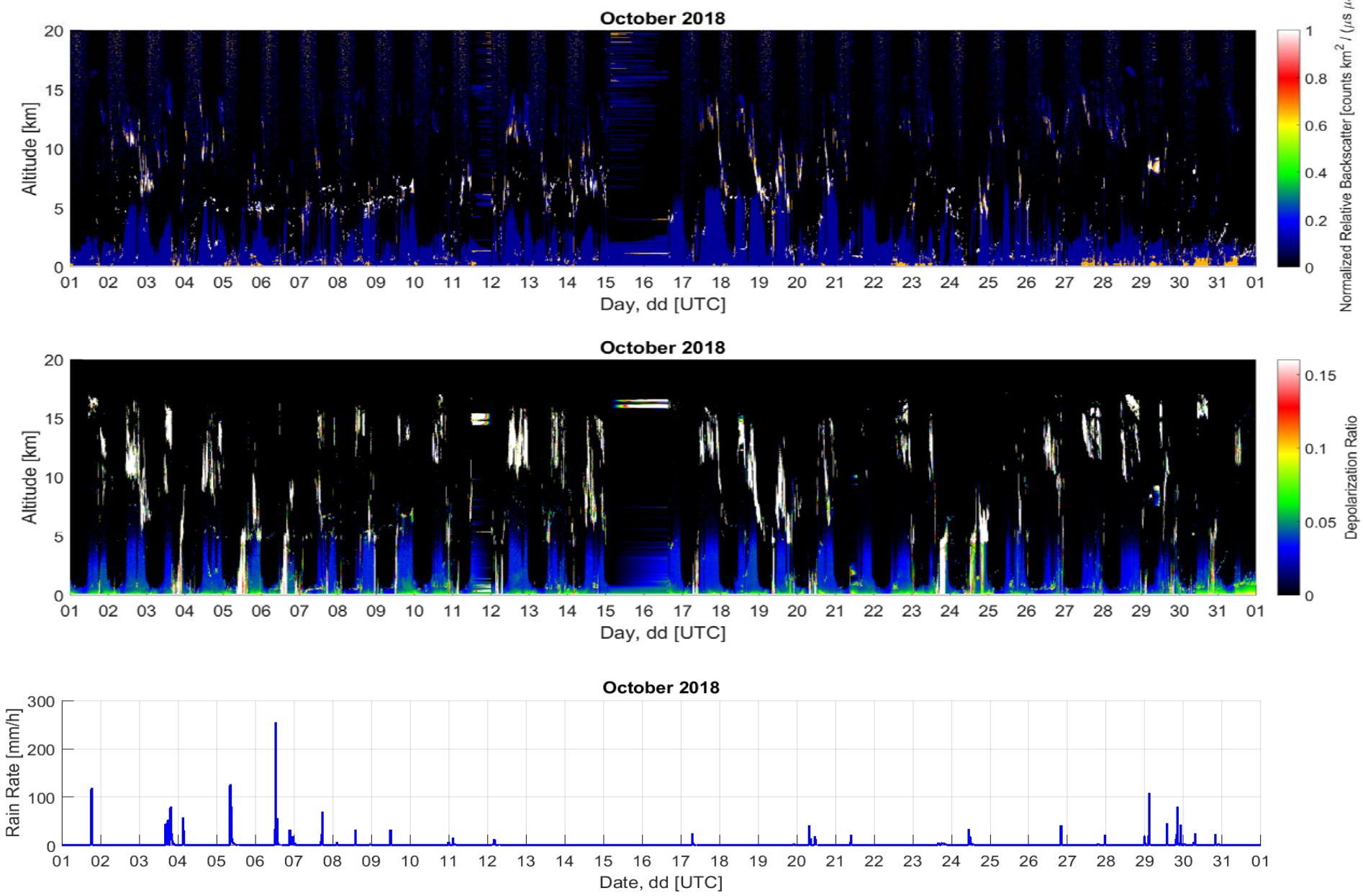

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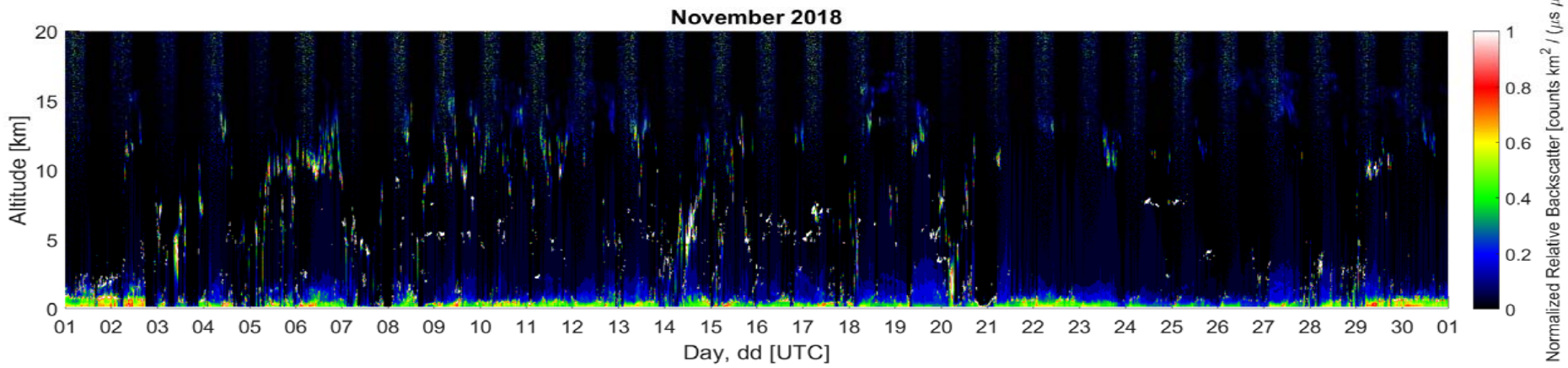

