



The Evolution of Lidar Networks: a US perspective

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NASA Micro Pulse Lidar Network (MPLNET)

Windpoort, Namibia

Photo: Seb Stewart



Introduction: Some Constraints for the Discussion

- Focus on atmospheric lidars providing cloud and aerosol profile data (should have altered title)
- Ceilometers vs Lidar
 - Similar design, here we consider only instruments providing signal profile data
 - Various met agencies have run ceilometer networks for a long time
 - Historically they were limited to providing cloud base height, no signal profiles
 - Newer ceilometers now provide profiling, and are incorporated into networks
 - DWD – Germany, E-PROFILE (EU)

Ground based lidar R&D progressed rapidly from the 1980s to 1990s

- Laser and detector technology led to improvements in data quality and ability to operate for extended periods
- Retrieval techniques matured

Multi-Disciplinary Programs create networks for earth data observations

- DOE Atmospheric Radiation Measurement (ARM) network
- Network for the Detection of Atmospheric Composition Change (NDACC)
- Both networks provide lidar profiling capability, but not dedicated lidar networks

Success of the NASA Aerosol Robotic Network and WMO Global Atmospheric Watch (GAW) in-situ aerosol network proved value of long-term aerosol monitoring

- In 1999-2000 three dedicated aerosol lidar networks were created, independently
 - NASA Micro Pulse Lidar Network (MPLNET)
 - Asian Dust and Aerosol Lidar Observation Network (AD-NET)
 - European Aerosol Research Lidar Network (EARLINET)



The NASA Micro Pulse Lidar Network (MPLNET)



2000 – current

Homogenous instrumentation

Commercial Micro Pulse Lidar (MPL)

elastic backscatter 532 nm, polarized

Network: Over 70 sites, ~20 currently active

Global distribution

Objective: provide lidar profiling at NASA AERONET sites

Co-location & partnership with AERONET

Sparse regional coverage (esp North America)

Data Processing:

MPLNET Calibration Center: GSFC

working on calibration device for field sites

Centralized & Standardized Processing: GSFC

NETCDF-4

Signal, Cloud, Aerosol, and PBL Products (L1, L1.5, L2)

Online data browsing (public)

Online data download (public)

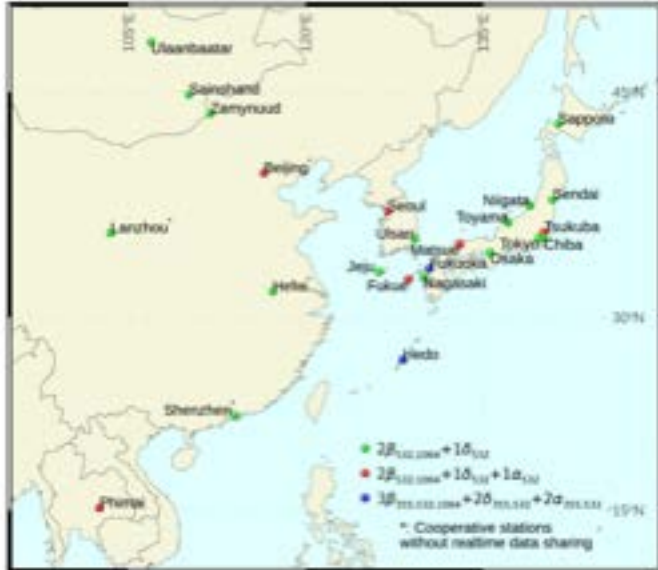
near real time online delivery (~ 1 hour)

NASA funded, with contributions from international partners



The Asian Dust and Aerosol Lidar Observation Network (AD-Net)

AD-Net



2000 – current

Homogenous instrumentation

NIES Dual Wavelength Backscatter lidar

elastic backscatter 1064 & 532 nm, polarized

Some now have raman capability

Network: 20 sites

Dense regional coverage over East Asia

Data Processing:

Calibration Center: NIES

Centralized & Standardized Processing: NIES

NETCDF

Signal, depolarization, extinction, cloud/rain flags

Online data browsing (public)

Online data download (public)

near real time online delivery

Significant progress with model assimilation of AD-Net Data

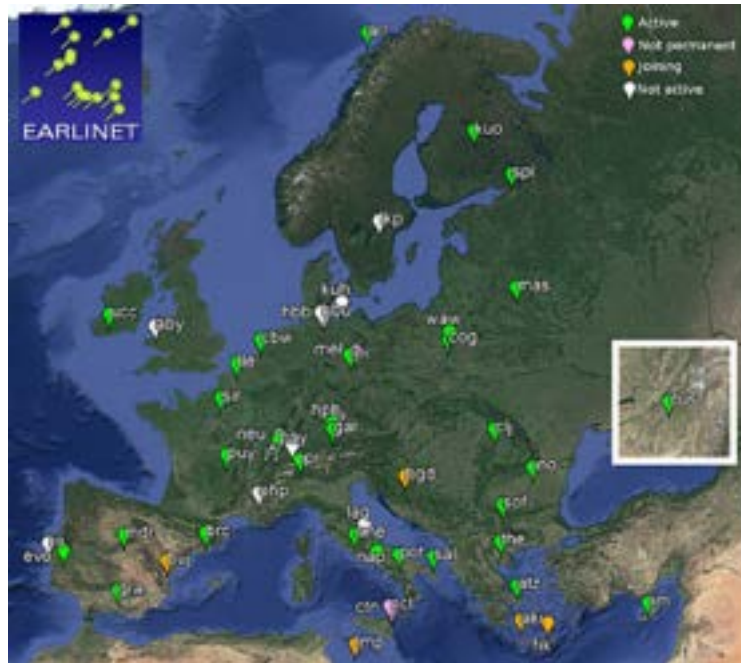
Asian Dust forecasting

Supported by Japanese Ministries of Environment and Education



The European Aerosol Research Lidar Network (EARLINET)

2000 – current



Heterogenous instrumentation

From basic elastic backscatter to
multi-wavelength & polarized raman lidars

Network: over 30 sites

Dense regional coverage in Europe

Some sites globally

Data Processing:

Decentralized at first

Have since solved issues running heterogenous network

Lidar Calibration Center Established

Instrument training, standards, & calibration

Centralized & Standardized Processing & Products

Single Calculus Chain (SCC)

NETCDF-4

Online data browsing (public)

Online data download (login required)

A few sites have NRT capability

many still only have a few obs per week

Advanced aerosol retrievals (have set standards)

Currently supported under ACTRIS program



These three networks + ARM & NDACC have common traits for success:

- Strong emphasis on calibration and quality control processes
- Centralized processing for standardization, traceability, and QA
- Core funding
- Multi-disciplinary science focus, integration with research community
 - Leads to strong publication history and data usage

EARLINET and AD-Net are regional networks with strong core funding

- these projects coalesced ground lidar activities in their regions
- end result is a mature, dense lidar network for these areas

MPLNET, ARM, and NDACC have a global focus

- No mandate to coalesce ground lidar work, nor provide dense network for USA/NA
- Ex: MPLNET was created to provide profiling at key AERONET sites worldwide
- Despite US funding of these efforts:
 - sparse coverage in North America
 - disparate ground lidar activities and fractured network projects in development
 - Very little or no interaction

Until 2008, these issues extrapolate globally.

