



RIVAL Field Campaign at the ENA, NSA, & SGP ARM Sites

Radiosonde **I**ntercomparison & **VAL**idation

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RIVAL Overview



What is RIVAL?

- RIVAL is an ARM field campaign in collaboration with JPSS & GRUAN
- Campaign idea was the result of discussions from ICM-8
- Approved July 2017 (many CO-Is here)

What is being done?

- Dual radiosonde soundings (RS92 & RS41 on same balloon) performed at ENA, NSA, & SGP weekly for 1-year (possibility of 2nd year extension)
- Launches occur at NOAA20 overpass times
- ARM providing 52-RS92 sondes per site +++
- JPSS (Tony Reale) providing RS41 sondes for each site

Goals:

- Assess RS92/RS41 differences ensuring continuity of ARM radiosonde dataset
- Use RIVAL to assess ancillary datastreams for use in Site Atmospheric State Best Estimate (SASBE) & delivery of satellite SDRs & EDRs to GRUAN

Southern Great Plains (SGP)

North Slope Alaska (NSA)

Eastern North Atlantic (ENA)



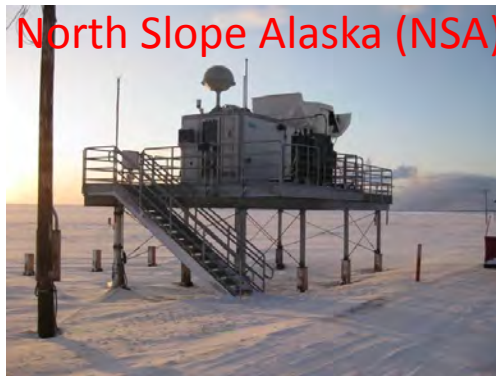
Historical dataset of JPSS (SNPP) sondes

ENA (since Feb 2015) , NSA & SGP (Jul2012)

Eastern North Atlantic (ENA)



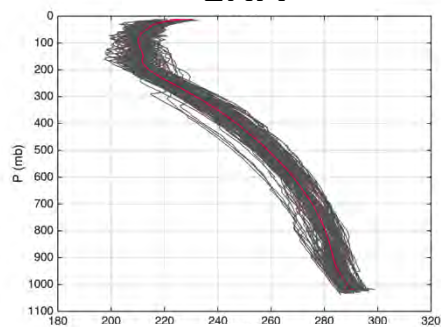
North Slope Alaska (NSA)



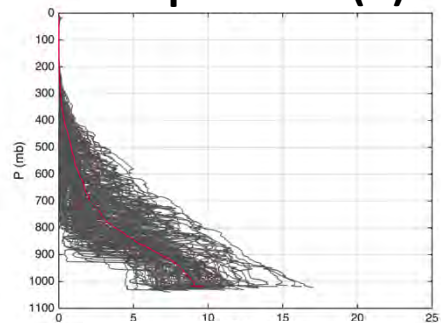
Southern Great Plains (SGP)



ENA

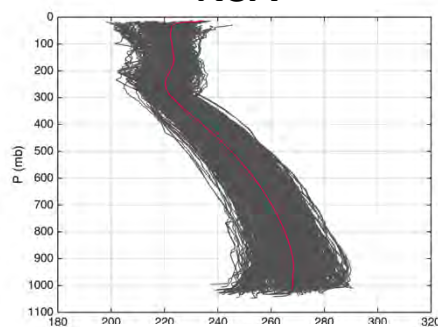


Temperature (K)

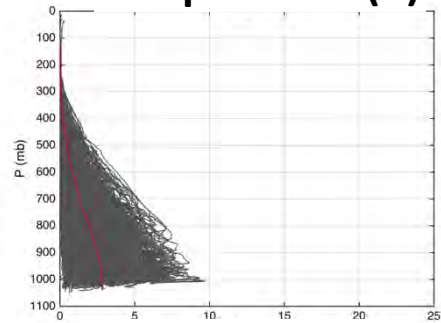


H2O (g/kg)

NSA

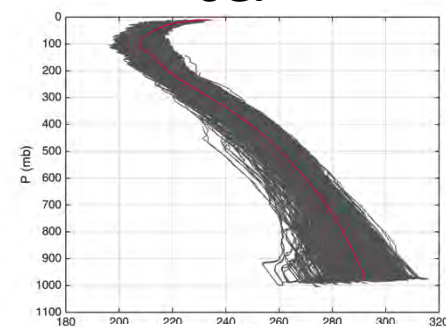


Temperature (K)

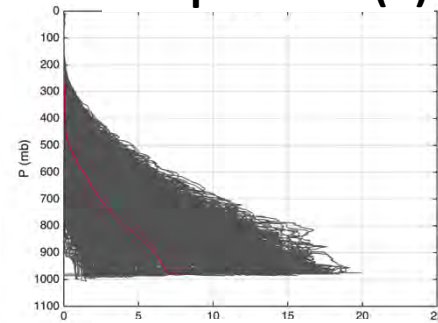


H2O (g/kg)

SGP



Temperature (K)



H2O (g/kg)

Preparations at ARM Sites

Thank you to Donna Holdridge, Scott Seabridge, and SGP crew!