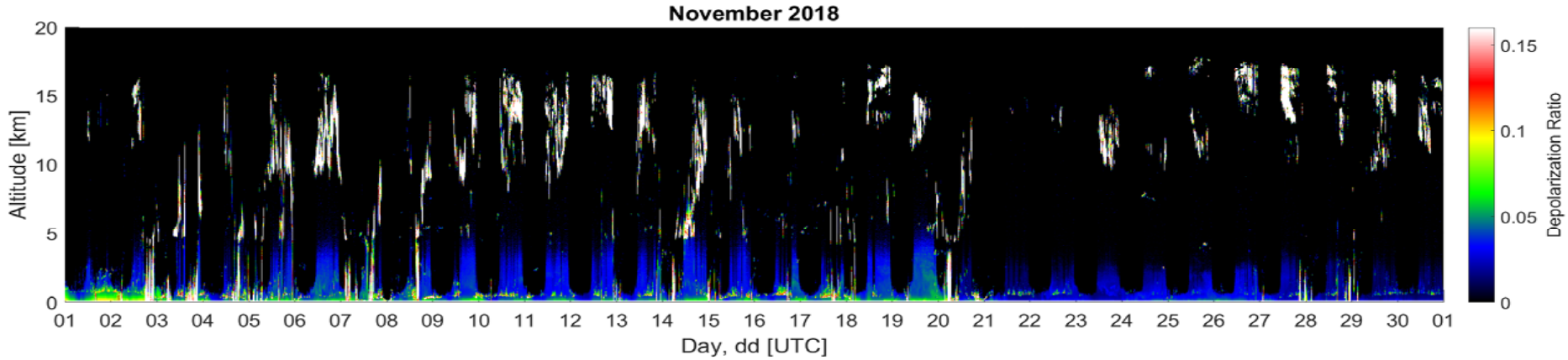

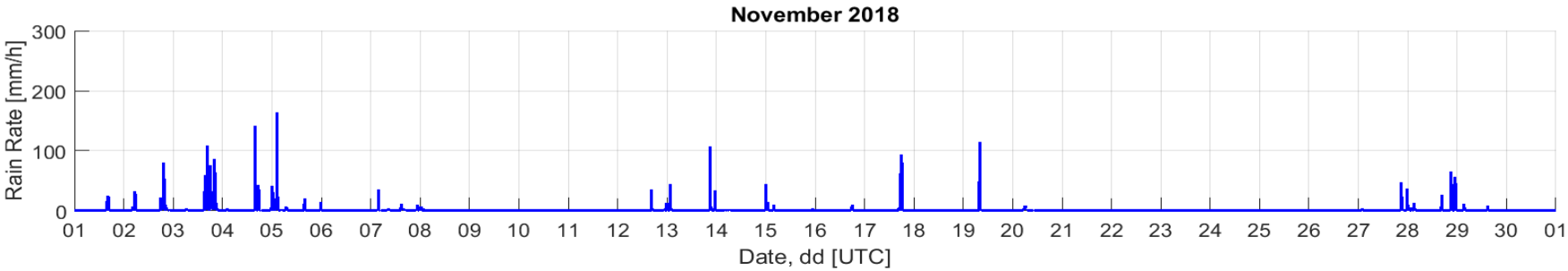

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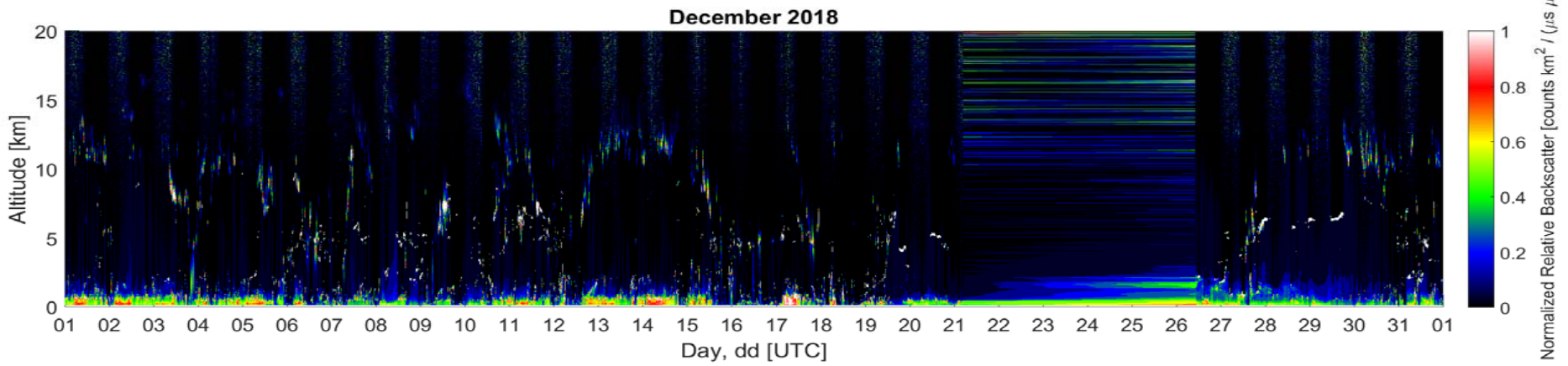
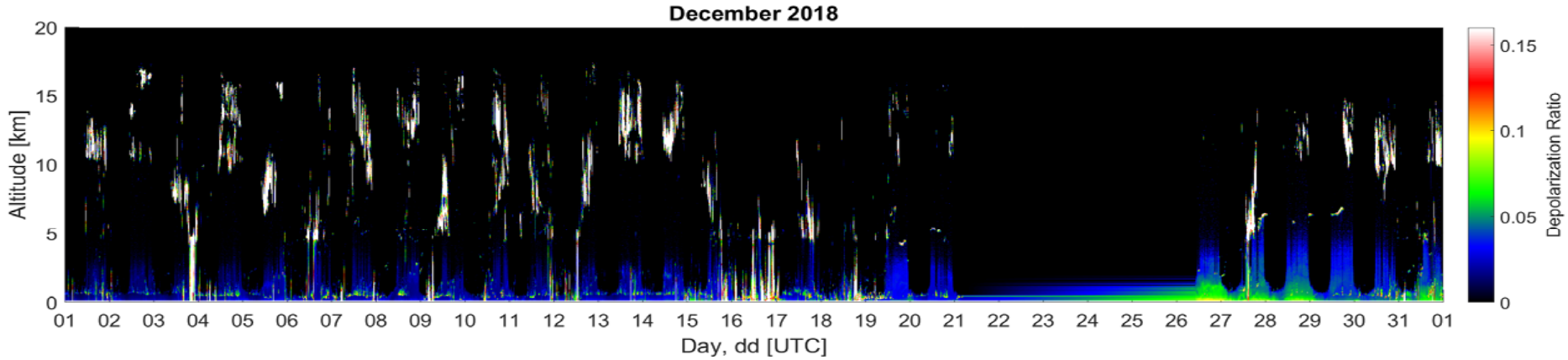
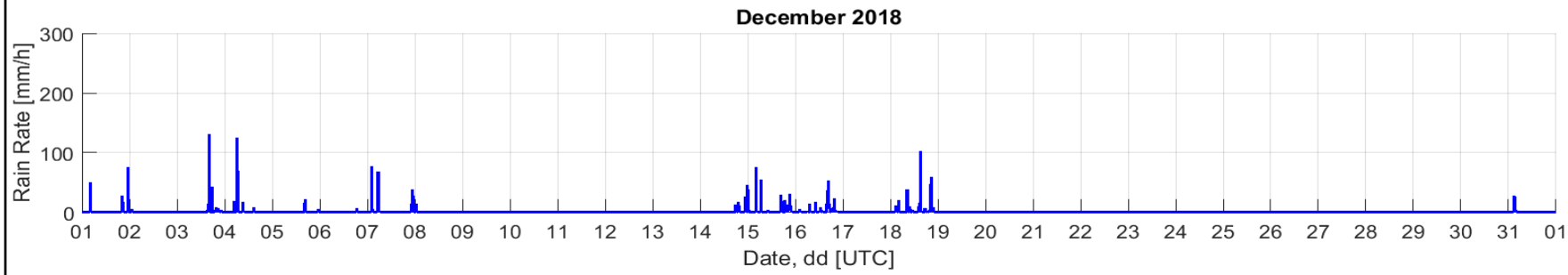
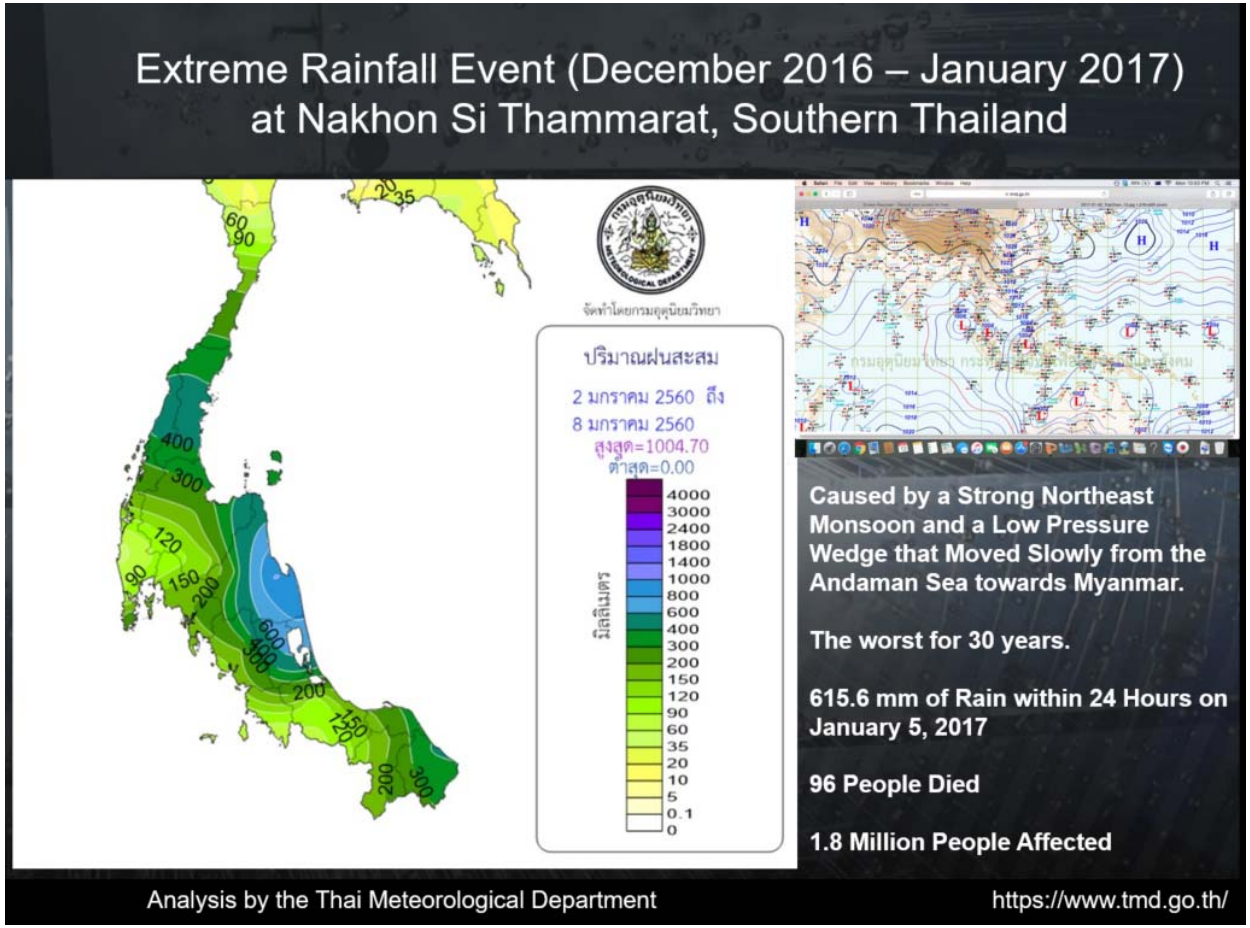