No one network provides dense global coverage.



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

WMO GAW Aerosol Lidar Observation Network (GALION):

A lidar network of networks organized through the WMO Global Atmospheric Watch (GAW) program, and is composed primarily of the world's leading lidar networks. Each is an official contributing network to GAW (or soon will be).

See GAW Report 178 (2008)

GALION Networks:

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

GALION Co-Chairs:

- Gelsomina Pappalardo (CNR IMAA)
- Ellsworth J. Welton (NASA)

Steering Committee:

Network Heads, GAW Leadership

Work Groups:

Calibration, QA/QC, processing/products, applications, data center

Successes:

- More frequent interaction between the networks
- Some joint planning
- Development of standards for lidar types/models: calibration, processing, products
- Subsequent creation of newer networks (e.g. LALINET)
- Integration with related WMO & GAW projects:
 - SDS-WAS: Sand and Dust Storm Warning and Advisory System
 - World Data Centers: current plan is to build GALION data center for lidar networks



Not complete site listing
From WMO GAW SIS Database



Lidar Network Developments After the Creation of GALION:

Regional networks within Europe after Eyjafjallajökull Eruption in 2010:

- Led to significant enhancement of EARLINET and funding stability
- Several met services upgrade ceilometer networks or create lidar networks
 - DWD, KNMI, UK, France, Spain, etc
- EUMETNET creates E-PROFILE
 - Includes Europe-wide ceilometer and lidar sites
 - Address use of commercial ceilometers to provide lidar-like data

North America:

- TOLNET (Ozone lidar network, connection to NDACC)
- Univ of Wisconsin HSRL network (global)
- NYS Mesonet (some sites have lidar)
- EPA PAMS (E-PAMS) (some sites have ceilometers)
- New Canadian lidar network

I may be missing some, new efforts keep growing



North American Ceilometer & Lidar Networks Situation:

First, we must recognize the successes of older and newer lidar networks..... **BUT**

MPLNET: mature lidar network but sparse coverage
NWS: ceilometers, no signal profiles (as of now)
E-PAMS: new, some ceilometers (mix)
NYS Meso: some lidars, NY only
UW HSLR: advanced lidar, sparse regional coverage
TOLNET: ozone and aerosol data, sparse coverage
CREST: education focus, sparse coverage
CORALNET: dismantled several years ago
New CA Net: new, currently sparse coverage

Common Theme:

Sparse coverage individually, but if combined provide dense network

Networks may benefit from experience of long running GALION networks and E-PROFILE

Suggestion: we meet to develop a framework to work together

Following slides demonstrate aspects of a mature lidar network

Using MPLNET as example



MPLNET: new Version 3 processing system (result of 20 years of network experience learned the hard way)

MPLNET V3 Data:

#	Site	Latitude	Longitude	Altitude	AERONET Site	Version	Status	Listed	Principal Investigator
Active Sites									
1	Asheban, State	36.2150° N	81.8947° W	1 080 km	Asheban, State	V3 Only	Active	Yes	James Sherman
2	Barcelona	41.3880° N	2.1170° E	0 126 km	Barcelona	V3 Only	Active	Yes	Josef M. Baldridge
3	Cape San Juan	18.3010° N	65.8187° W	0 015 km	Cape San Juan	V3 Only	Active	Yes	Dpa Mavor
4	El Arcozillo	37.1050° N	8.7340° W	0 058 km	El Arcozillo	V3 Only	Active	Yes	Margarita Yela Gonzalez
5	EPA/NCU	24.3670° N	121.1810° E	0 136 km	EPA/NCU	V2 & V3	Active	Yes	Carlo Weng
6	Fairbank	64.8590° N	147.8490° W	0 300 km	Boronia Creek	V3 Only	Active	Yes	Judit Weller
7	GSFC	38.8900° N	76.8480° W	0 080 km	GSFC	V2 & V3	Active	Yes	Judit Weller
8	Kathburg	23.8790° N	120.2820° E	0 018 km	Kathburg	V3 Only	Active	Yes	Carlo Weng
9	KAUST_Campus	22.3040° N	38.1130° E	0 011 km	KAUST_Campus	V3 Only	Active	Yes	Georgiy L. Stetsko
10	King George Island	52.3000° S	58.8660° W	0 030 km	-	V3 Only	Active	Yes	Raul Cordes
11	NASA LaRC	37.1050° N	78.2790° W	0 508 km	NASA LaRC	V3 Only	Active	Yes	Greg Schuster
12	Phoson, Shingon, AmalPark	18.8100° N	98.8980° E	0 300 km	Chung, Mai, Mat, Sta	V3 Only	Active	Yes	Ronald Muckenroy
13	Santa Cruz, Tenerife	28.4700° N	16.2470° W	0 060 km	Santa Cruz, Tenerife	V2 & V3	Active	Yes	Margarita Yela Gonzalez
14	SEIZ_BOKER	30.8560° N	24.7820° E	0 480 km	SEIZ_BOKER	V2 & V3	Active	Yes	Armen Karadz
15	Sisakom, Utah	13.8190° N	100.0410° E	0 070 km	Sisakom, Utah	V3 Only	Active	Yes	Judit Weller
16	Singapore	1.2980° N	103.7800° E	0 030 km	Singapore	V2 & V3	Active	Yes	Boo-Chul Lee
17	Sorghata Regional Observatory	7.1380° N	100.8120° E	0 108 km	Sorghata, Mat. Sta	V3 Only	Active	Yes	Ronald Muckenroy
18	South Pole	89.9500° S	24.8000° W	2 835 km	South Pole	V2 & V3	Active	Yes	Judit Weller
19	UMBC	39.2050° N	76.7100° W	0 040 km	UMBC	V2 & V3	Active	Yes	Ruben Delgado
20	Xitun	24.1680° N	120.8170° E	0 084 km	Xitun	V3 Only	Active	Yes	Carlo Weng
Inactive Sites									
1	Abricos Hill	10.7907° S	62.2667° W	0 280 km	Abricos Hill	V2 & V3	Inactive	Yes	Judit Weller
2	ACE Asia Cruise	-	-	0 000 km	ACE Asia Cruise	V2 & V3	Inactive	Yes	Judit Weller
3	Armeer	38.8300° N	126.2187° E	0 048 km	Armeer	V2 & V3	Inactive	Yes	Myoung-Goo Kim

Easy, public online data browsing and data download

With data center interoperability (links to other data centers)

Data product descriptions, file formats, variable and flag documentation (peer-review papers & online ATBD)

Processing & Calibration Traceability

Publication lists with citations for each topic area

Management:

- Secure data communications
- Well maintained, detailed metadata database
 - instrument tracking
 - calibration histories
 - site information
 - data availability
- Real time instrument health & data quality tracking & alerts
- Multi-threaded processing system with logging and control app
 - Web based ideal



