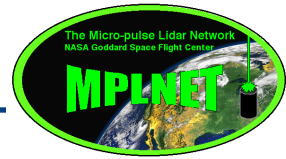




The NASA Micro-Pulse Lidar Network (MPLNET)



Principal Investigator:

Judd Welton, NASA GSFC Code 612

Network Manager & Engineer:

Sebastian Stewart, SSAI GSFC Code 612

Data Processing:

Phillip Haftings, SSAI GSFC Code 612

Larry Belcher, SSAI GSFC Code 612

Science Team:

James Campbell, Naval Research Lab

Jasper Lewis, UMBC GSFC Code 612

Simone Lolli, UMBC GSFC Code 612

Administrative Support:

Jasmine Smith, SSAI GSFC Code 612

CALIPSO Validation Activities:

Judd Welton, James Campbell

AERONET & Synergy Tool Partnership:

Brent Holben, NASA GSFC Code 618

Dave Giles, NASA GSFC Code 618

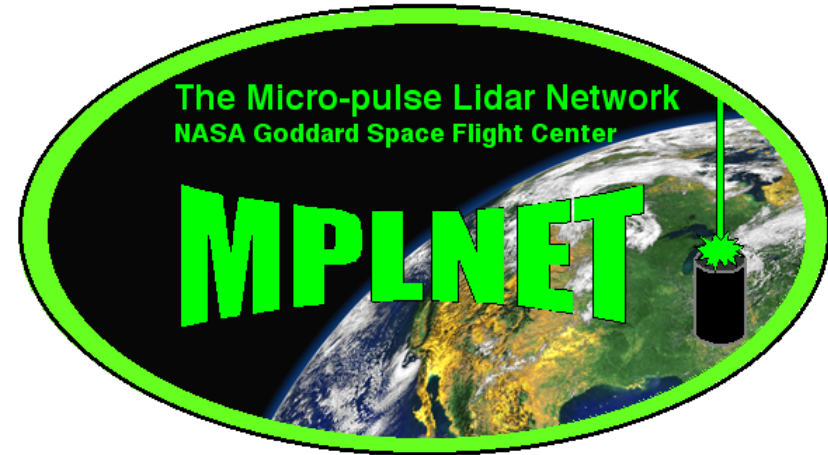
NASA SMARTLABS Field Deployments:

Si-Chee Tsay, NASA GSFC Code 613

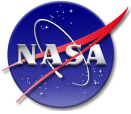
Site Operations & Science Investigations

.... many network partners around the world

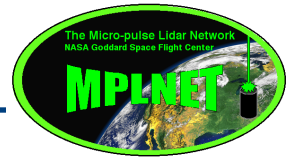
MPLNET is funded by the NASA Radiation Sciences Program and the Earth Observing System



Newest Site: Windpoort, Namibia



The Micro Pulse Lidar Network (MPLNET): 2000 - current



Focus since last ICAP:

1. New Site Deployments

16 currently active sites

Lost a few the past year:

- * Penang, Bozeman, Trinidad Head

Added a few:

- * USA, Namibia

Three more planned sites over next year

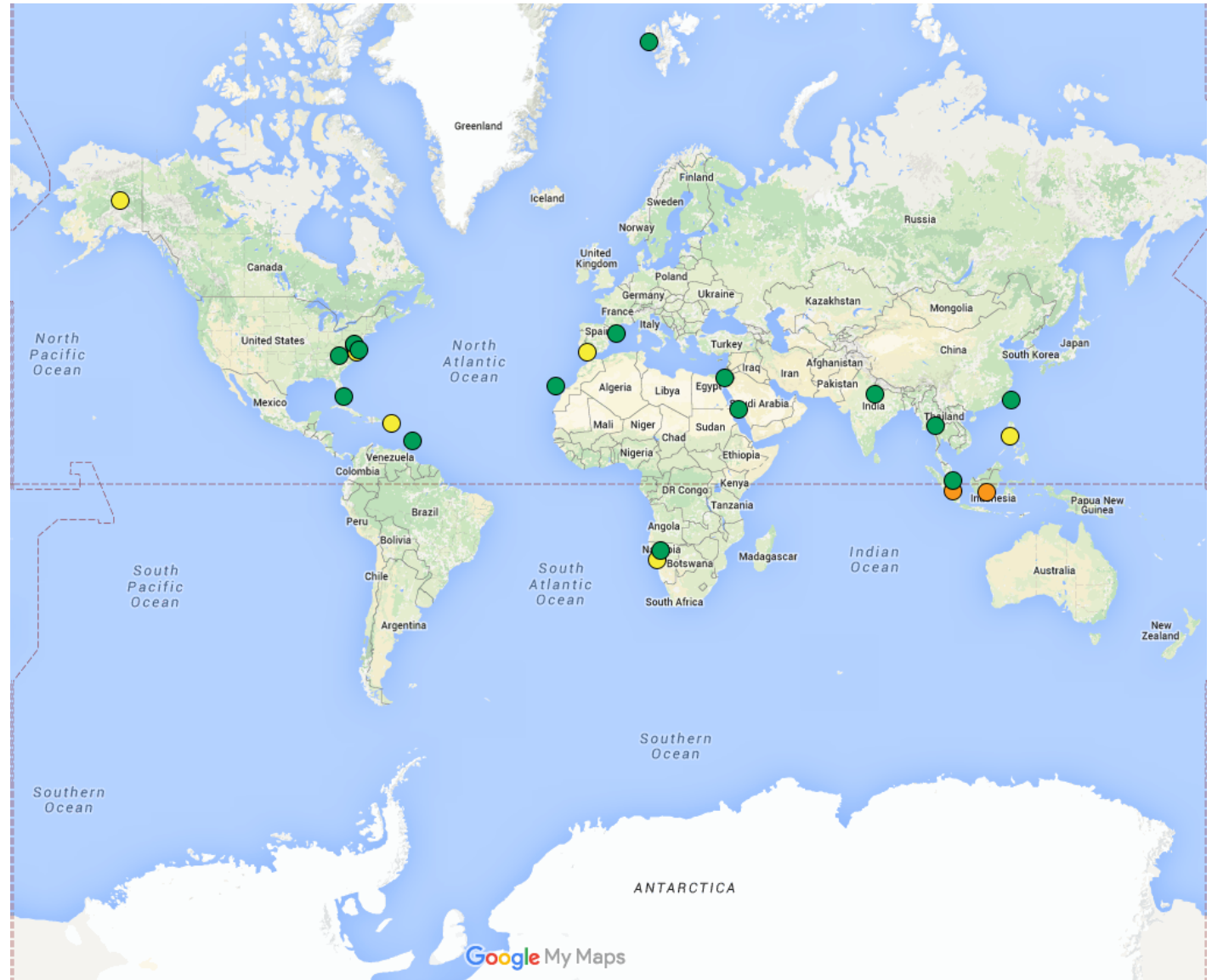
- * Puerto Rico, Spain, Indonesia, Philippines

2. Finalize new operational calibration protocol for polarized MPL Instruments

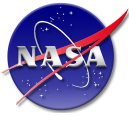
* a “minor” hurdle appeared in January, but this task is now finished

3. Version 3 Development & New Website

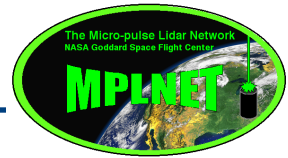
4. GALION



NOTE: South Pole Site off map (all that money and brains and Google's still using mercator)



MPLNET Newest Site: Etosha Pan, Namibia (a new look at old problem: power)