- Upgraded multiple ground systems
- Designed and built mobile launch carts for each site
- Designed and built stands for sondes for each site
- Installed mass flow controller at SGP (will be installed at ENA & NSA)
- ENA now bringing helium on site for these launches

Thank you to Vaisala for loaner ground system!

Mobile launch cart at SGP



Sonde launch stands at SGP





Sonde System Specifications by Site

Sonde Systems:

ENA:

- C1 (SPS311): MW41, 92&41 compatible - Currently set up for RS92
- S01 (SPS311): MW41, 92&41 compatible - Currently set up for RS41

NSA:

- C1 (SPS311): MW41, Autosonde, 41 compatible only. Can launch a 41 after dual launch.
- S01 (SPS311): MW41, Manual, 92&41 compatible
- S02 (SPS311): MW41, Manual, 92&41 compatible

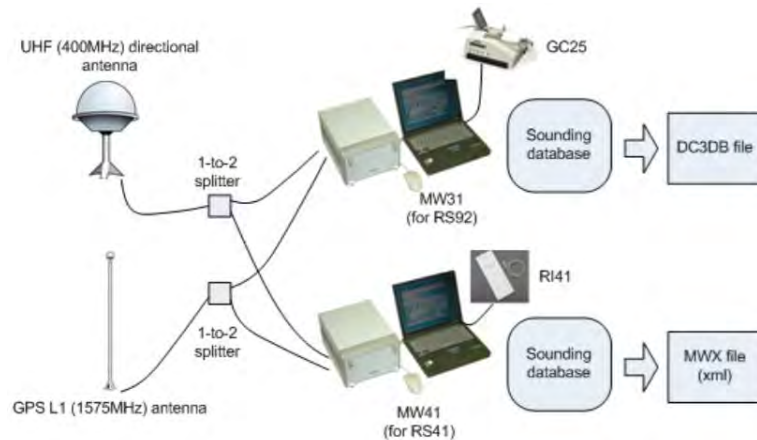
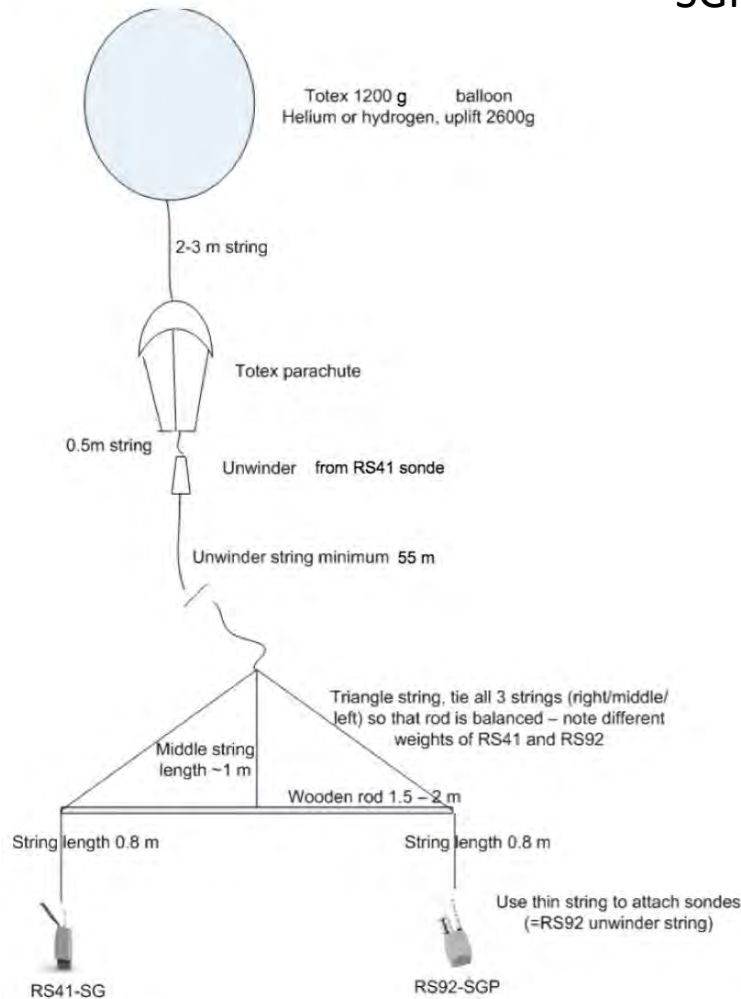
SGP:

- C1 (SPS311): MW41, Manual, 92&41 compatible
- S01 (SPS311): MW41, Manual, 92&41 compatible
- S02 (SPS311): MW41, Manual, 92&41 compatible
- S03 - Vaisala loaner (SPS311): MW41, Manual, 92&41 compatible

Sonde & Sounding System Setup

D. Holdridge (after Vaisala test plan)

SGP: 3800L helium, 6m/s ascent rate



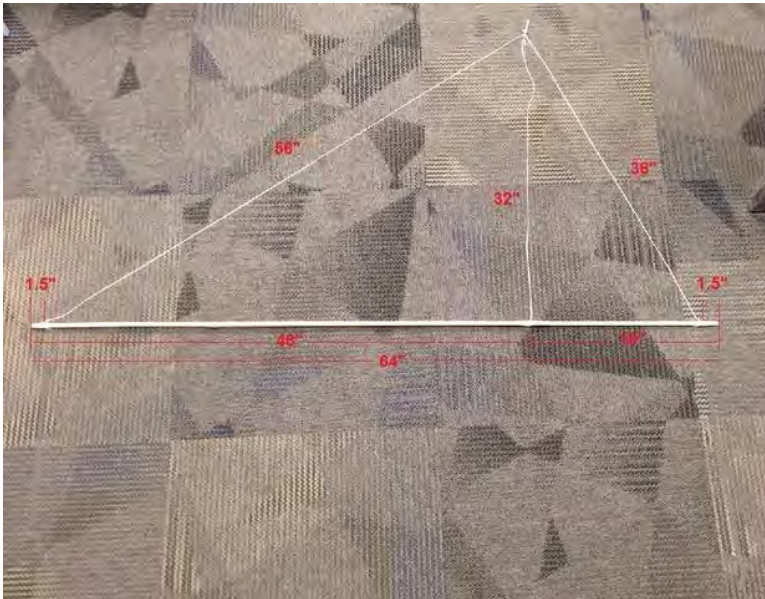
Setup follows recommendations by
GRUAN (images from GRUAN documentation)

Draft test plan documentation available:

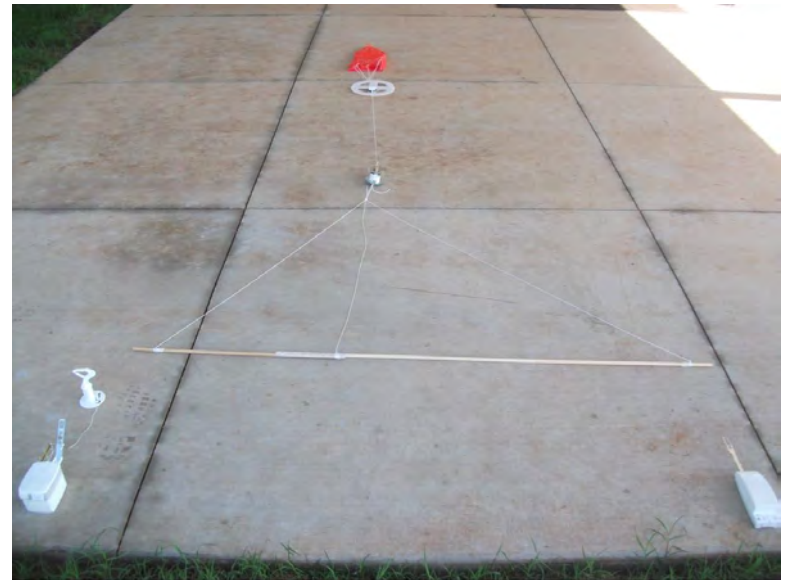
[ftp://ftp.ssec.wisc.edu/pub/rival/documentation/RS41-RS92 RIVAL Comparison Test Plan Draft.pdf](ftp://ftp.ssec.wisc.edu/pub/rival/documentation/RS41-RS92%20RIVAL%20Comparison%20Test%20Plan%20Draft.pdf)