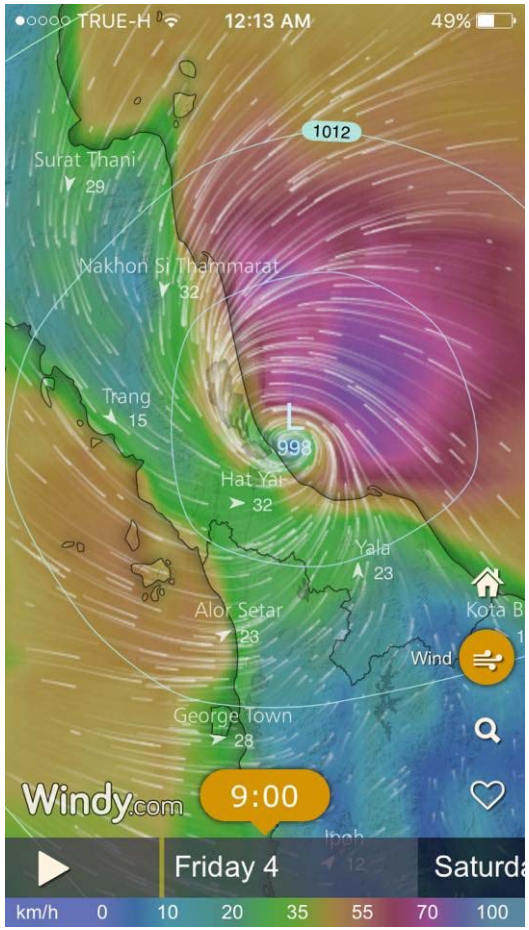




Southern Thailand and the Maritime Continent

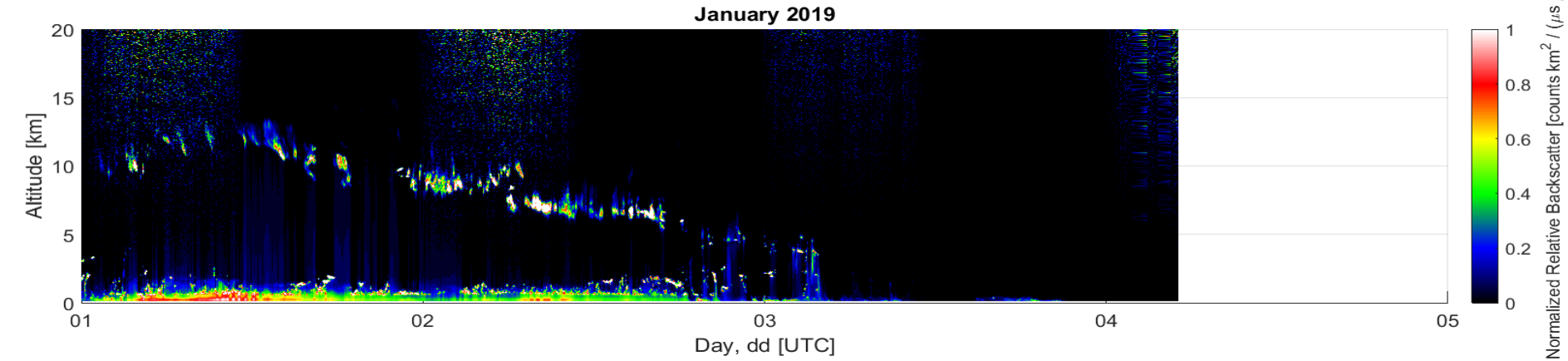
Recent Extreme Events

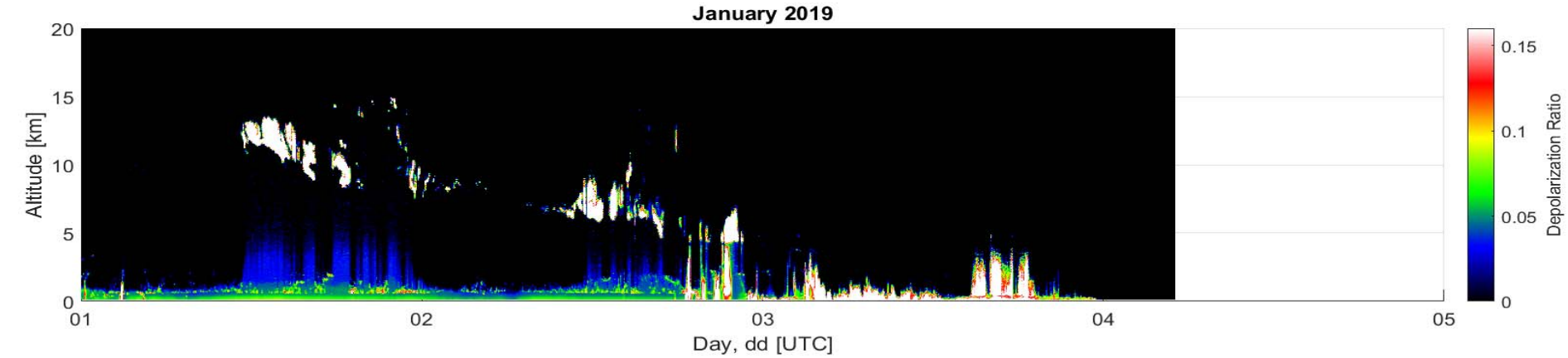


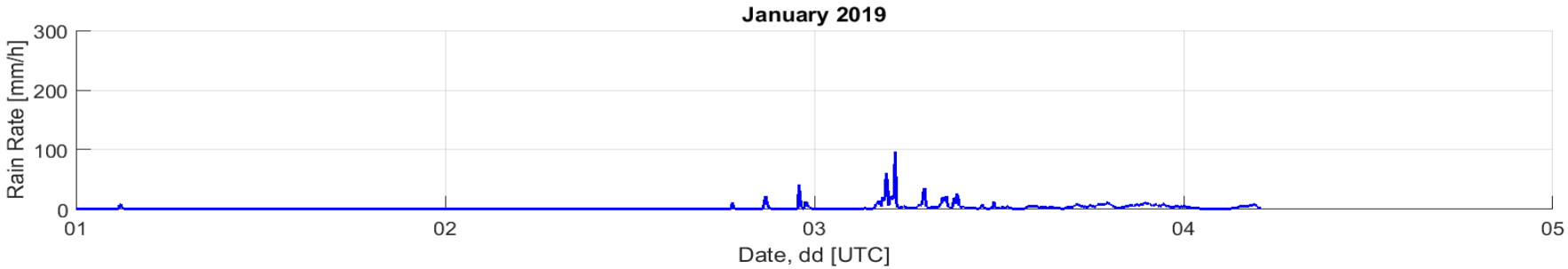


- Nakhon Si Thammarat Floods: Prompted LiDAR Installation at Southern Thailand
- Tropical Storm “Pabuk” (December 31, 2018 – January 4, 2019): Damaged LiDAR Aircon Unit (awaiting replacement)