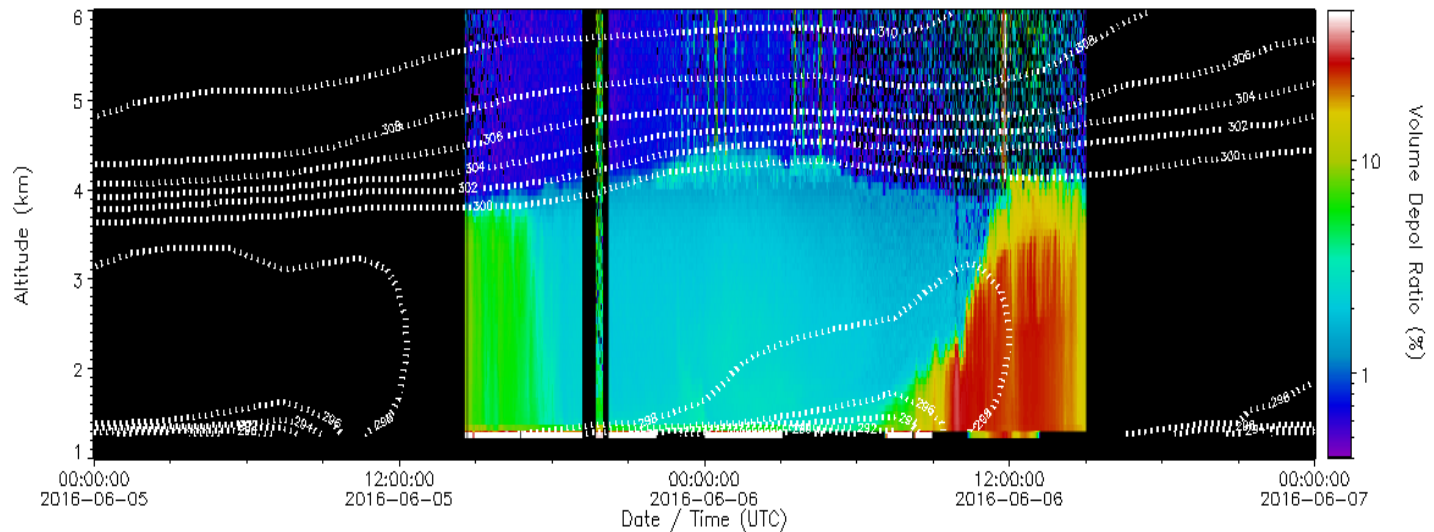
First new site in Africa since 2000 established near Etosha Pan, Namibia.

At these remote installations we are testing new power and data communications:

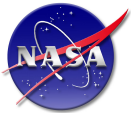
Solar Power & cellular service

GEOS-5 Data: Windpoort, 2016-06-05 to 2016-06-07

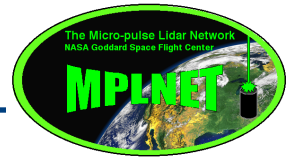
Virtual_Potential_Temperature



“First Light” at the new Windpoort MPLNET Site Immediately downwind of Etosha Pan



The Micro Pulse Lidar Network (MPLNET): 2000 - current



Focus since last ICAP:

1. New Site Deployments

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Lost a few the past year:

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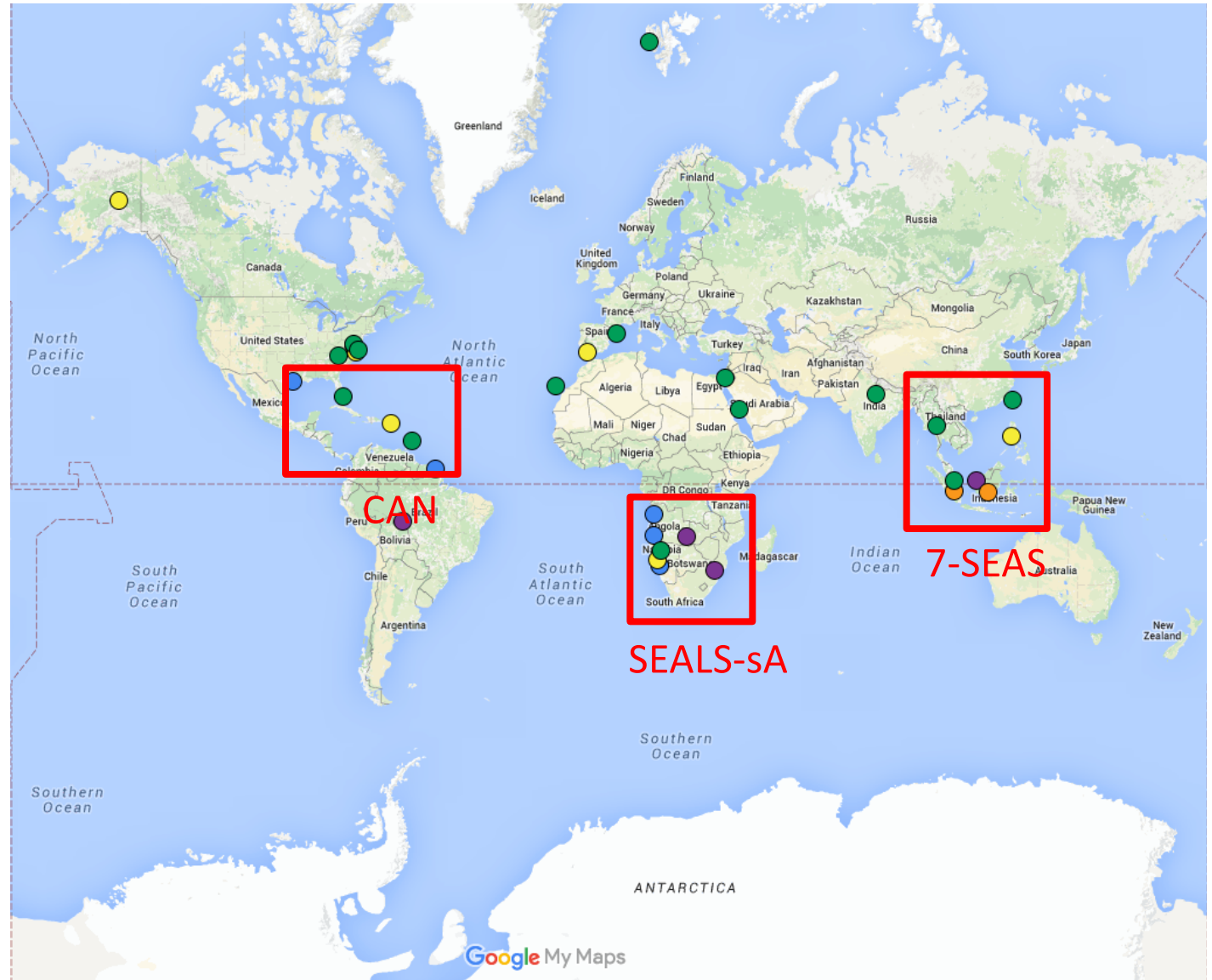
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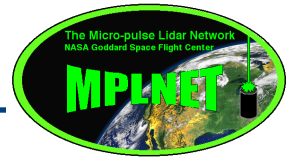
* a "minor" hurdle appeared in January, but this task is now finished

3. Version 3 Development & New Website

4. GALION



NOTE: South Pole Site off map (all that money and brains and Google's still using mercator)



Version 3 Progress and New Website



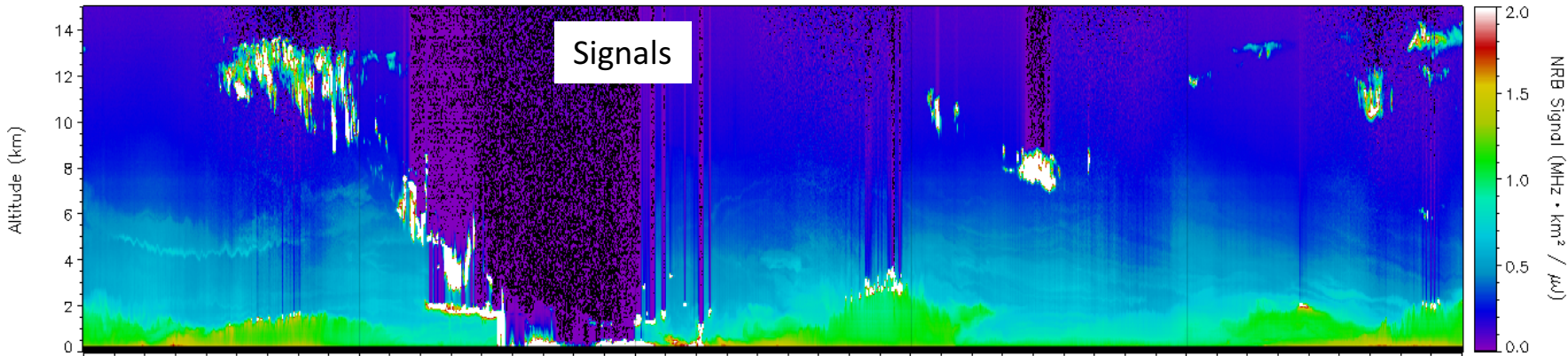
MPLNET Version 3 Products:

L1 Signals

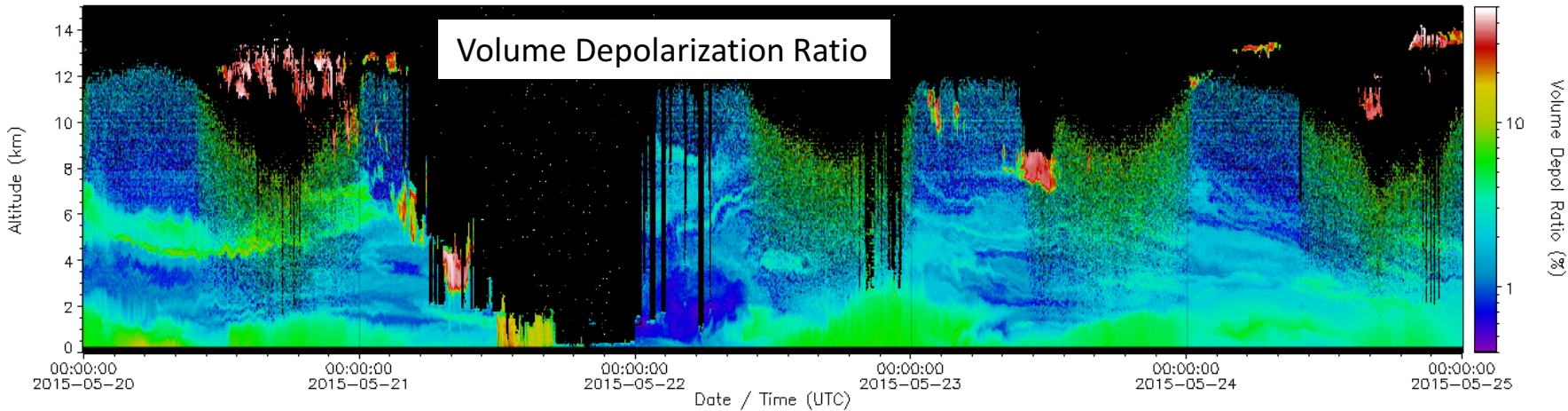


MPLNET RA L1_NRB: GSFC_ra, 2015-05-20 to 2015-05-25

1 minute temporal, 30 or 75 meter vertical resolution



MPLNET RA L1_VDEPOL: GSFC_ra, 2015-05-20 to 2015-05-25



Highly Accurate Measurement:
≤ 0.5% error

But daytime SNR is a problem in free troposphere

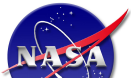
Welton et al., New Polarized MPL, JTECH, in prep, 2015

Incorporate both older MPLs and new polarized MPLs

New signal averaging scheme:
aerosol retrievals up to cloud edge

All Products have QA Flags:

- No data acquired (no raw lidar signal data)
- instrument status (temps, energy, calibrations)
- Failed retrieval (no PBL, Fernald fail, etc)
- Specific product screen (ex. L15V_AER)



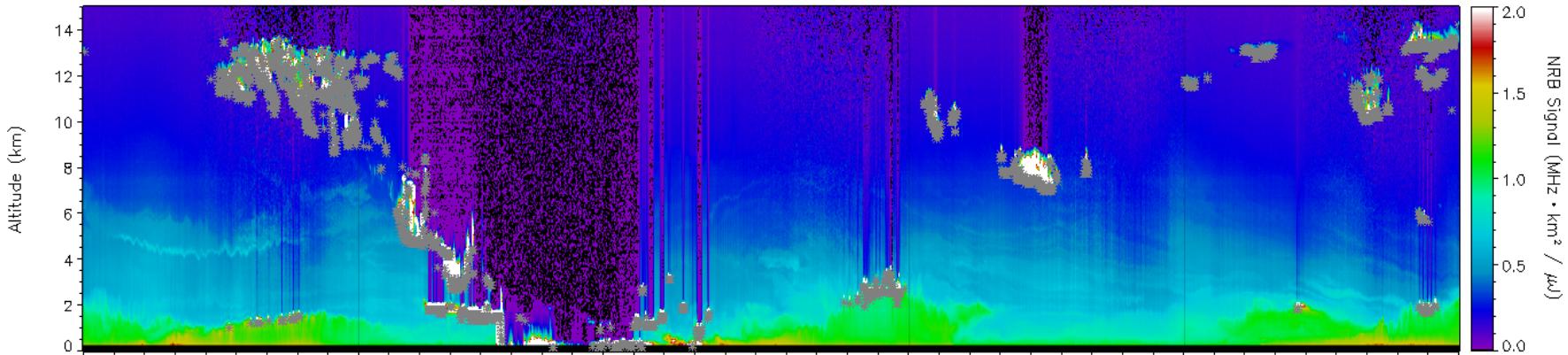
MPLNET Version 3 Products:

L15 Clouds

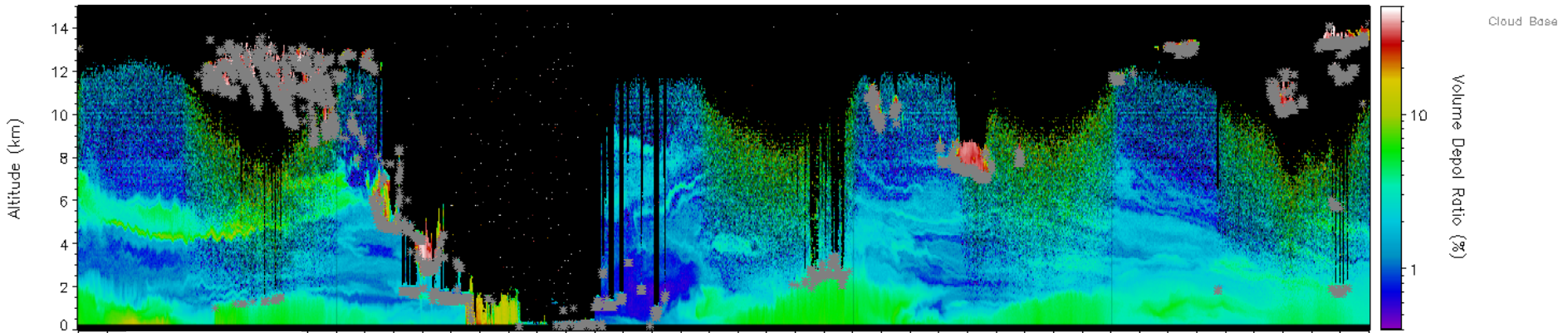


MPLNET RA L1_NRB: GSFC_ra, 2015-05-20 to 2015-05-25

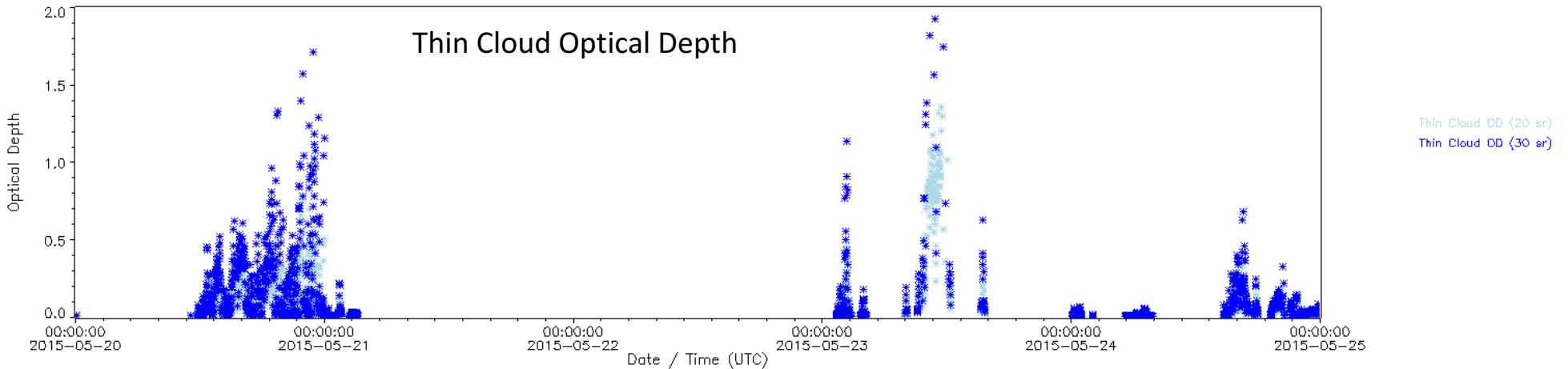
Cloud products from 1, 5, or 20 minute signal averages



MPLNET RA L1_VDEPOL: GSFC_ra, 2015-05-20 to 2015-05-25



MPLNET RA L15_CLD COD GSFC_ra, 2015-05-20 to 2015-05-25





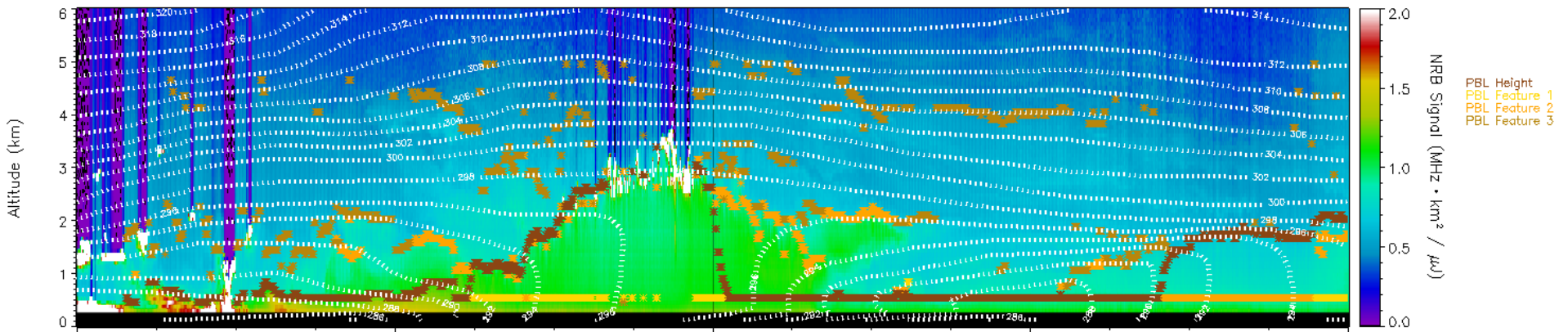
MPLNET Version 3 Products: L15 PBL Heights



MPLNET RA L1_NRB: GSFC_ra, 2015-05-22 to 2015-05-24

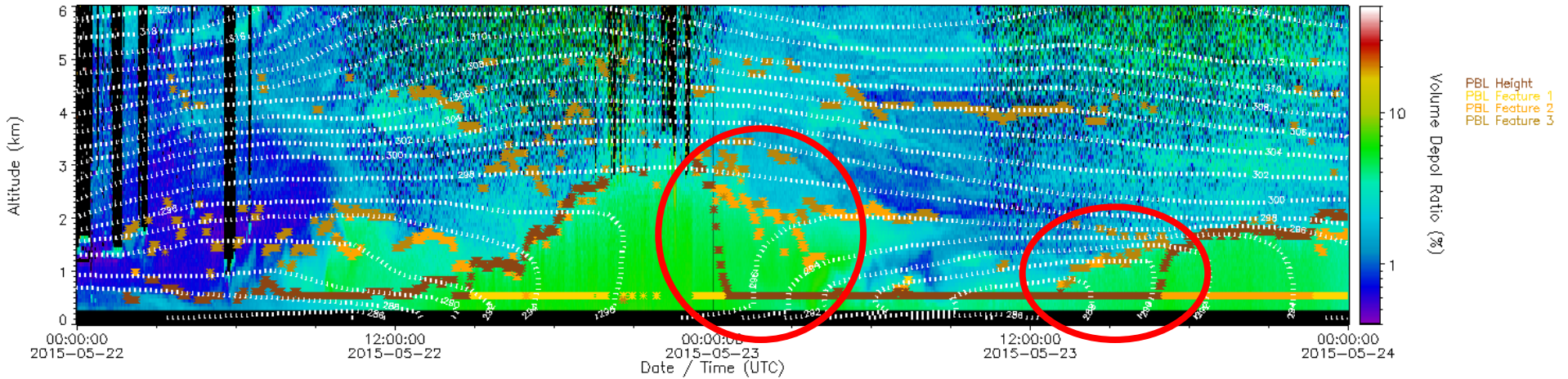
5 minute signal average

Virtual_Potential_Temperature



MPLNET RA L1_VDEPOL: GSFC_ra, 2015-05-22 to 2015-05-24

Virtual_Potential_Temperature



Lewis et al., Improved boundary layer depth retrievals from MPLNET, JGR, 2013

Lewis co-I on NASA ACCDAM project to improve PBL parameterization in WRF

Results will help refine the operational implementation of the PBL research algorithm



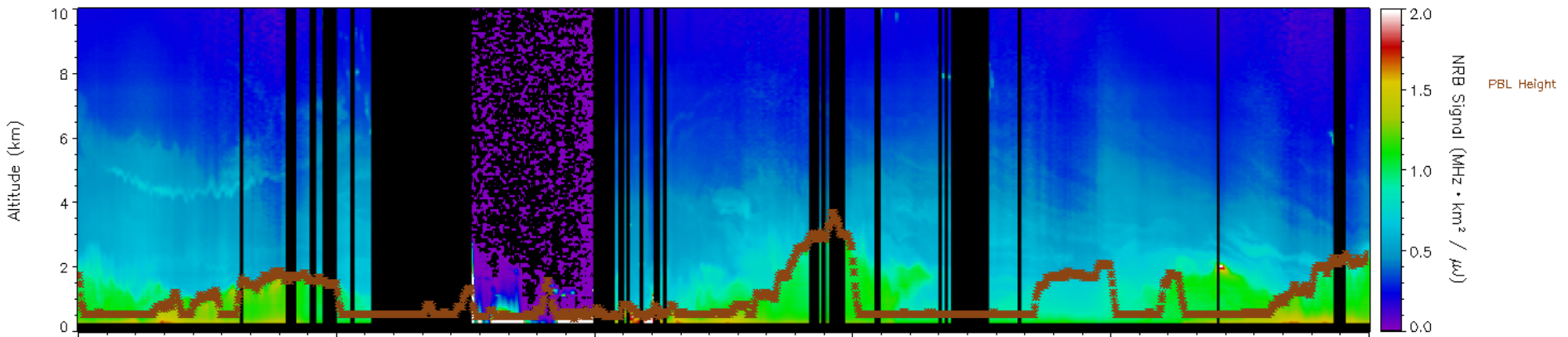
MPLNET Version 3 Products:

L15V Aerosols (Beta)