Overview of MPLNET: Version 3 Product Suite

Detailed information on V3 Products: mplnet.gsfc.nasa.gov/product-info/

V3 Product		QA Screening: Confidence Levels	
NRB	QA Confidence Level	Value	Descriptions
CLD	n/a	0	Only set if variable has no QA inspection applied.
AER	High	1	Long history with variable and QA procedures results in high confidence
PBL	Moderate	2	Lower confidence in an ancillary data input results in lower overall QA confidence
Product F	Low	4	Reserved for variables that are new and require more study to elevate confidence
Formats	Fail	8	Data fail QA screen, variable data replaced with NaN

* Each data variable in all products has a corresponding QA confidence variable

Product Levels	Availability	Calibration	QA Screen	Ancillary Input
L1_NRB	Automated Browse: Near Real Time Download: Next Day *	intial, ongoing field calibrations	none	GEOS5 Forecast NRT, reprocessed next day with GEOS5 Assimilated, AERONET L15 AOD
L1_CLD				
L1_PBL				
L1_AER				
L15_NRB	Automated Browse: Near Real Time Download: Next Day *	intial, ongoing field calibrations	L15	GEOS5 Forecast NRT, reprocessed next day with GEOS5 Assimilated, AERONET L15 AOD
L15_CLD				
L15_PBL				
L15_AER				
L2_NRB	upon request †	intial, ongoing field calibrations, post calibration, additional‡	L2	GEOS5 Assimilated, AERONET L2 AOD
L2_CLD				
L2_PBL				
L2_AER				

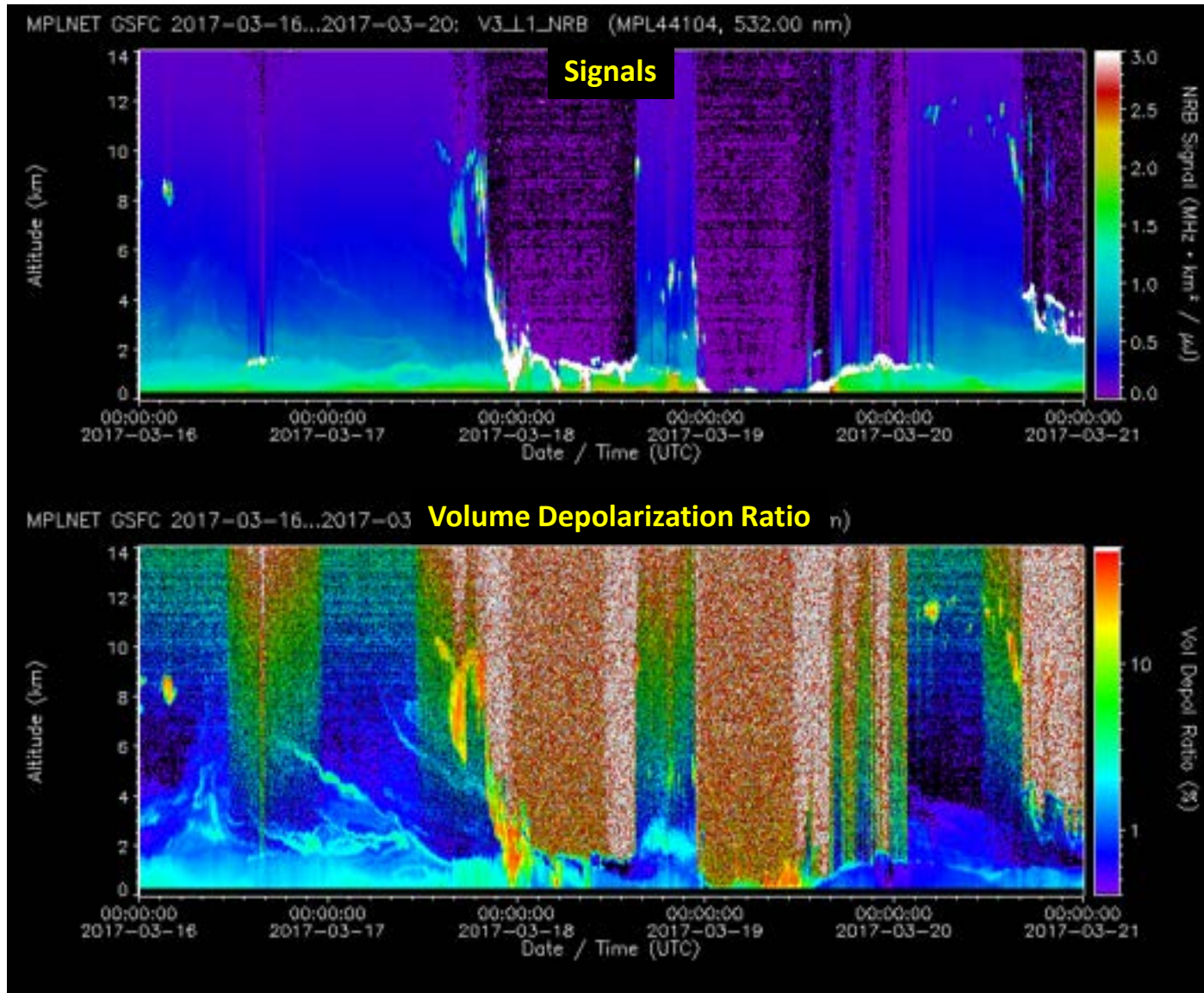
* Near real time data can be provided to site partners and forecasting/modeling centers

† L2_AER products subject to availability of L2 AERONET data

‡ Additional L2 calibrations may include corrections for instrument temperature and manual inspection of data