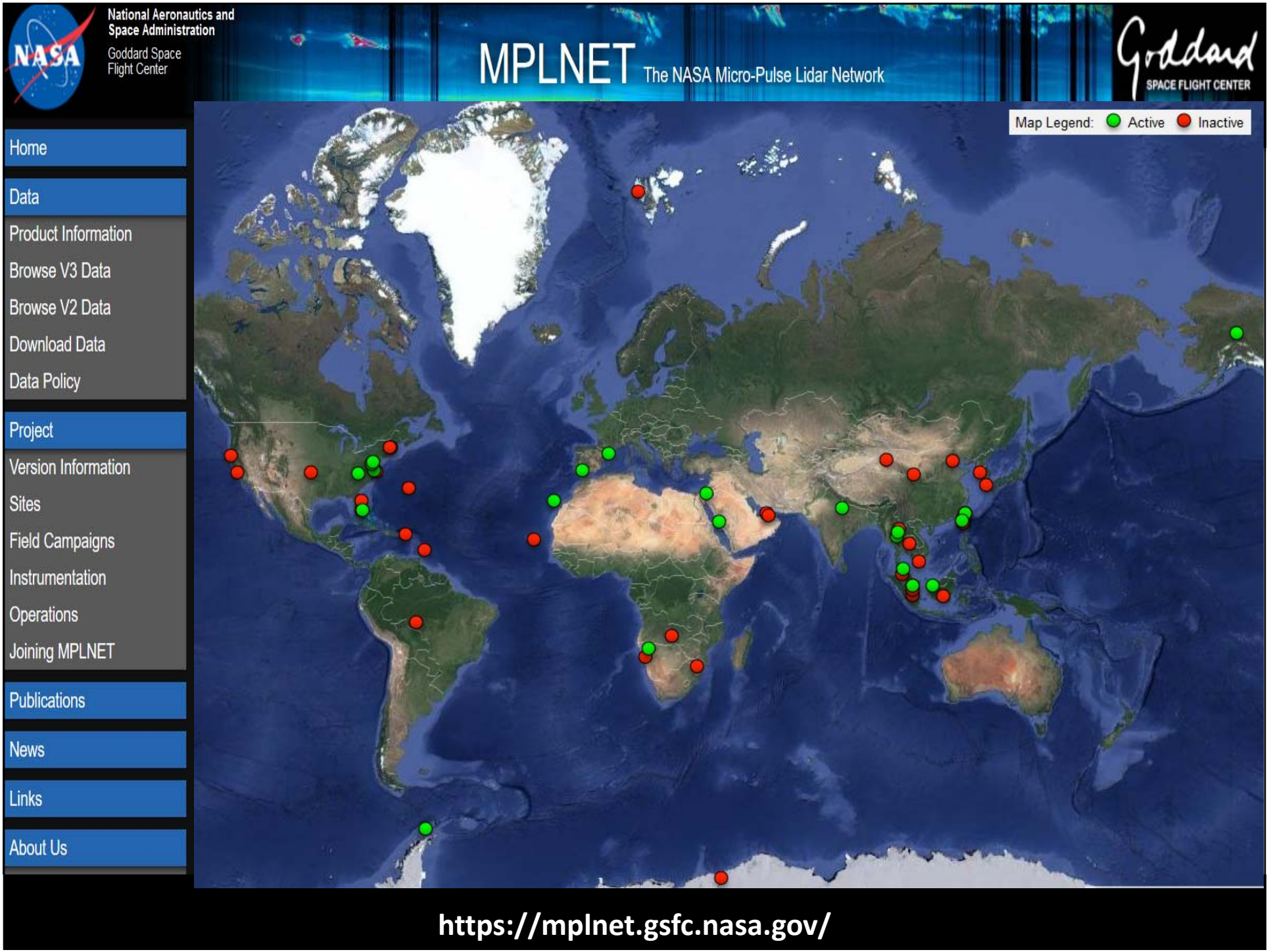
NRB, Depolarization Ratio and Rainfall







https://mplnet.gsfc.nasa.gov/


National Aeronautics and Space Administration
Goddard Space Flight Center
MPLNET
The NASA Micro-Pulse Lidar Network
Goddard SPACE FLIGHT CENTER
Map Legend: Active Inactive
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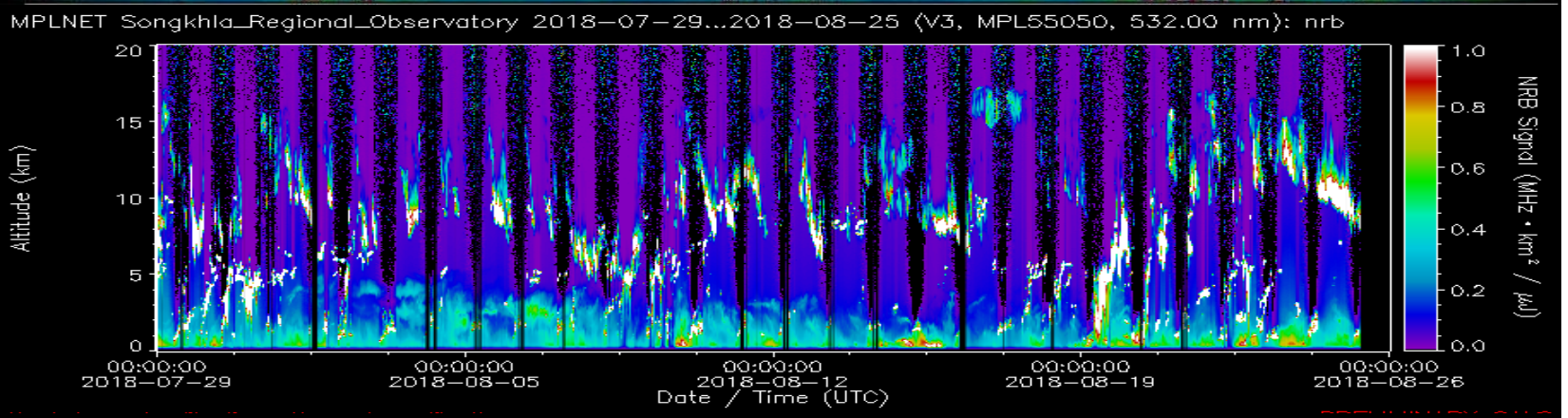
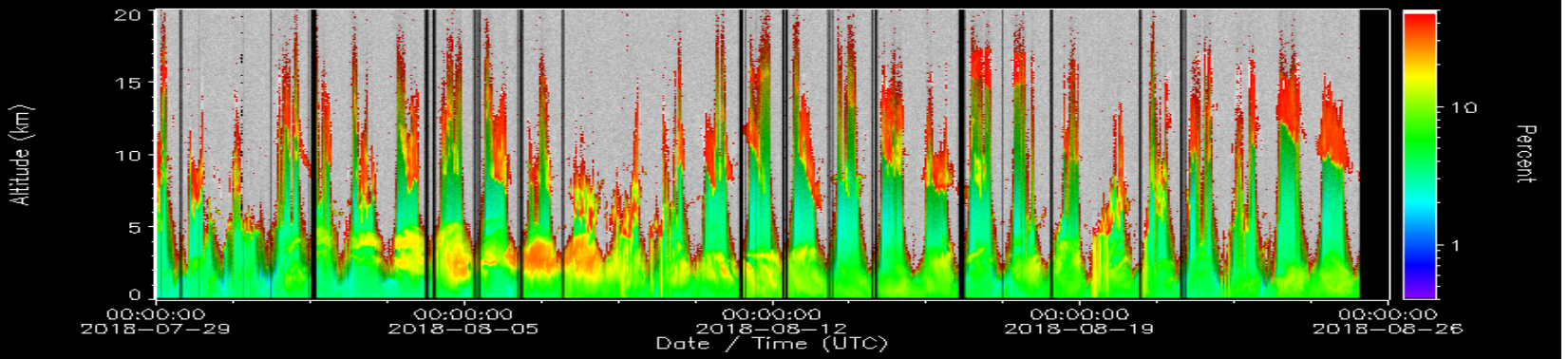
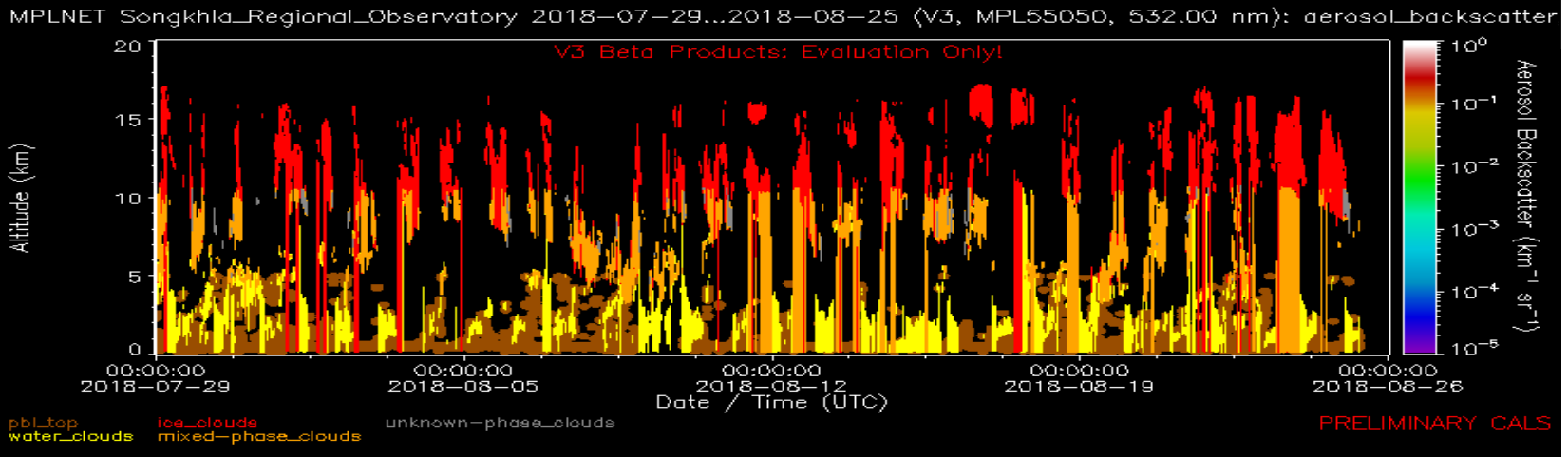






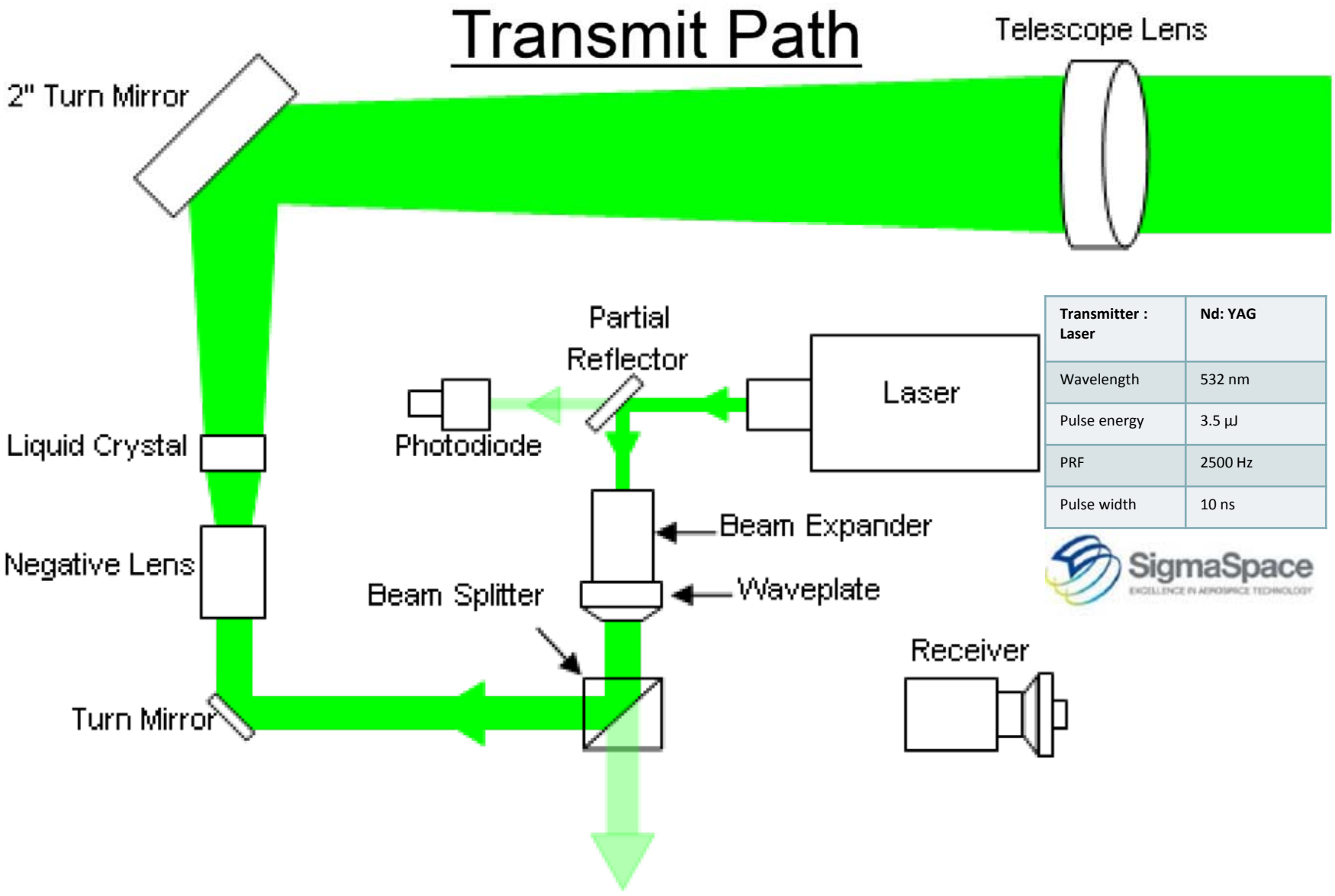
Next Steps

- Separate daytime and night time data
- Look at aerosol optical properties (e.g. backscatter coefficients, extinction profiles, aerosol optical depths)
- Analyze Diurnal Variations of aerosol optical properties, PBL height and rainfall rates
- Compare with AERONET (complementary aerosol size distribution), MODIS and CALIPSO
- Replace airconditioning unit and resume operations (March 2019)
- Light rain retrievals (c/o Simone Lolli)

Thank You for Your Attention!

Light Detection and Ranging (LiDAR)

Principle, Components and Types of Atmospheric LiDAR Systems



Transmitter : Laser	Nd: YAG
Wavelength	532 nm
Pulse energy	3.5 µJ
PRF	2500 Hz
Pulse width	10 ns