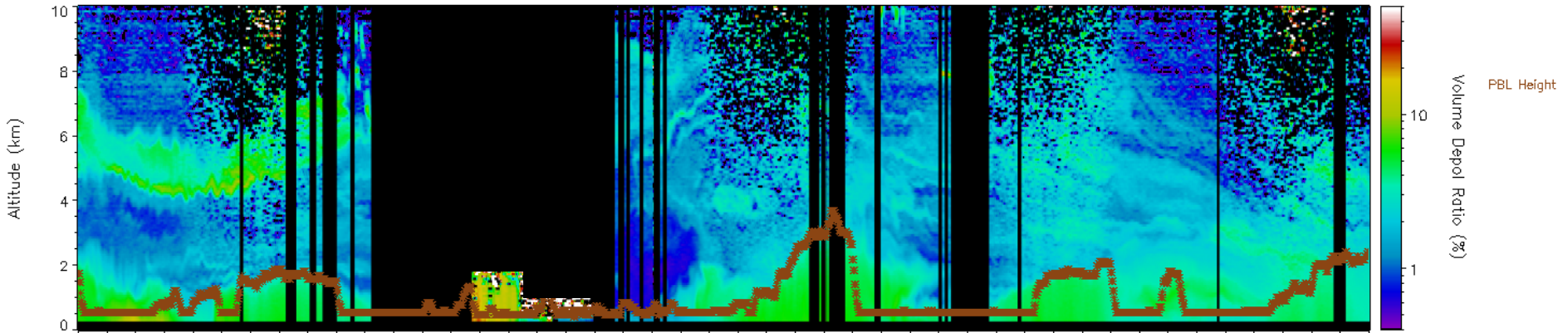


MPLNET RA L1_NRB: GSFC_ra, 2015-05-20 to 2015-05-25

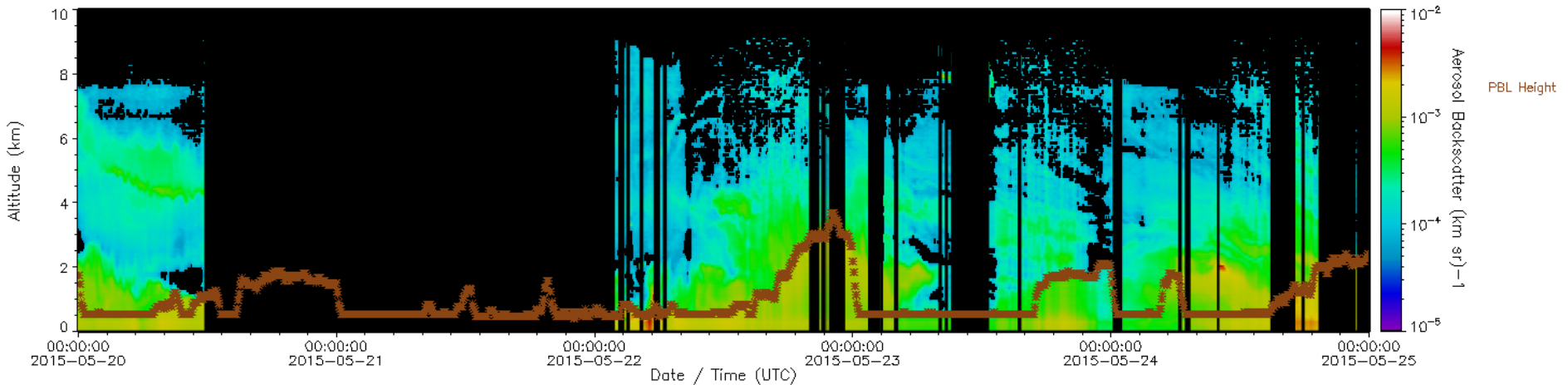
20 minute, cloud screened signal averages



MPLNET RA L1_VDEPOL: GSFC_ra, 2015-05-20 to 2015-05-25



MPLNET RA L15_AER Backscatter: GSFC_ra, 2015-05-20 to 2015-05-25



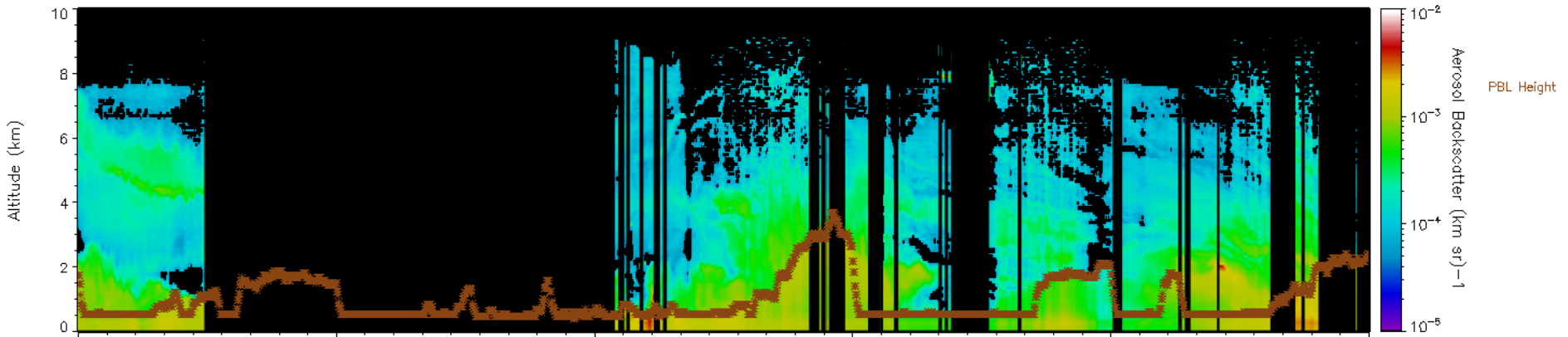


MPLNET Version 3 Products:

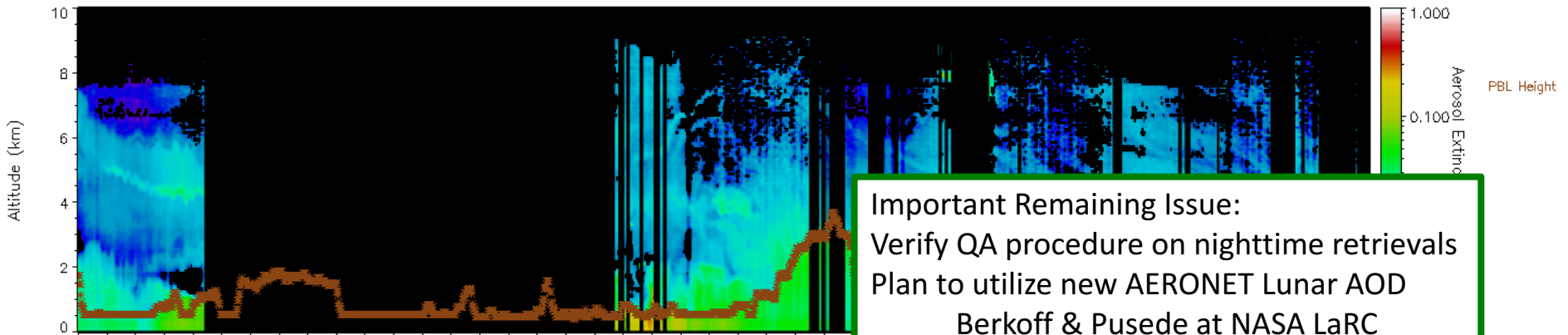
L15V Aerosols (Beta)