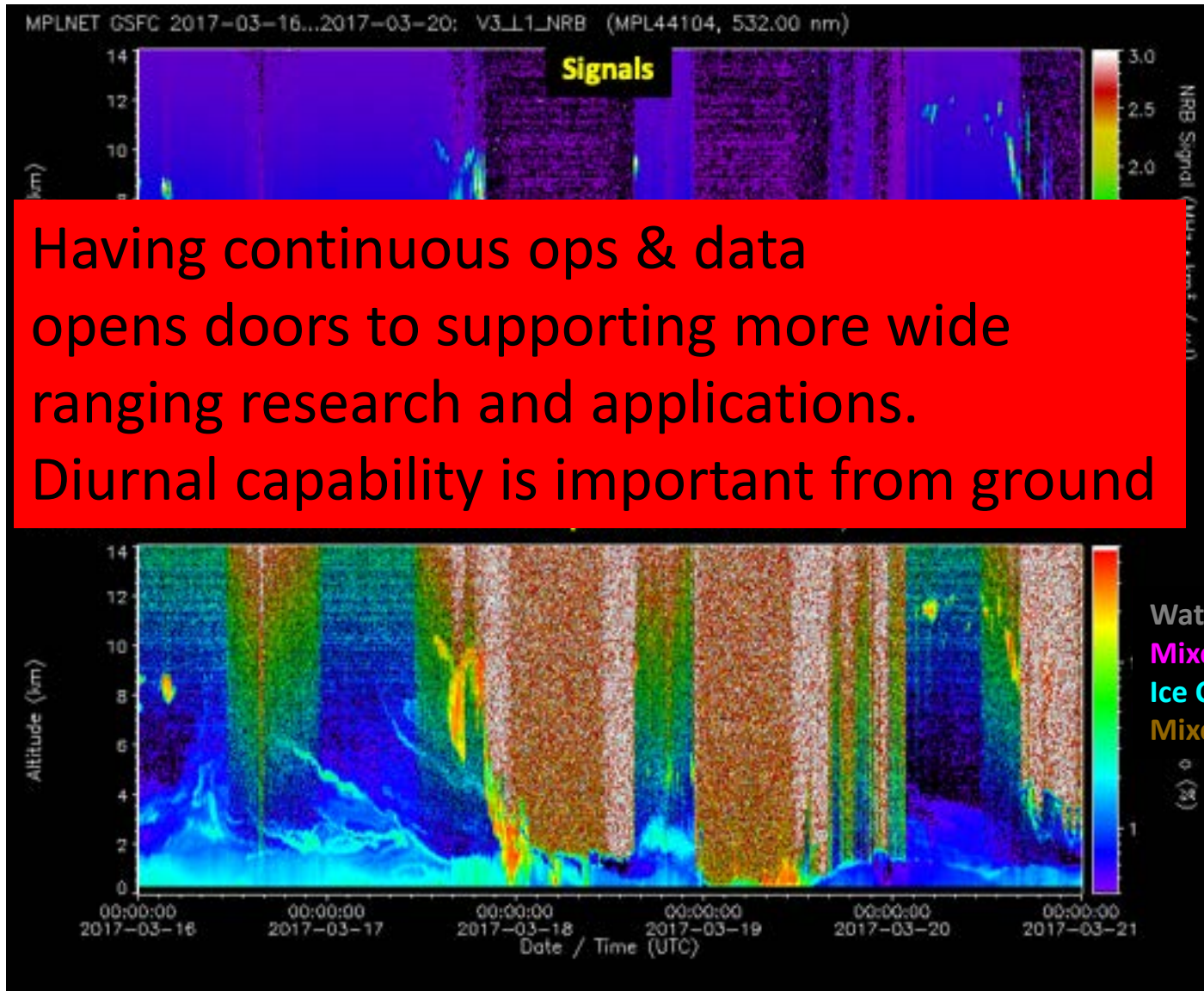


Overview of MPLNET: Level 1 (and L1.5) NRB Product. (Signals and Diagnostics)





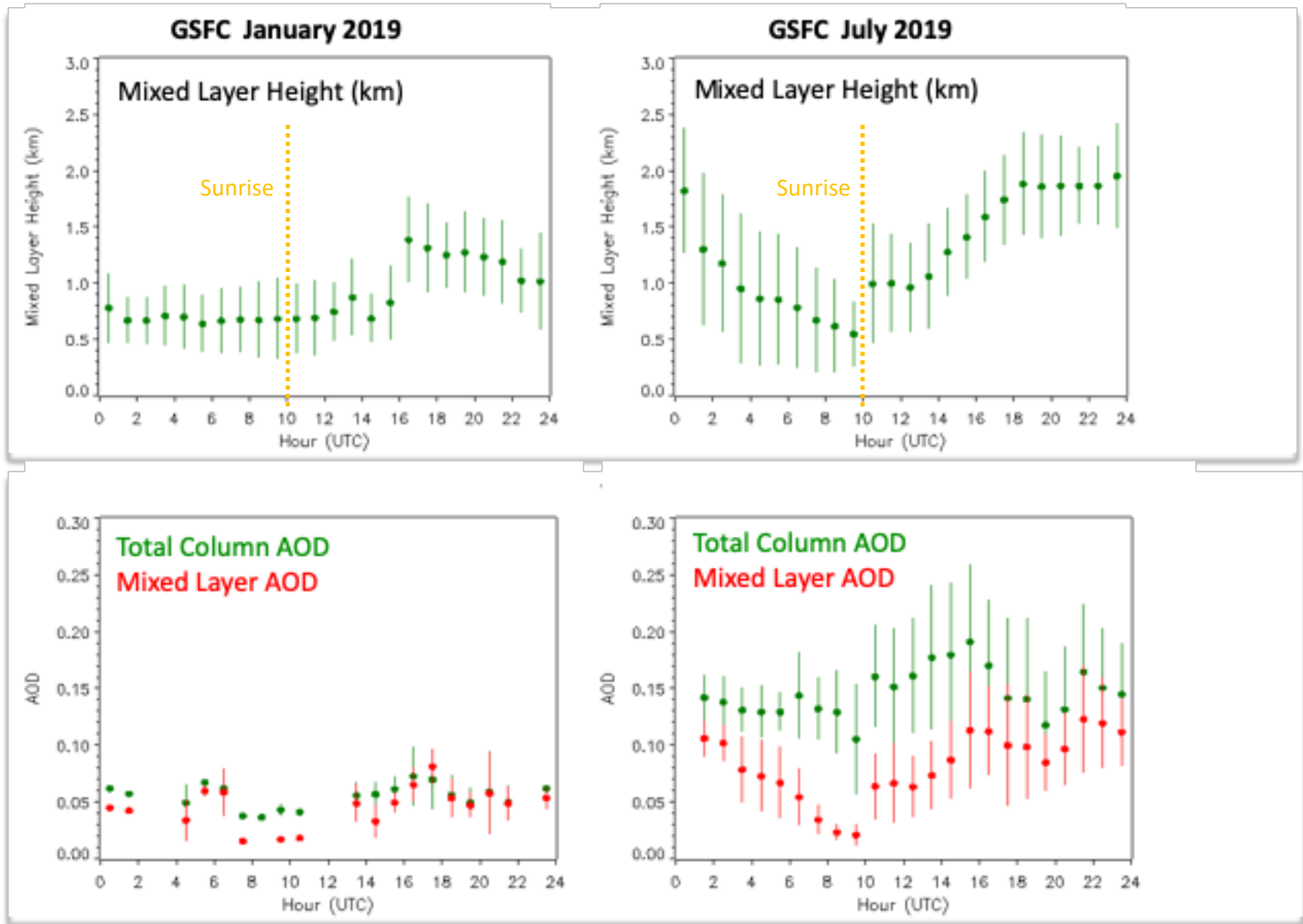
Cloud, Aerosol, & PBL Product Overview






Overview of MPLNET: Long term, continuous sites lead to Diurnal Climatologies

Ground data play a key role as most satellite obs do not provide diurnal information. None do with profiling.