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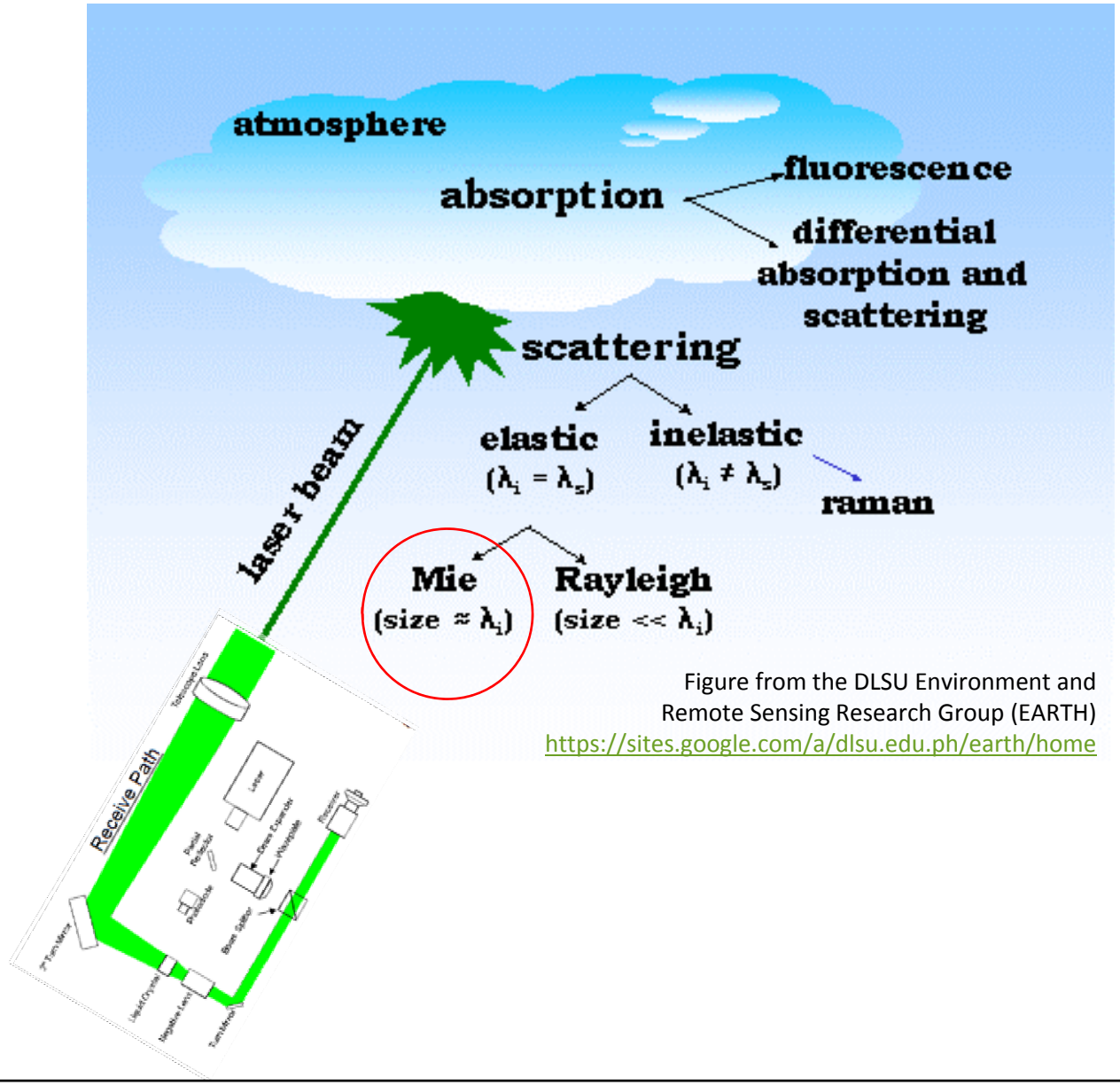

Figure from the DLSU Environment and Remote Sensing Research Group (EARTH)
https://sites.google.com/a/dlsu.edu.ph/earth/home

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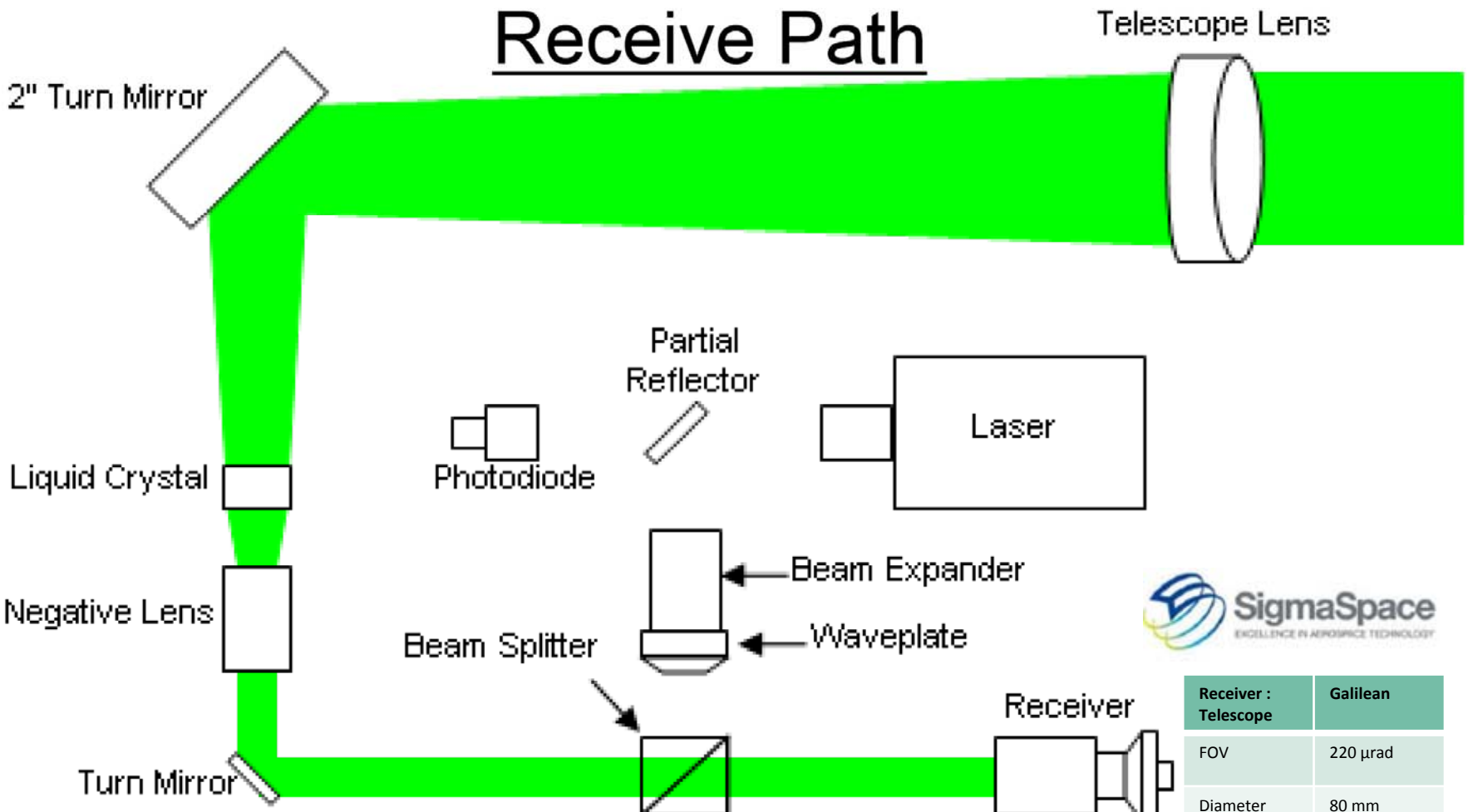

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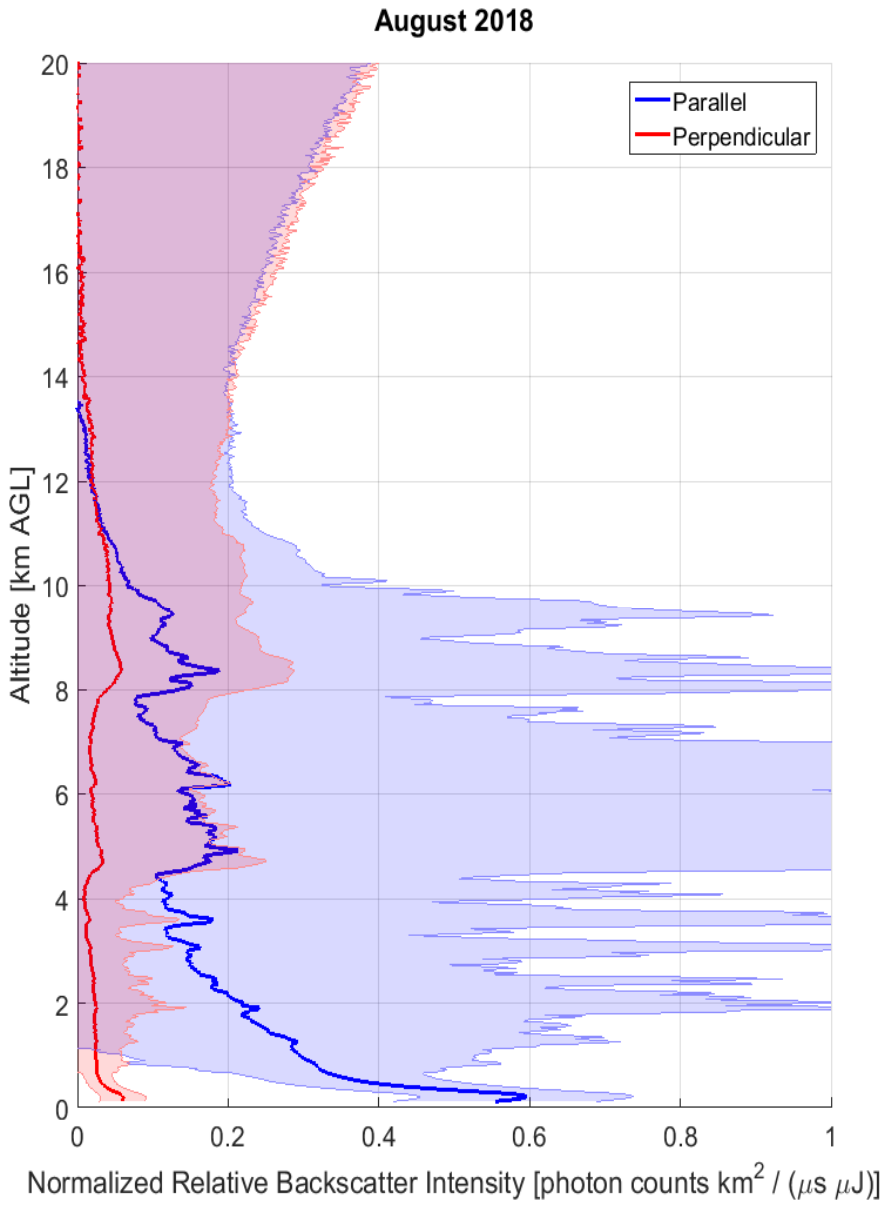
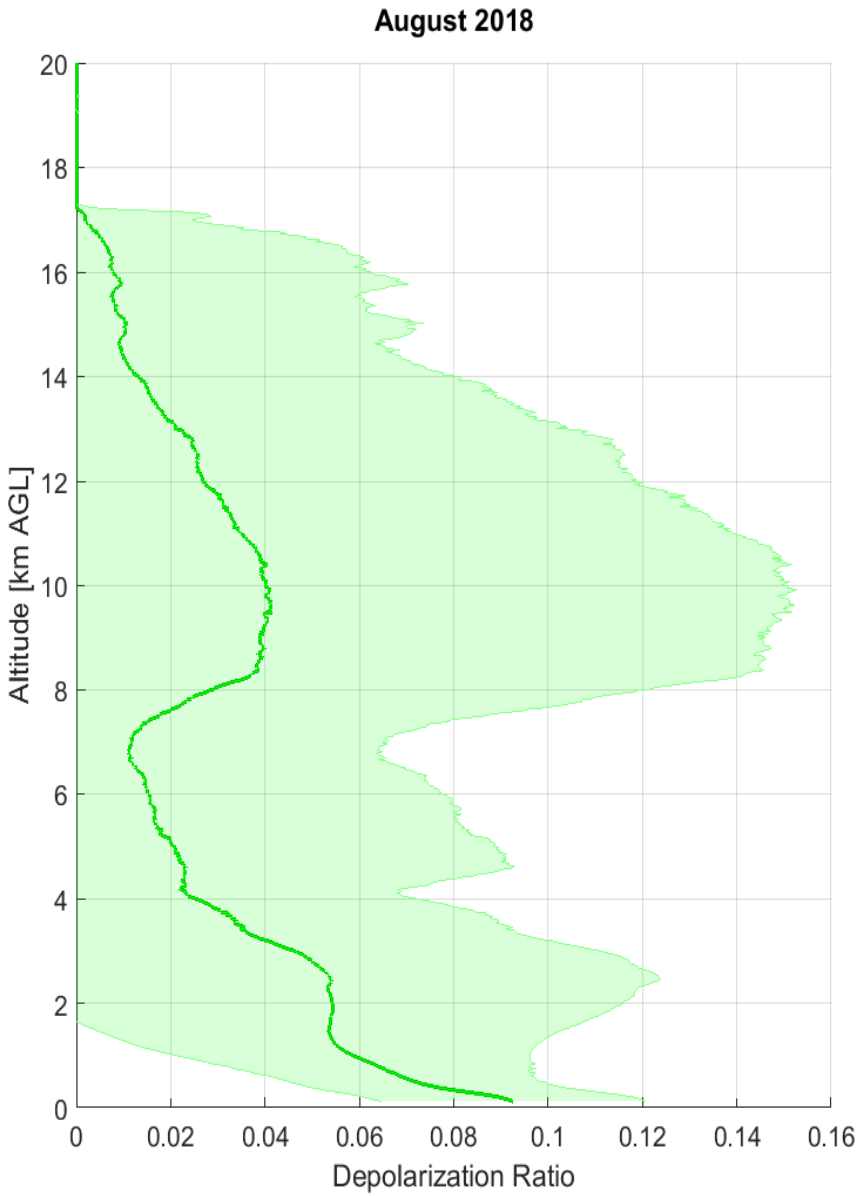
Receiver : Telescope	Galilean
FOV	220 µrad
Diameter	80 mm