MPLNET RA L15_AER Backscatter: GSFC_ra, 2015-05-20 to 2015-05-25

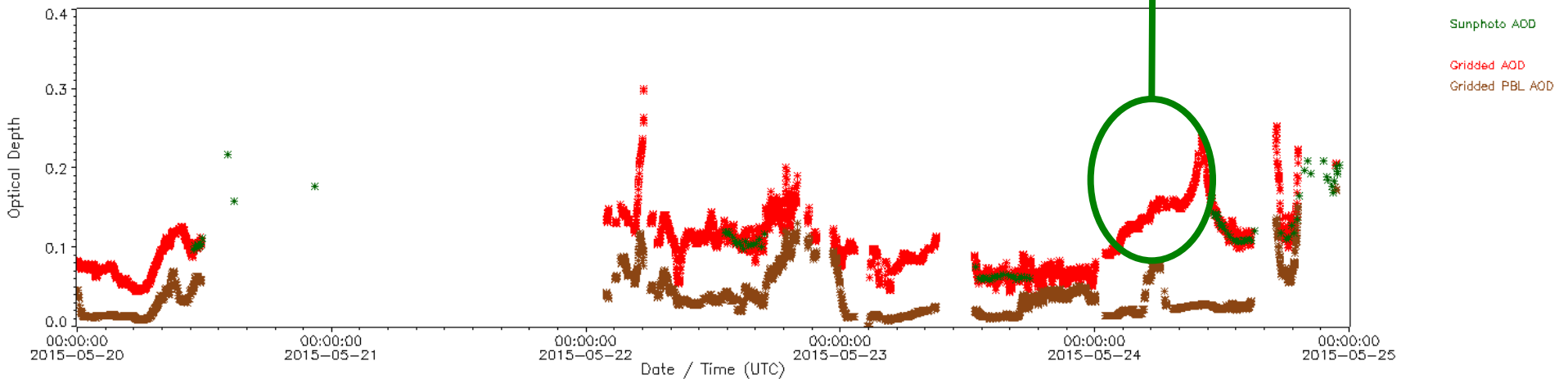


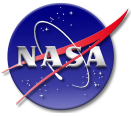
MPLNET RA L15_AER Extinction: GSFC_ra, 2015-05-20 to 2015-05-25



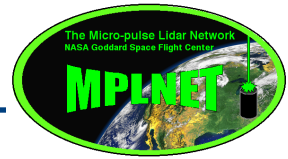
Important Remaining Issue:
Verify QA procedure on nighttime retrievals
Plan to utilize new AERONET Lunar AOD
Berkoff & Pusede at NASA LaRC

MPLNET RA L15_AER AOD: GSFC_ra, 2015-05-20 to 2015-05-25





MPLNET Version 3: Changes since last ICAP

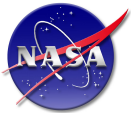


Version 3 Products Finalized

Product Levels Adjusted to match new AERONET definitions: L15V to redefined L15

V3 Product	Description
NRB	Lidar signals, volume depolarization ratios, and diagnostics.
CLD	Cloud heights and retrievals.
PBL	PBL height and estimated AOD.
AER	Aerosol heights and retrievals for coincident, co-located sunphotometer observations.
CAER	Aerosol heights and retrievals (continuous). Less accurate than AER product.

V3 Product Levels	V3 Notes	V2 Product Levels	V3 Notes
L1_NRB	NRT, not screened, initial calibration, auto GEOS5 Forecast NRT, reprocessed next day with GEOS5 Assimilated, AERONET L15 AOD	L1	
L1_CLD		L15b	only cloud products
L1_PBL		—	
L1_AER		L15a	only sunphotometer constrained data
L1_CAER		L15caer	L15a file, but only gridded products. Browsable but not downloadable.
L15_NRB	NRT, screened, initial calibration, auto GEOS5 Forecast NRT, reprocessed next day with GEOS5 Assimilated, AERONET L15 AOD	—	
L15_CLD		—	
L15_PBL		—	
L15_AER		—	
L15_CAER		—	
L2_NRB	Not NRT, screened, post calibration, human GEOS5 Assimilated, AERONET L2 AOD	—	
L2_CLD		L2b	only cloud products
L2_PBL		—	
L2_AER		L2b	only sunphotometer constrained data
L2_CAER		—	



Version 3

- L1_NRB product is finished. Operational forward processing running for all sites
 - Some sites require final calibrations, can browse data but not download files. Final calibrations will be complete by Sept 2016 for all active sites
- L1_CLD product in final ops testing
- L1_AER, L1_CAER, and L1_PBL products still in R&D, ops testing soon.
- L15 and L2 quality assurance algorithms nearly complete (some are, ie aerosols)

Data Availability:

Full V3 Forward Processing: All Products available from all sites by Fall 2016

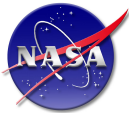
- *July 2016 - current*

V3 Reprocessing Stream 1: July 2006 – July 2016

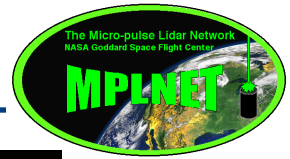
- Reprocess all older V2 L1, L15, and L2 data: effort begins by Winter 2016

V3 Reprocessing Stream 2: Dec 1999 – June 2006

- Reprocess all older V2 L15 and L2 data
 - Cannot easily reprocess L1 data (cal files only exist from V1 era, time consuming)
 - Not sure how to handle this yet
-



New MPLNET Version 3 Website



MPLNET The NASA Micro-Pulse Lidar Network



2016-07-10 23:10:53 UTC

MPLNET Site: GSFC:

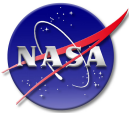
MPLNET PI: Judd Welton Latitude: 38° 59' 33" N
 MPLNET Lidar: MPL44104 Longitude: 76° 50' 23" W
 AERONET Site: [GSFC](#) Altitude: 0.050 km
 Additional Site Information: -

Site: Version: Product:

- Home
- Data
- Product Information
- Browse V3 Data
- Browse V2 Data
- Download Data
- Data Policy
- Project
- Version Information
- Sites
- Field Campaigns
- Instrumentation
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2016																															
January							February							March							April										
Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat				
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May							June							July							August									
Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat			
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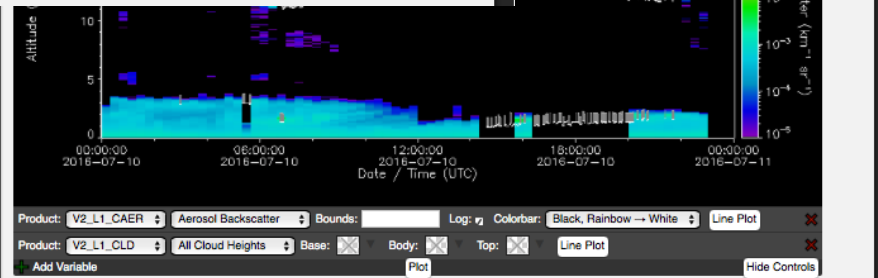
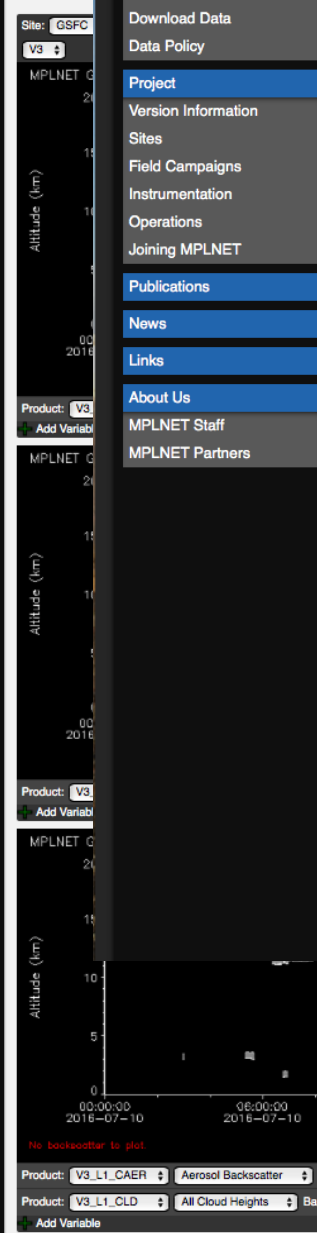
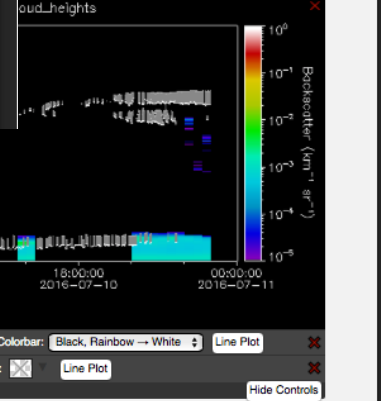
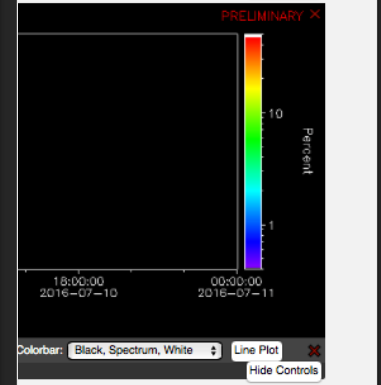
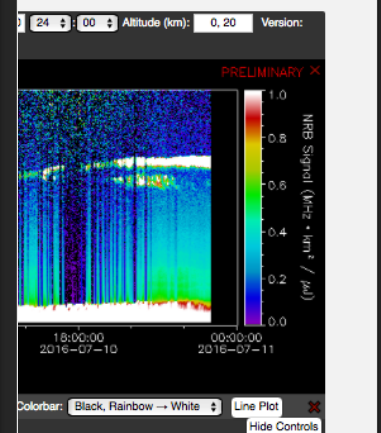
- Home
- Data
 - Product Information
 - Browse V3 Data
 - Browse V2 Data
 - Download Data
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MPLNET Line Plot