New MPLNET Site Page: Site contacts & metadata



National Aeronautics and Space Administration
Orsted Space Flight Center

MPLNET Sites

Micro-Pulse Lidar Network

Show Active Periods Show Public Sites Go

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CAMPAIGNS: CAMM

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ICAP: BYZANTIUM

ICAP: EASTASIA

ICAP: SUBTROPATL

ICAP: PACIFIC

ICAP: CONUS

ICAP: SATLANTIC

ICAP: SOALUS

ICAP: NPOLAR

SDS: NAMEE

SDS: EASTASIA

SDS: PANAM

DUSTBELT

NAAPS

----- Sites -----

ACE_Ark_Cruise

Abracos_Hill

Arnyon

Appalachian_State

Appledons_Island

Bac_Lieu

Bangiao

Barcelona

Bermude

Bidur

Bozeman

CART_SITE_JOP

COVE

CRYSTAL_FACE

Cape_Ser_Juin

Cape_Verde

Doi_Ang_Khang

Doi_Inthanon

Doulu

Dunhuang

EPA-NCU

EL_Arenosillo

Fairbanks

Fang

OSFC

Gosan_SBU

Gulfrest

Heng-Chun

Hertles_Bay

ICEALOT

Jambi

KAUST_Campus

Karpur

Kathelung

Key_Biscayne

IS: 7SEAS Sites

Site Information	Active Periods
th.j.watson@nasa.gov 730 Goddard Space Flight Center g.ncu.edu.tw 442	
w.taty-1@nasa.gov 500	2017-07-16 to 2017-10-08 2013-02-01 to 2013-04-15 2014-02-28 to 2014-04-19 2015-03-15 to 2015-04-17
trromodo@gmail.com 820 Astronomical Research Institute of Thailand g.ncu.edu.tw 545	2018-10-25 to 2019-01-30 2015-09-12 to 2015-10-28 2017-04-18 to 2017-10-03
g.ncu.edu.tw sonyc@g.ncu.edu.tw j.stefani.huang@g.ncu.edu.tw nync@g.ncu.edu.tw arfo@g.ncu.edu.tw 181	2005-01-04 to 2010-05-13 2011-12-19 to current
trromodo@gmail.com 320	2019-01-31 to 2019-09-17



Overview of MPLNET: New Online Data Portal

The screenshot shows a web browser displaying the MPLNET Data Portal. The URL is `mpinet.gsfc.nasa.gov/out/data/V3/GSFC/Y2019/M09/D15/`. The page features a NASA logo and the text "National Aeronautics and Space Administration Goddard Space Flight Center" on the left. The main header includes the MPLNET logo and "The NASA Micro-Pulse Lidar Network" with the Goddard Space Flight Center logo on the right. A navigation menu on the left lists sections like Home, Data, Project, Publications, News, and Links. The main content area displays the title "MPLNET Data Portal: V3/GSFC/Y2019/M09/D15/" and a note: "use of downloaded files must follow our [data policy](#)". A red warning message states: "We are preparing the data sets, if please check back later if data are missing or contact MPLNET staff." Below this is a table of data files with columns for Name, Last Modified, and Size.



Name	Last Modified	Size
Parent Directory	-	-
MPLNET_V3_L1_AER_20190915_MPL44258_GSFC.nc4	2019-09-22 23:23	32M
MPLNET_V3_L1_CLD_20190915_MPL44258_GSFC.nc4	2019-09-22 23:12	21M
MPLNET_V3_L1_NPB_20190915_MPL44258_GSFC.nc4	2019-09-22 23:11	24M
MPLNET_V3_L1_PBL_20190915_MPL44258_GSFC.nc4	2019-09-22 23:27	2.5M
MPLNET_V3_L15_AER_20190915_MPL44258_GSFC.nc4	2019-09-22 23:41	32M
MPLNET_V3_L15_CLD_20190915_MPL44258_GSFC.nc4	2019-09-22 23:30	21M
MPLNET_V3_L15_NPB_20190915_MPL44258_GSFC.nc4	2019-09-22 23:29	24M
MPLNET_V3_L15_PBL_20190915_MPL44258_GSFC.nc4	2019-09-22 23:43	2.5M

Easy to automate data grabs with `wget` or `curl`
Setup for Data Center Interoperability (DCIO) applications

Sciences and Exploration Directorate
Earth Sciences Division
Laboratory for Atmospheres
Mesoscale Atmospheric Processes

NASA Official: Elsworth-Judd Nelson
Webmaster: Elsworth-Judd Nelson
Privacy Policy and Important Notice

Contact NASA
Visit [NASA.gov](#)
Contact MPLNET
GSFC Homepage

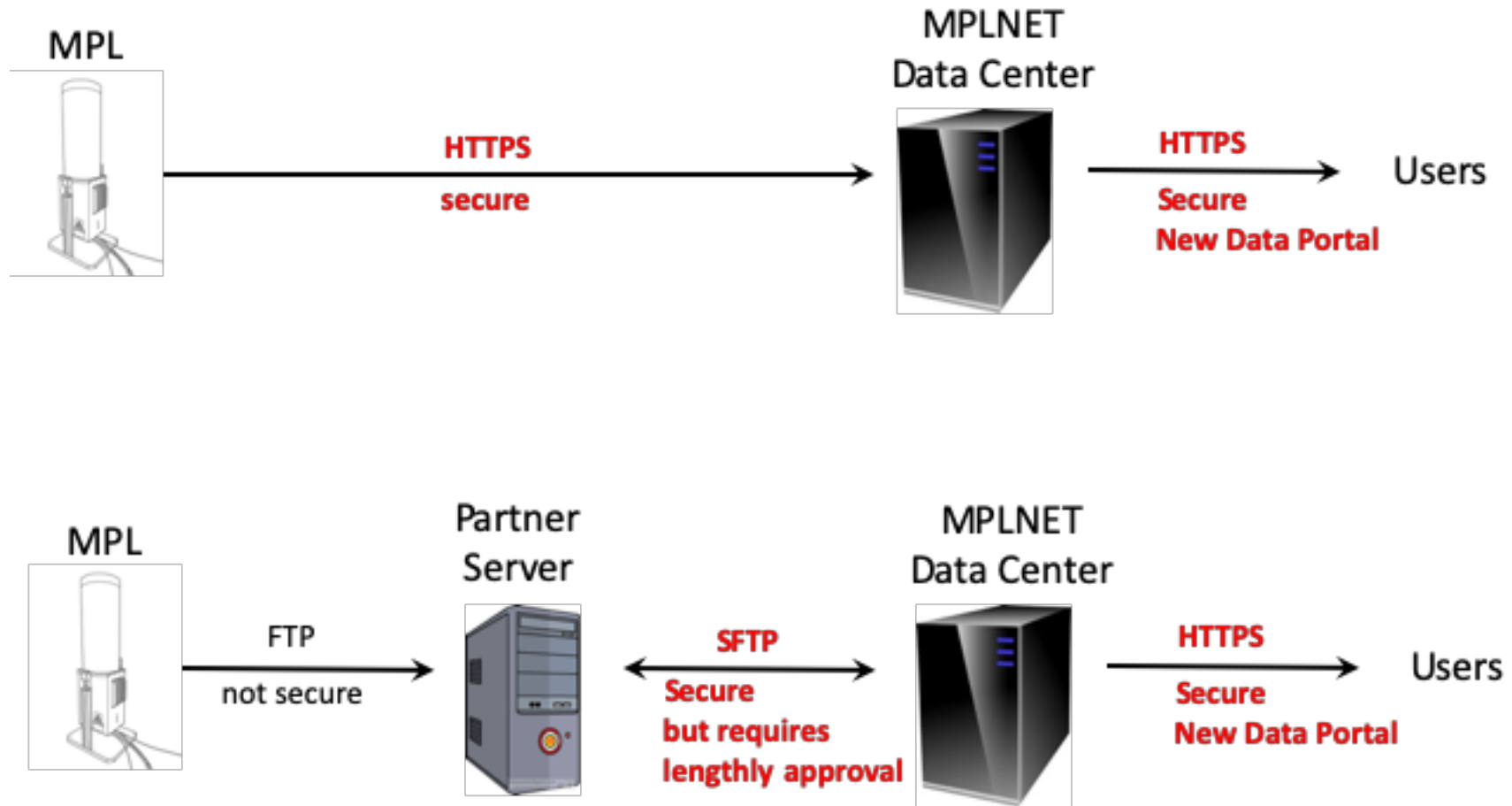




MPLNET: Data Communications


Automated Push scripts
on instruments

Automated Processing Hourly






MPLNET Network Management: Site Status & Automated Alert System



MPLNET

The NASA Micro-Pulse Lidar Network



Active Site Status: 2019-09-30 13:02:16

Problem ■ Alert ■ Good ■
 missing overlap and polarization calcs temporarily ignored