Detector efficiency	25 %

NRB and Depolarization Ratio Monthly Profiles





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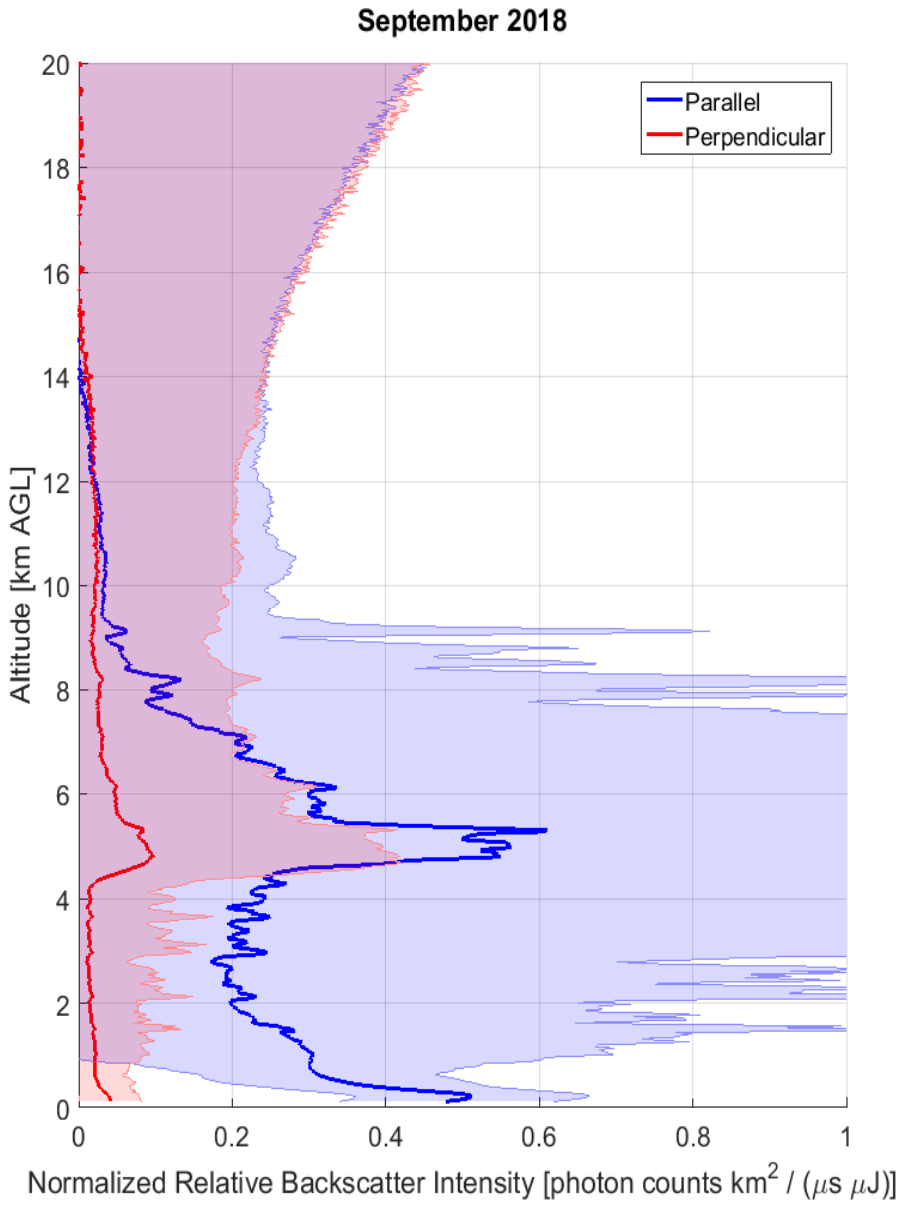