Sample Rigging

RIVAL rig



Rig from 2014 inter-comparison





Launch Logistics

Launch Criteria: JPSS & RIVAL launches

Launches **MAY** take place if:

- There is not steady precipitation
- There is cloud cover of 50% or LESS
- There is high cirrus clouds – this is okay
- There are NO thunderstorms or threatening skies in the area

< 50% Cloudy

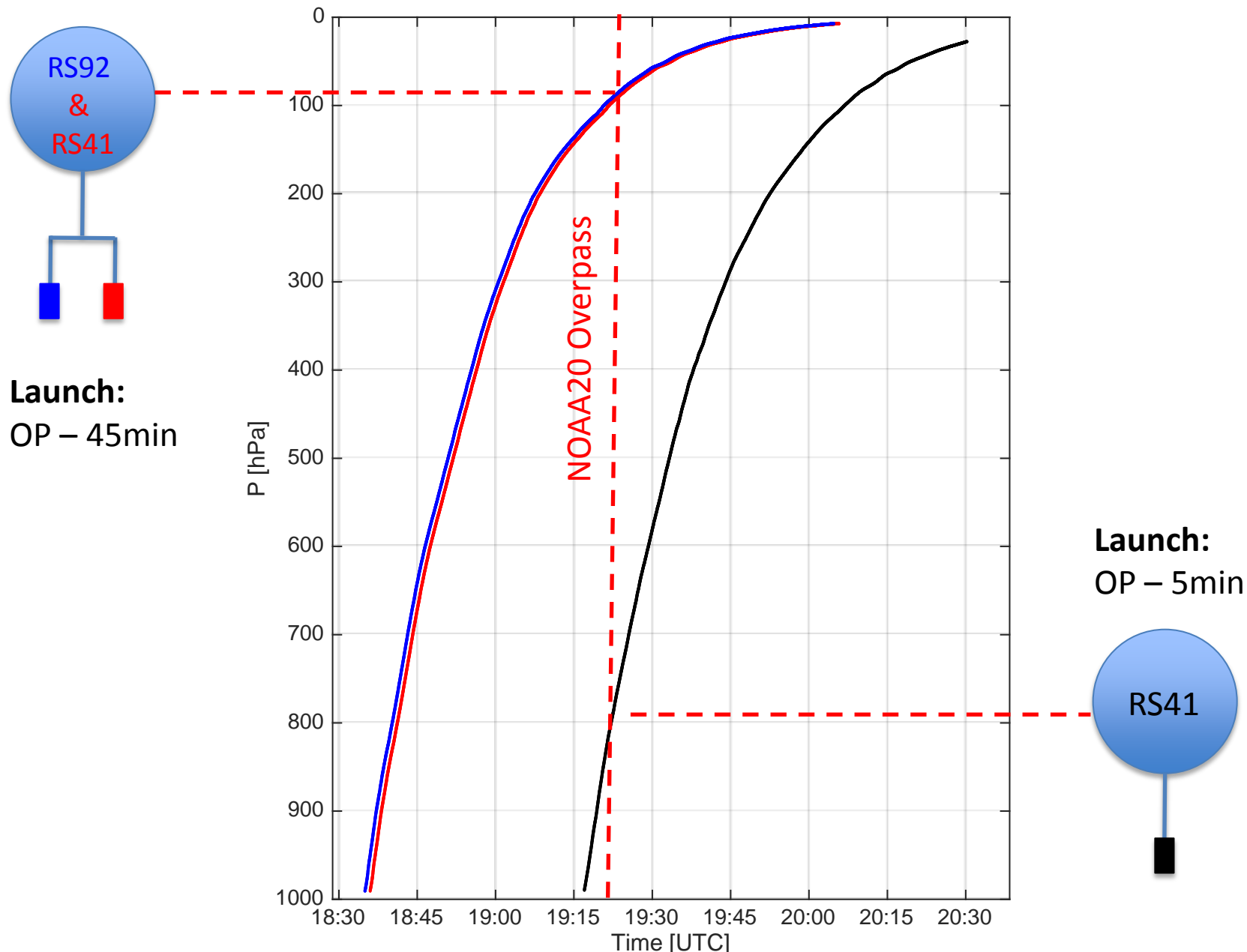
Launches will **NOT** take place if:

- There is steady precipitation
- There is cloud cover of greater than 50%
- There are thunderstorms or threatening skies in the area
- The weather is rapidly changing in advance of storms blowing through

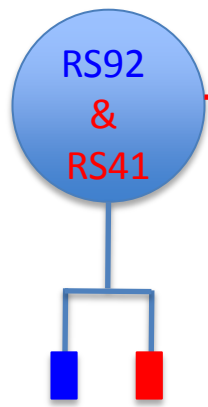
Note:

During a 2-balloon launch (either a dual-then-single or single-then-single), launch the 2nd balloon even if conditions have worsened and launch criteria are not met.