#	Site	Instrument	L1 Data	DC Cal Data	AP Cal Data	Energy	Box Temp
8	GSEC	MPL44258		DC Data Overdue	AP Data Overdue		
9	Karsur	MPL44240	2019-09-20 13:00:00 10.0 days ago			energy deviation from set point > 20% Energy: 6.5 uJ set point: 5.0 uJ	no set point
10	KAUST_Campus	MPL44233	2019-07-30 15:00:00 61.9 days ago	DC Data Overdue	AP Data Overdue	Low Energy (< 2 uJ)	no set point
11	Klog_George_Island	MPL55036				no set point	no set point
12	Kuching	MPL44251					no set point
13	NASA_LaRC	MPL44104					
14	Process_Skindhorn_AstroPark	MPL55038	2019-09-29 06:00:00 1.3 days ago				no set point
15	Santa_Cruz_Tenerife	MPL44255					
16	SEDE_BOKER	MPL44241					no set point
17	Sigma_Space_Corp	MPL44111		DC Data Overdue	AP Data Overdue		
18	Slovakia_Univ	MPL44234		DC Data Overdue	AP Data Overdue		no set point
19	Singapore	MPL44235	2019-07-16 13:00:00 76.0 days ago	DC Data Overdue	AP Data Overdue	Low Energy (< 2 uJ)	temp NaN or INF

Note 1: click on the row number to see plots of the L1 NRFB, Volume Depolarization Ratio, and Instrument Diagnostics
 Note 2: only the last minute of received data is used to determine instrument energy and box temp status, see diagnostic plots for past week statistics
 Note 3: the table can be limited to specific site(s), example URL: <https://mplnet.gsfc.nasa.gov/operations/status?sites=sitenam1,sitenam2,sitenamN>

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MPLNET Network Management: Processing Monitor

MPLNET Processing Monitor:

Log: [mpl_auto_3](#) Auto Date: 2019-09-30 Auto Hour: Current View Log View active processes [Go to MPLNET Operations Page](#)

mpl_auto_1	mpl_auto_2	mpl_auto_3	mpl_auto_4	mpl_auto_5	mpl_auto_6	mpl_auto_7	mpl_auto_8	mpl_auto_9
10 mins after hour	10 mins after hour	10 mins after hour	10 mins after hour	10 mins after hour	10 mins after hour	10 mins after hour	10 mins after hour	10 mins after hour
Process Time: 00:36:27	Process Time: 00:19:50	Process Time: 00:34:27	Process Time: 00:02:48	Process Time: 00:01:45	Process Time: 00:03:24	Process Time: 00:32:37	Process Time: 00:51:04	Process Time: 00:03:58
Appalachian_State Barcelona Bidur	Cape_San_Juan El_Arenosillo EPA-NCU	Fairbanks GSFC KAUST_Campus	Kanpur King_George_Island Kuching	MPL44244-NCU MPL44250-NCU MPL44250-WFR0708-NCU	MPL44254-WFR0704-UMBC MPL44255-WFR0705-TEN MPL44258-WFR0706-LAB	NASA_LaRC Princess_Sirindhorn_AstroPark SEDE_BOKER	Santa_Cruz_Tenerife Sigma_Space_Coep Silpakorn_Univ	Singapore Songkhla_Regional_Observatory South_Pole UMBC Xi'an

Saved V3_staff download file: MPLNET_V3_L1_CLD_20190927_MPL44258_GSFC.nc4
 Saved V3_partners download file: MPLNET_V3_L1_CLD_20190927_MPL44258_GSFC.nc4
 % Time elapsed: 52.171768 seconds.
 Processing L1_CLD for GSFC on 2019-09-28.
 Saved archive file: MPLNET_V3_L1_CLD_20190928_MPL44258_GSFC.nc4
 /MPLNET/download/V3/GSFC/
 /MPLNET/download/V3_staff/GSFC/
 /MPLNET/download/V3_partners/GSFC/
 /MPLNET/download/nrt/GSFC/
 rmdir: failed to remove /MPLNET/download/nrt/GSFC/download/nrt/GSFC: No such file or directory
 rmdir: failed to remove /MPLNET/download/nrt/GSFC/download/nrt: No such file or directory
 rmdir: failed to remove /MPLNET/download/nrt/GSFC/download: No such file or directory
 Saved V3 download file: MPLNET_V3_L1_CLD_20190928_MPL44258_GSFC.nc4
 Saved V3_staff download file: MPLNET_V3_L1_CLD_20190928_MPL44258_GSFC.nc4
 Saved V3_partners download file: MPLNET_V3_L1_CLD_20190928_MPL44258_GSFC.nc4
 Saved NRT download file: MPLNET_V3_L1_CLD_20190928_MPL44258_GSFC.nc4
 % Time elapsed: 40.333944 seconds.
 Processing L1_CLD for GSFC on 2019-09-29.
 Saved archive file: MPLNET_V3_L1_CLD_20190929_MPL44258_GSFC.nc4
 /MPLNET/download/V3/GSFC/
 /MPLNET/download/V3_staff/GSFC/
 /MPLNET/download/V3_partners/GSFC/
 /MPLNET/download/nrt/GSFC/
 rmdir: failed to remove /MPLNET/download/nrt/GSFC/download/nrt/GSFC: No such file or directory
 rmdir: failed to remove /MPLNET/download/nrt/GSFC/download/nrt: No such file or directory
 rmdir: failed to remove /MPLNET/download/nrt/GSFC/download: No such file or directory
 Saved V3 download file: MPLNET_V3_L1_CLD_20190929_MPL44258_GSFC.nc4
 Saved V3_staff download file: MPLNET_V3_L1_CLD_20190929_MPL44258_GSFC.nc4
 Saved V3_partners download file: MPLNET_V3_L1_CLD_20190929_MPL44258_GSFC.nc4
 Saved NRT download file: MPLNET_V3_L1_CLD_20190929_MPL44258_GSFC.nc4
 % Time elapsed: 44.623764 seconds.
 Processing L1_CLD for GSFC on 2019-09-30.