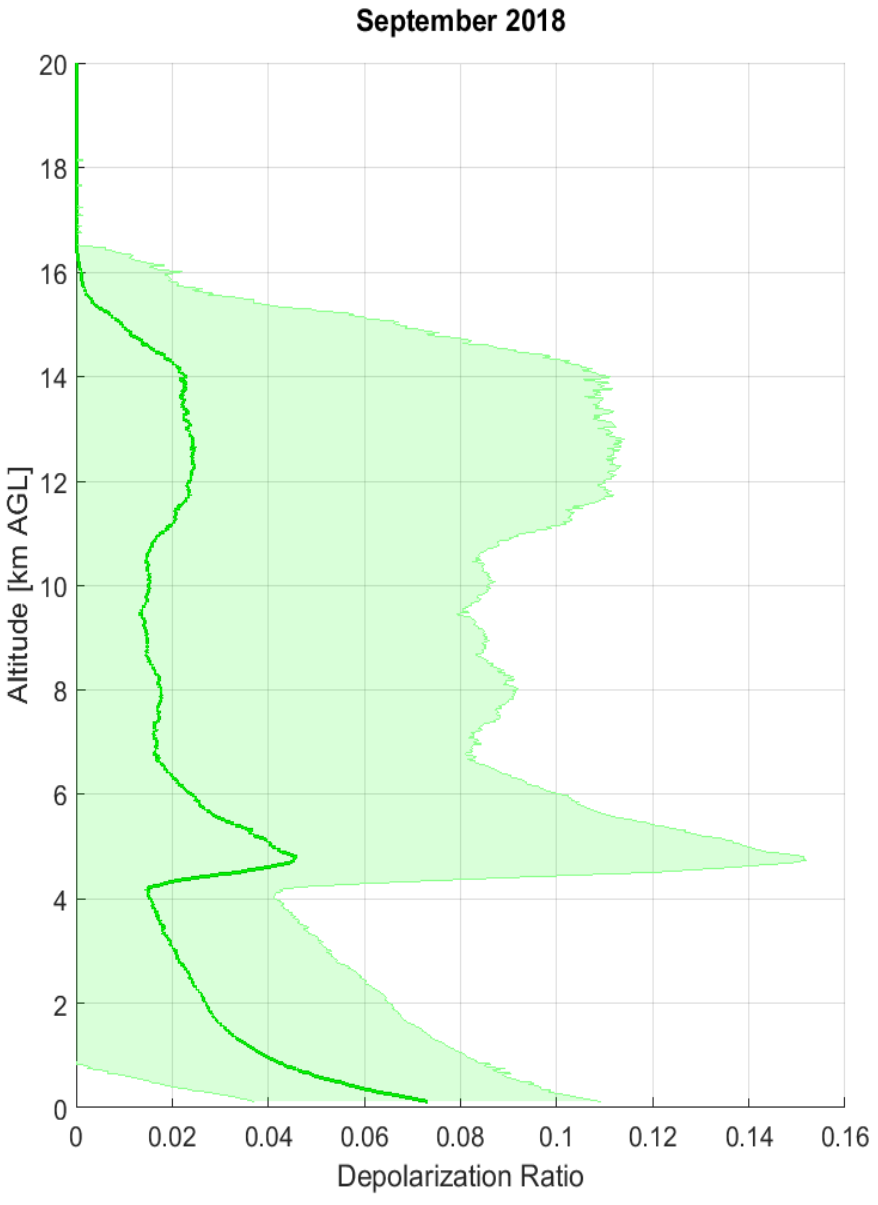

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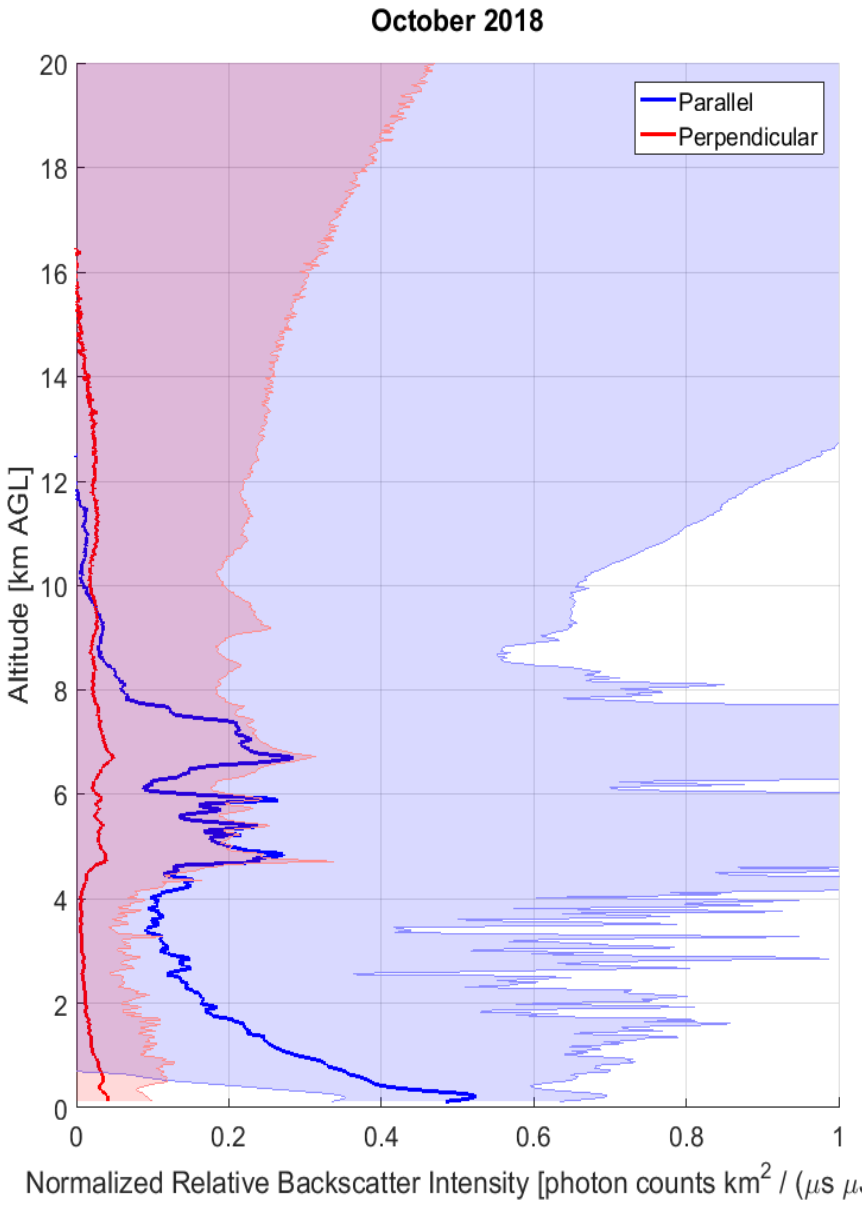

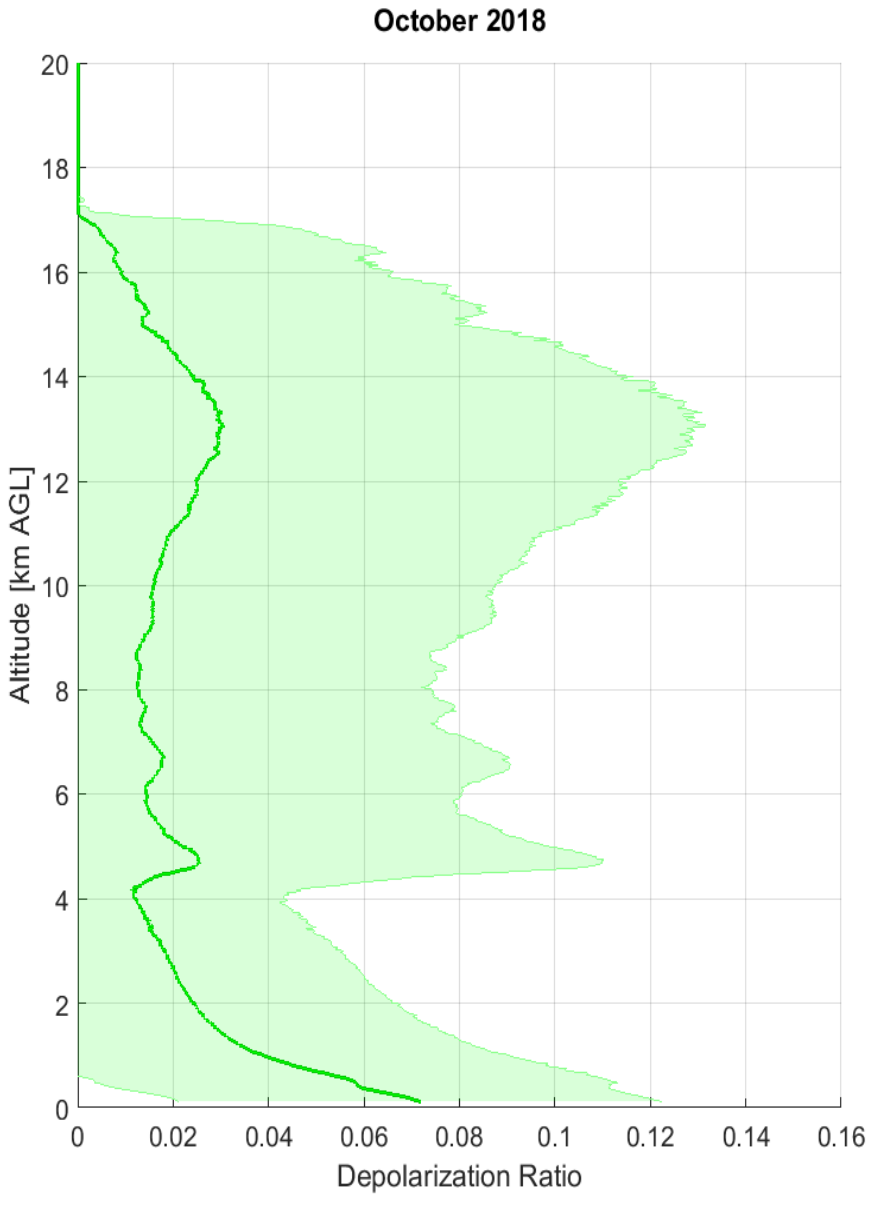

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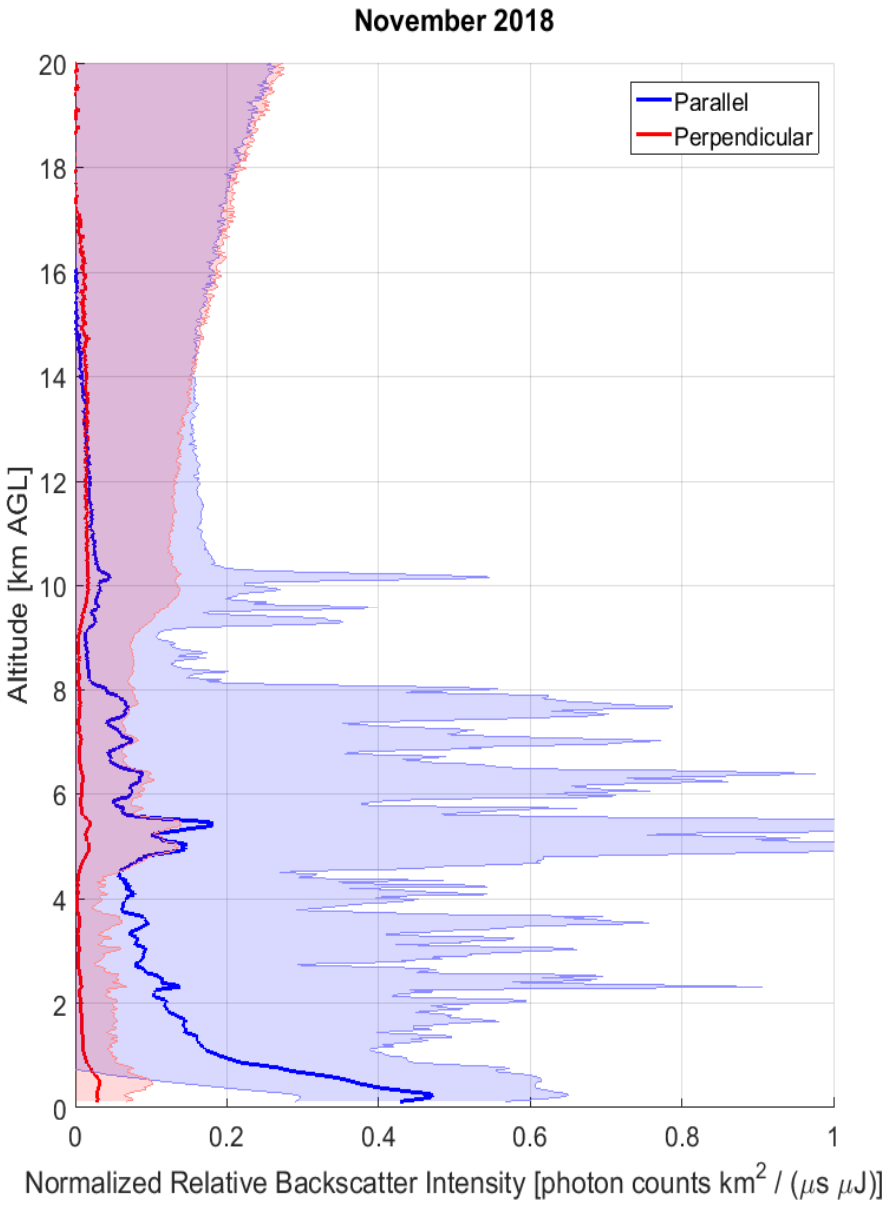