Site: Date/Time: 2016-07-10 10:59:59 Altitude: 0, 5 Version:

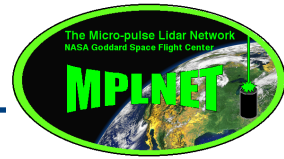



Product: Variable: Bounds: 0.0, 0.1 Log: Symbol:






New MPLNET Version 3 Website: New Online Download Tool





MPLNET
The NASA Micro-Pulse Lidar Network



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MPLNET Data Download

Your request will download a zip file containing the requested data. Please agree to the MPLNET data policy below, in order to proceed. This will use up 6 of your remaining 364 credits.

Data Policy

The public domain data available from MPLNET are contributed by the Interagency Lidar Network (ILN) at NASA Goddard Space Flight Center. The ILN is responsible for deployment, maintenance, and data collection. The PI(s) is entitled to be informed of any other use of the data.

Although journal paper authorship and acknowledgement is the domain of the PI(s), the MPLNET contributors ask that every practical attempt be made to highlight the data in any publication.

Using MPLNET data:

Please consult with the PI(s) of the data to be used. If planning a further publication, especially if you are unfamiliar with lidar and/or MPLNET.

Publishing MPLNET data:

Please identify the type of data usage in your publication:

- Significant contribution to the paper/presentation: Please offer co-authorship.
- Minor contribution to the paper/presentation: Please consider co-authorship.

Please provide final citation information to the PI(s) upon publication. This will help support to the earth science community.

Acknowledgements:

Please include the following acknowledgements in any publication or presentation of MPLNET data, regardless of co-authorship status.

- The MPLNET project is funded by the NASA Radiation Sciences Program and Earth Observing System.
- The site PI(s) may provide any additional specific funding acknowledgements.

Please include the following for any PI(s) not included as co-author:
We thank the MPLNET (PI) for (its/theirs) effort in establishing and maintaining (site name(s)) sites.

Please contact the PI(s) listed below according to our data policy above.

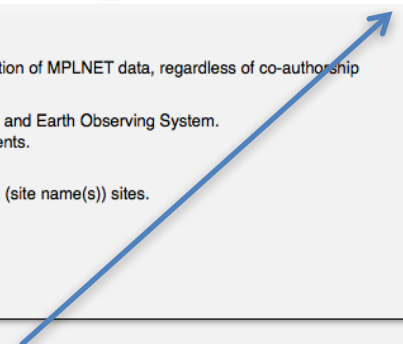
GSFC: [Judd Welton](#)

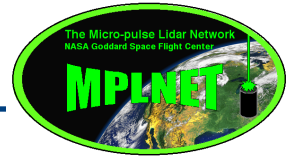
▼ **GSFC**

- ▼ **L1_AER**
 - [MPLNET_V2_L1_AER_20160709_MPL44104_GSFC.nc4](#)
 - [MPLNET_V2_L1_AER_20160710_MPL44104_GSFC.nc4](#)
- ▼ **L1_CLD**
 - [MPLNET_V2_L1_CLD_20160709_MPL44104_GSFC.nc4](#)
 - [MPLNET_V2_L1_CLD_20160710_MPL44104_GSFC.nc4](#)
- ▼ **L1_NRB**
 - [MPLNET_V2_L1_NRB_20160709_MPL44104_GSFC.nc4](#)
 - [MPLNET_V2_L1_NRB_20160710_MPL44104_GSFC.nc4](#)

[Agree and Download](#)

Standardized format for all products
CF compliant netcdf4
Error Values and QA Flags

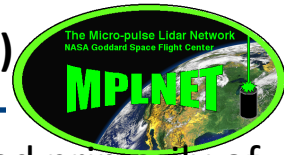




GALION Update & Progress Toward Improved Support for Support of Aerosol Forecasting



WMO Global Atmospheric Watch (GAW) Aerosol Lidar Observation Network (GALION)



GALION is a lidar network of networks organized through the GAW program, and is composed primarily of the world's leading lidar networks. Each is a contributing network to GAW.

GALION Networks:

- EARLINET
- AD-NET
- CIS-LINET
- LALINET
- CORALNET
- CREST
- MPLNET (global)
- NDACC (global)

Active sites Remain:

- Basic GALION Whitepaper
- Canada consensus and agreement in lidar community
- West/Central USA aerosol lidar networks
- Australia
 - * several met service lidar networks started
 - * Blueprint for coordinated networks
- Central Asia
 - * Standards for instrumentation and data quality
- Africa
 - * ex: EARLINET single-calculus chain

Improved coverage of under-sampled regions

Other Issues:

- * LALINET has come along way (Latin America)
- * WMO GAW SIS (only current discovery system)
- * MPLNET in SE Asia (7-SEAS)
- * incomplete listing of sites, inadequate metadata content

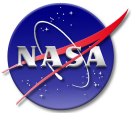
Still lack a GALION website and data center

- * also common data product list and file format

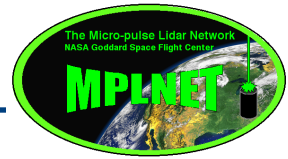
Newly formed (and forming) met service lidar networks have little (or no) connection to GALION

- * this was a concern during prep of the GALION whitepaper, and is now a reality





GALION Data Discovery: GAW Station Information System (GAWSIS) at moment



<https://gawsis.meteoswiss.ch/GAWSIS/>

GAWSIS designed for GAW, based on WMO Integrated Global Observing System (WIGOS)

* not ideal for GALION specific needs (metadata limited)