Fact of life for long running projects:
when a new Version is released its already out of date

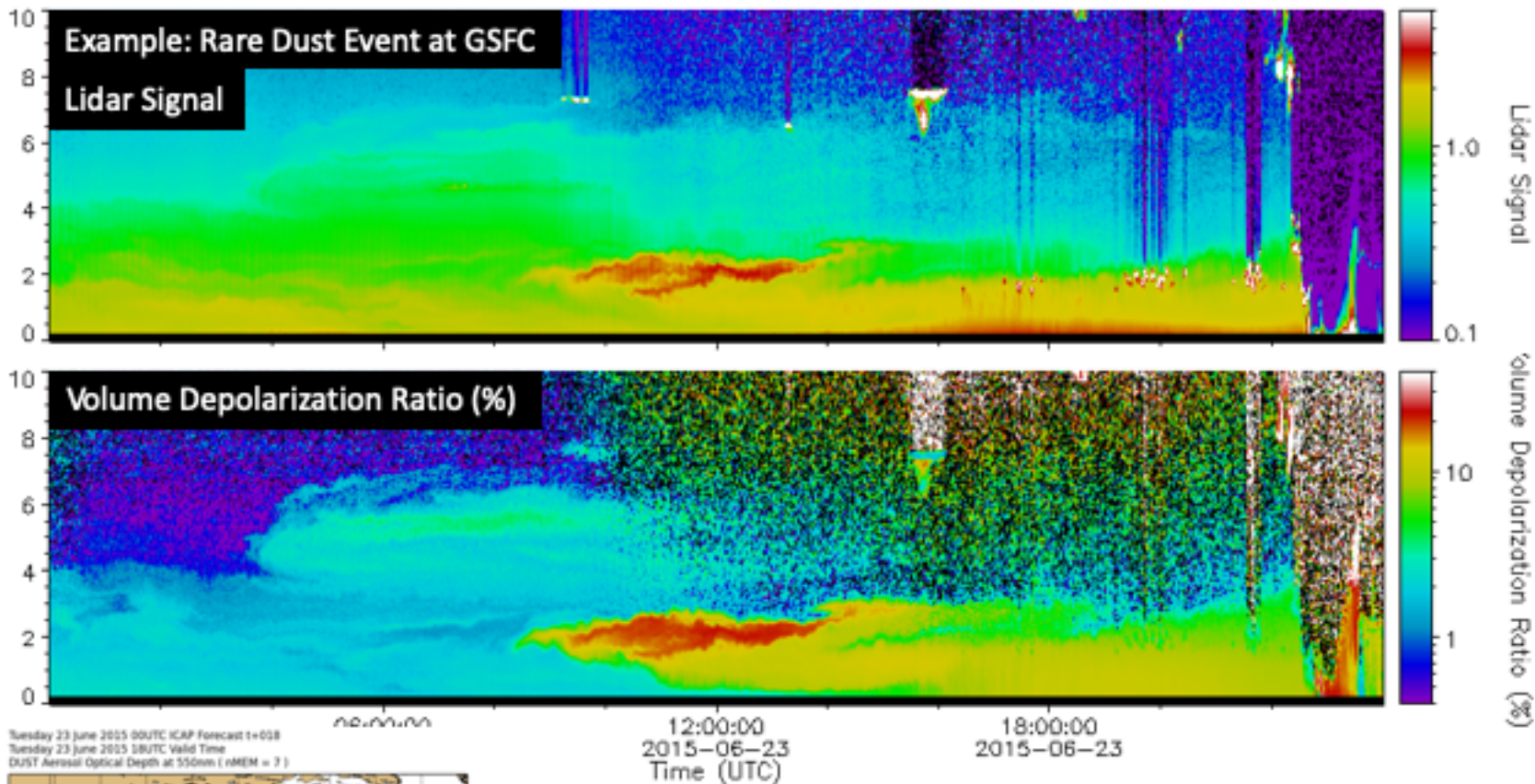
MPLNET is developing new V4 products, testing in V3

- Precipitation Product (see Lolli et al later this session)
- A NRT attenuated backscatter product
 - New aerosol & cloud detection algorithms
- Dust Alert System

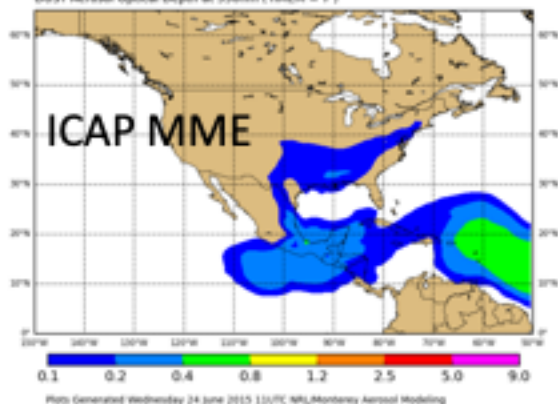
Balancing R&D enhancements and network operations
has been challenging with fixed budgets



MPLNET Support for operational aerosol forecasting: dust detection



Tuesday 23 June 2015 00UTC ICAP Forecast 1+028
 Tuesday 23 June 2015 18UTC Valid Time
 DUST Aerosol Optical Depth at 550nm (rMEM = 7)



International Cooperative for Aerosol Prediction (ICAP)