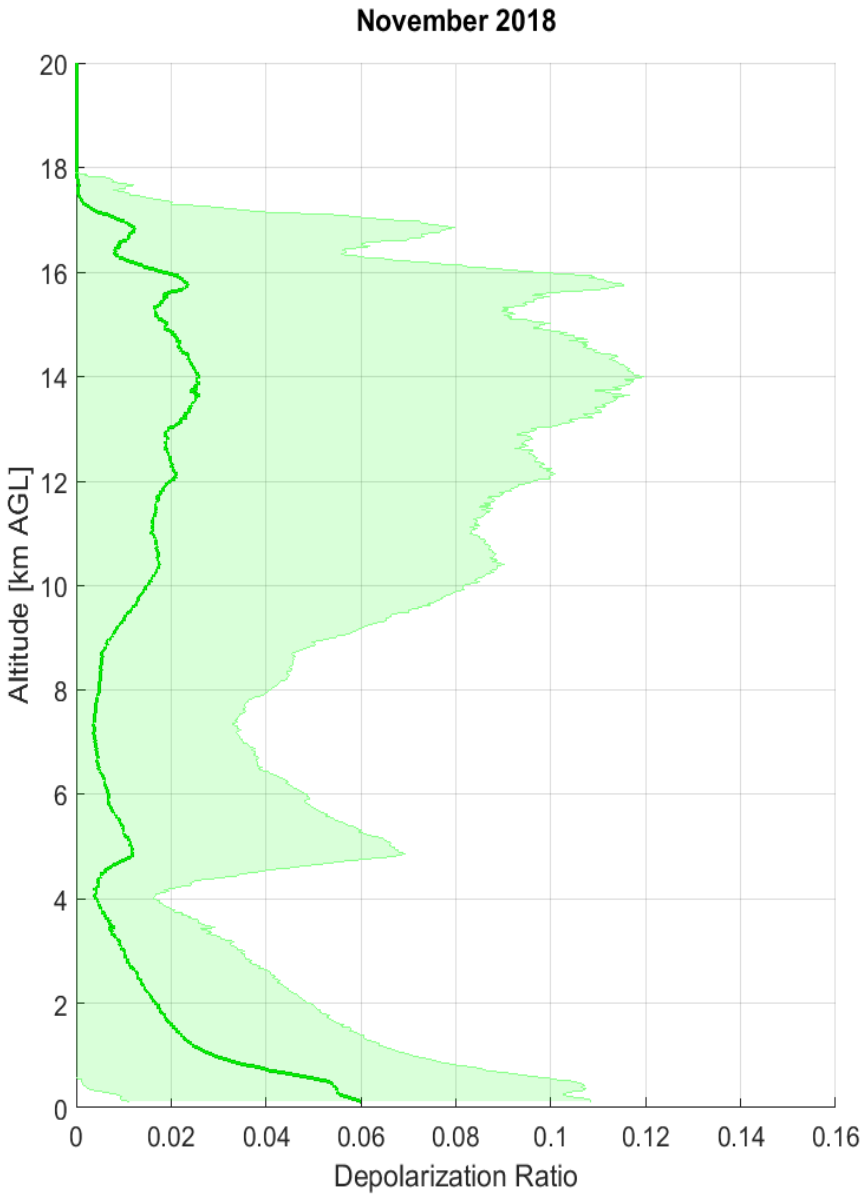

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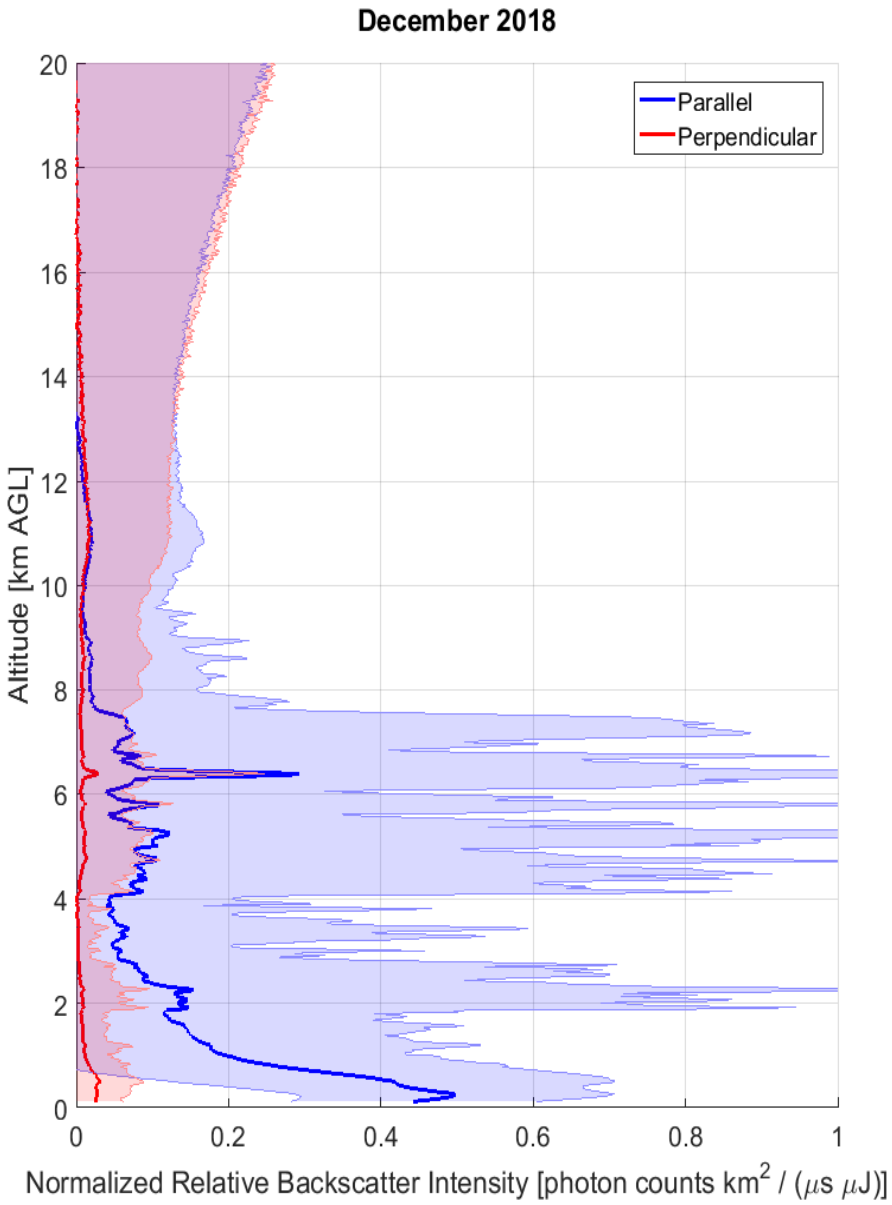

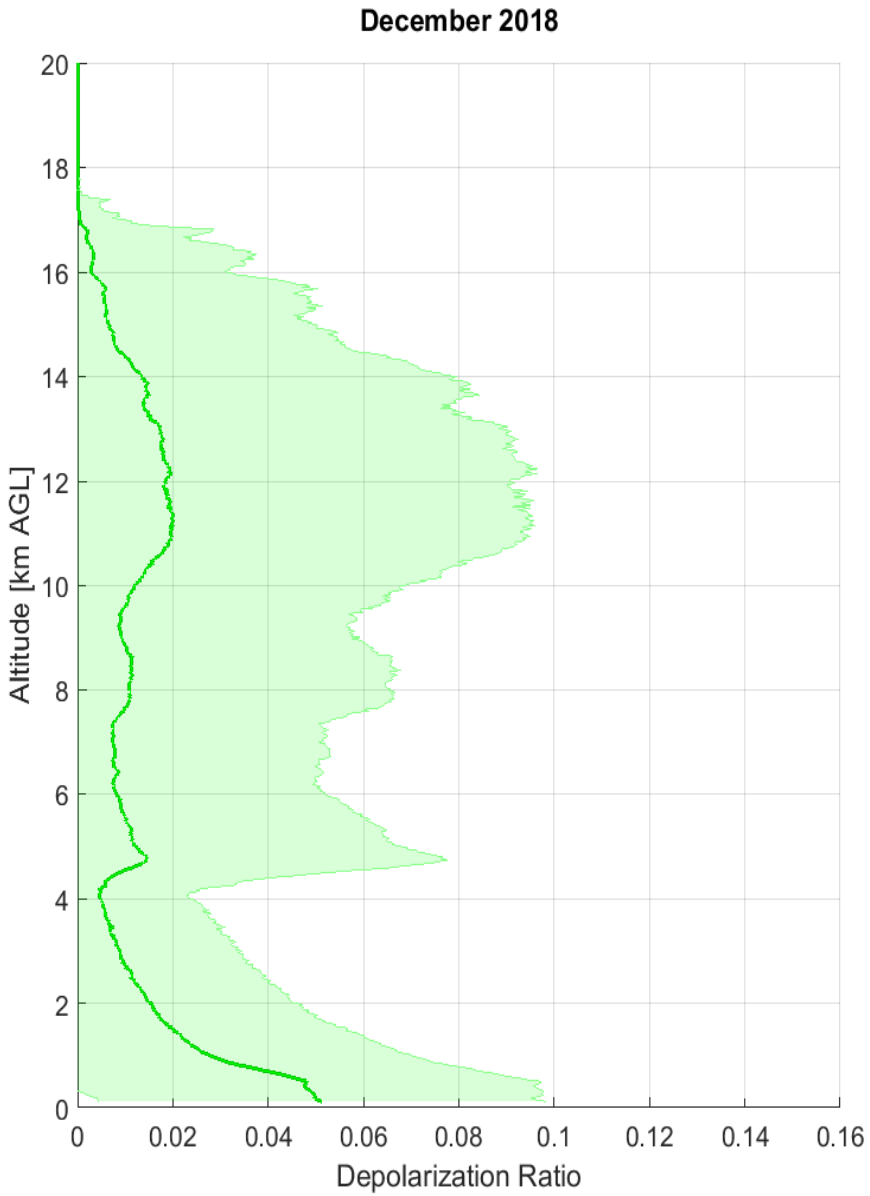

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