Not easy to add sites to GAWSIS or edit existing ones

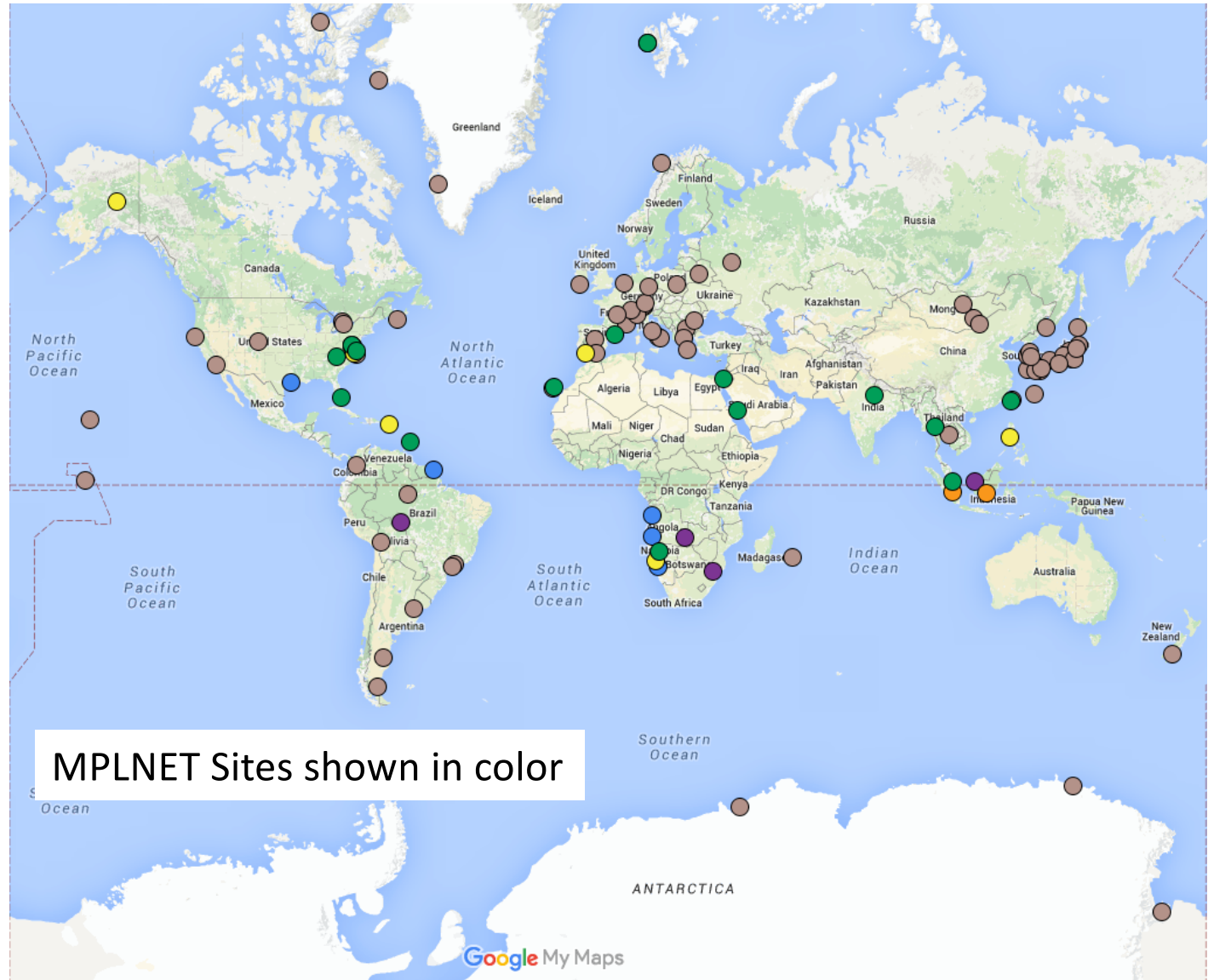
* especially true for pre-existing sites with other WMO projects

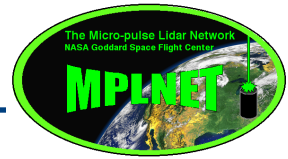
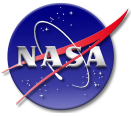
GALION Sites incomplete (many missing)

NOTE: WMO requires GALION members to input data to GAWSIS

New GAWSIS website is much improved, and helpful to get some site data (in kml also)

GALION needs its own data center and discovery applications





The GALION steering committee (network heads) recently agreed to begin work towards creation of a data center

Creation of new data center working group (members TBD)

- Establish initial metadata content, and call for input
- Develop common data products & file format
 - Note, similarity already exists between EARLINET & MPLNET
- one data center for GALION, or a distributed approach
 - Regardless we will have one web portal starting point
- Once membership is final, begin telecons
- Next GALION meeting planned joint with ILRC 2017 (data center group meeting)

GALION representation on GAW SDS-WAS and VAAC working group

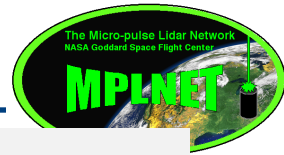
Pappalardo on GAW SAG on Modeling Applications

Welton recently became member of the GAW Expert Team for World Data Centers

- Plan to have GALION data center be approved GAW data center
 - Hopefully address, or add some weight to, aerosol content available to operational forecasters (specifically lidar related parameters needed for modeling)
-



GALION Data Center: Step One --- Metadata Collection (underway)



GALION Metadata: Create

Site Name: Contact Person Name: Contact Person Email:

Network: Start Date: End Date: (enter "current" if ongoing)

Latitude: Longitude: Elevation (meters above sea level):

Is your site already in GAWSIS? You can check here: [GAWSIS](#)

Does your lidar provide near surface profiling capability of use for PBL studies?

Does your lidar provide tropospheric profiling capability?

Does your lidar provide stratospheric profiling capability?

If so, do you have an estimate of the minimum scattering ratio required for detection of a stratospheric layer?

What is your observation schedule?

Do you have the capability to provide near-real-time data?
Definition: browse images and/or data files online

Please specify the type of lidar data provided

Does your site meet the minimum 3B+2A correlation coefficient criteria?
(size distribution, absorption, etc)

Is your site co-located with any of the following?

- Sun Photometer:
- Star or Lunar Photometer:
- Aerosol In-situ Sampling:
- Surface Met Observations:
- Met Profiles:
- Operational Air Quality Monitoring Station:
- Surface Solar Radiation Observations:
- Other WMO GAW Observations:

Select

----- Backscatter Lidar Options -----

- single wavelength backscatter
- multi-wavelength backscatter
- single wavelength backscatter + single wavelength depolarization
- multi-wavelength backscatter + single wavelength depolarization
- multi-wavelength backscatter + multi-wavelength depolarization

----- Raman Lidar Options -----

- single wavelength backscatter + single wavelength raman
- multi-wavelength backscatter + single wavelength raman
- multi-wavelength backscatter + multi-wavelength raman
- single wavelength backscatter + single wavelength raman + single wavelength depolarization
- multi-wavelength backscatter + single wavelength raman + single wavelength depolarization
- multi-wavelength backscatter + single wavelength raman + multi-wavelength wavelength depolarization
- multi-wavelength backscatter + multi-wavelength raman + single wavelength depolarization
- multi-wavelength backscatter + multi-wavelength raman + multi-wavelength wavelength depolarization

----- HSRL Lidar Options -----

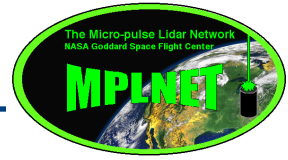
- single wavelength backscatter + single wavelength hsrl
- multi-wavelength backscatter + single wavelength hsrl
- multi-wavelength backscatter + multi-wavelength hsrl
- single wavelength backscatter + single wavelength hsrl + single wavelength depolarization
- multi-wavelength backscatter + single wavelength hsrl + single wavelength depolarization
- multi-wavelength backscatter + single wavelength hsrl + multi-wavelength wavelength depolarization
- multi-wavelength backscatter + multi-wavelength hsrl + single wavelength depolarization
- multi-wavelength backscatter + multi-wavelength hsrl + multi-wavelength wavelength depolarization

----- Other Lidar Options -----

Other



Conclusion



MPLNET Version 3 full implementation by Fall 2016

- Reprocessing of older data begins by end of 2016
- ICAP & SDS-WAS specific data collections
 - NRT FTP data files available
 - Specific product subsets possible

GALION

- Work beginning on data center for lidar sites & data discovery
- Links to data for browsing and download
- Provide above capabilities for smaller networks or individual sites if needed
- Improved metadata will allow better coordination among networks
 - Potential for joint field campaign activities
 - Ability to coordinate deployments with other observations (ex: in-situ)

Next big lidar meeting: ILRC 2017 (joint GALION meeting planned)

Final Thoughts:

- Do better job building new sites with coincident aerosol remote sensing, in-situ, and met obs
 - Regional science programs like 7-SEAS, CAN, and SEALS-SA provide a potential mechanism
 - Standardize ICAP vertical products (name & def)
 - Limitations on the number of aerosol related parameters (WIGOS, model cost)
 - Issue: lidar aerosol layer detection vs retrieval of extinction (not same)
 - How do we report “no aerosol detected” vs aerosol detected but no extinction? If only have one variable “extinction” and no flags to use, then be careful reporting data (0s vs NaN vs -999, etc)
-