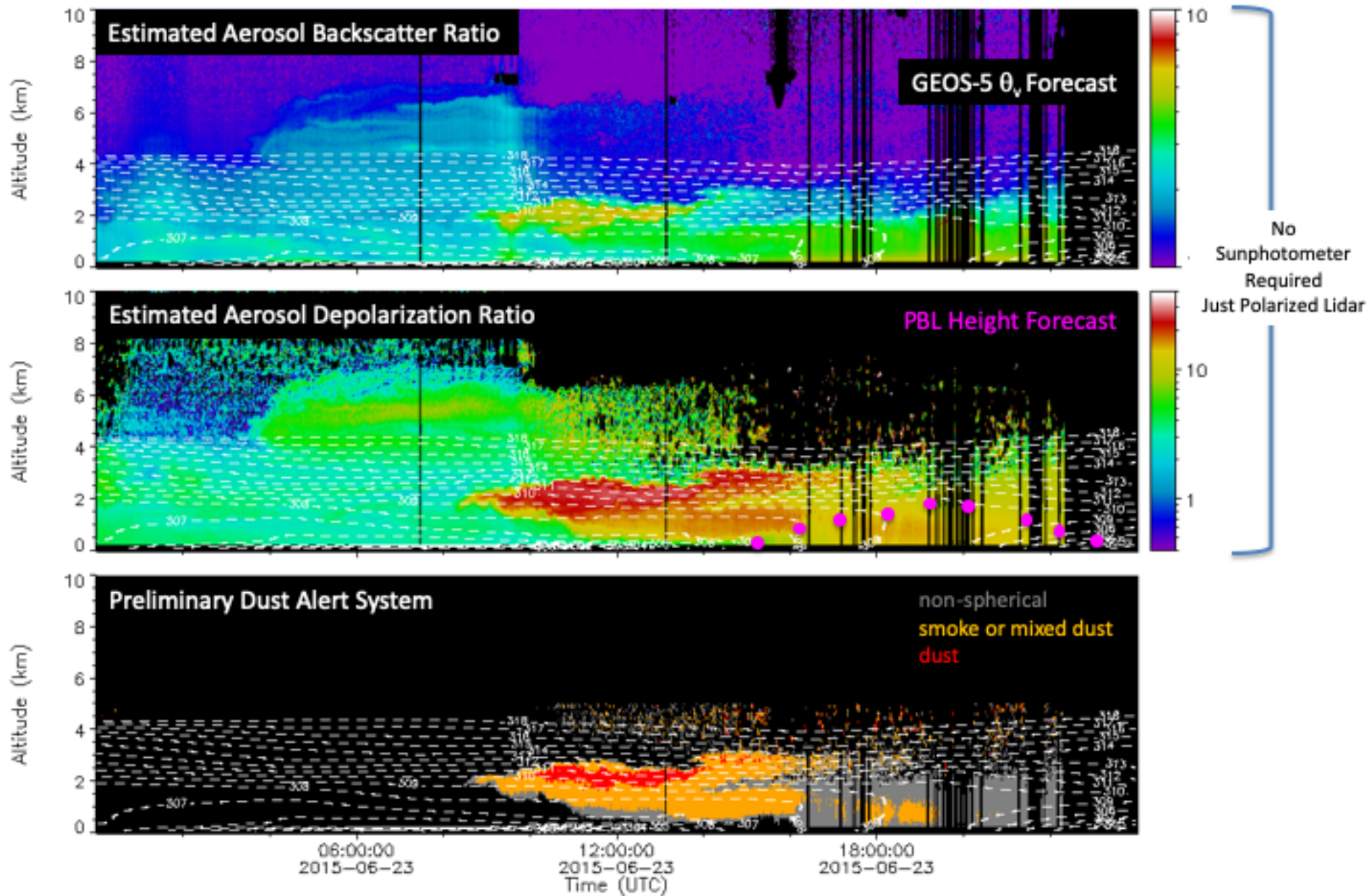
- Members from operational forecast centers worldwide & data providers
- Developed Research Multi-model Ensemble (MME) forecasting speciated AOD

Dust detection, alert system

- Local air quality assessment
- Aerosol forecasting (ICAP members)
 - Includes WMO Sand & Dust Storm Warning & Advisory System (SDS-WAS)
 - Model verification (NRT and historical)
 - Eventual assimilation
- Research support (catalog dust occurrences)



MPLNET Support for operational aerosol forecasting: dust detection





Conclusion

GALION networks and related ceilometer and lidar networks have grown drastically this century

- Global coverage has increased correspondingly, more data available

However, ground lidar data is now dispersed over many different data centers

- also, products, file formats, NRT capability, etc all vary
- more complicated process for users to discover & access all this new data

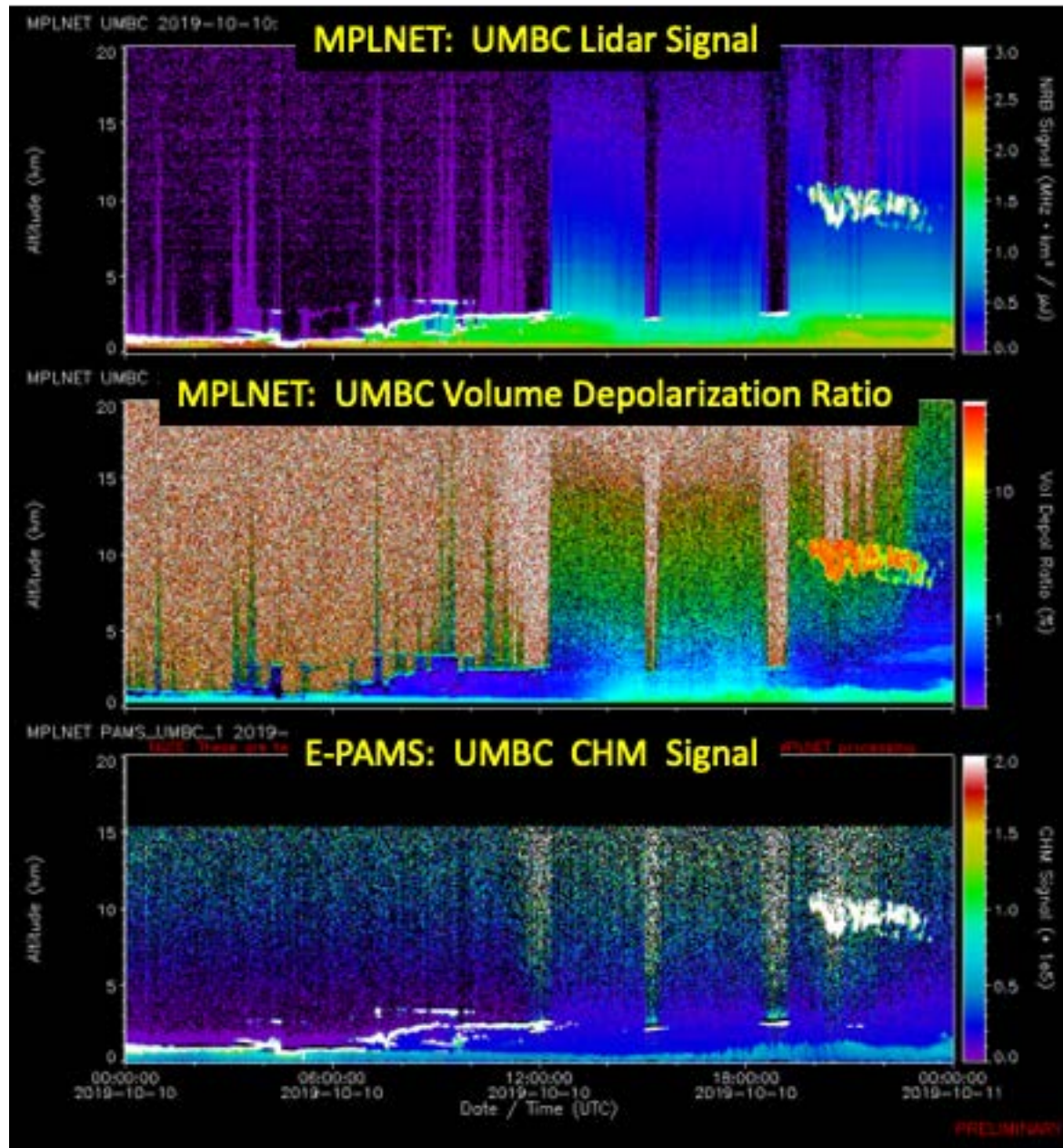
GALION Goal: create a world data center for lidar network data

- Distributed approach utilizing existing network level data centers
 - Provide common metadata archive for search & discovery
 - eventually common data products & file download
- MPLNET is planning to build a US GALION data center node
 - can support lidars outside MPLNET





MPLNET & UMBC: E-PAMS Collaboration





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NA Contribution to GALION could grow with addition of new networks

- I propose creation of a NA lidar network working group
 - Gather information on each network
 - develop plans to fill coverage gaps
 - teams for processing/calibration standards
 - Consider a common, distributed data center ala GALION
 - Provide career pathways for students
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