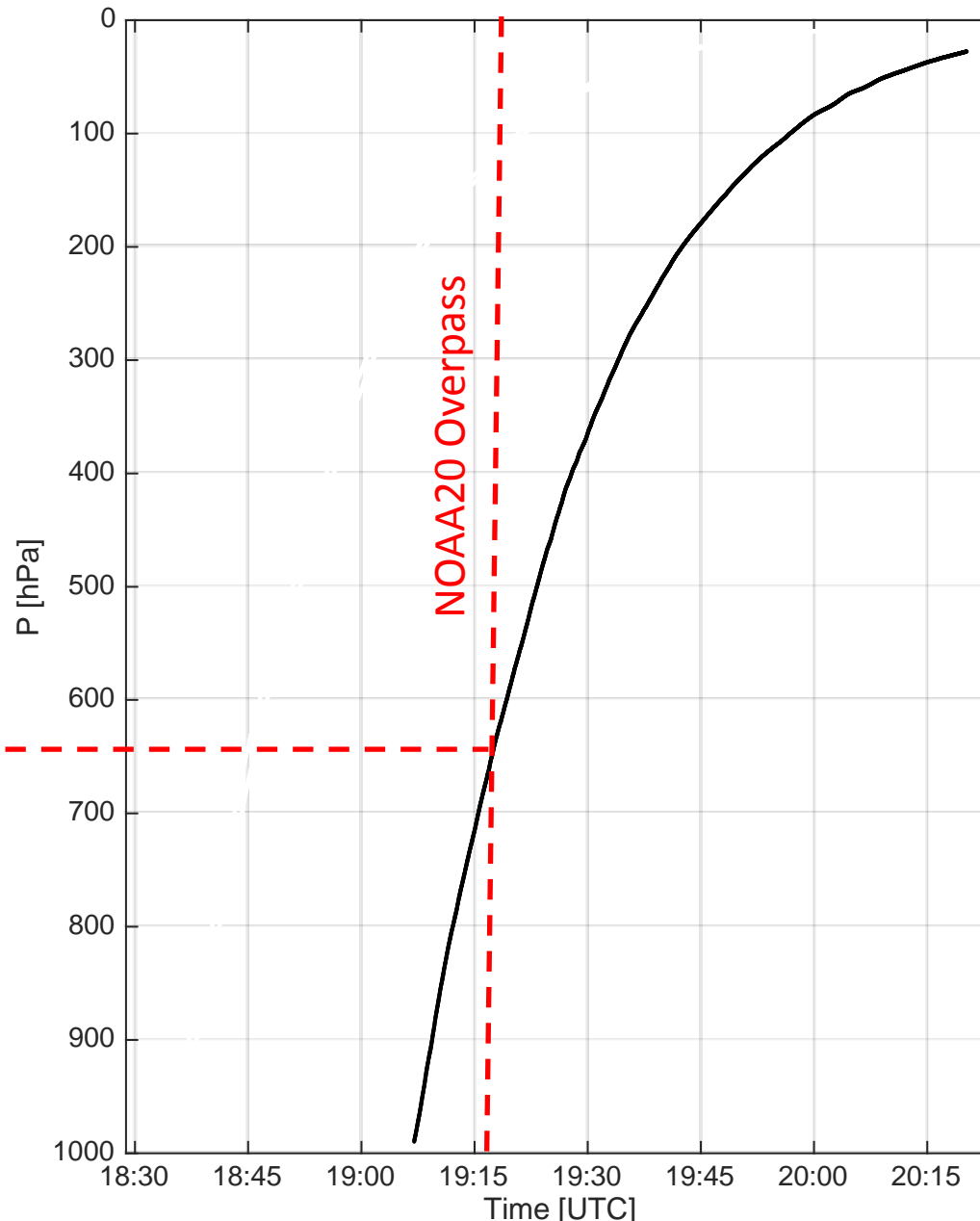
Launch Strategies at ARM Sites: NSA ('day') & SGP (day & night)



Launch Strategies at ARM Sites: ENA (day & night)



Launch:
OP – 15min



Datastreams Collected for RIVAL: SASBE & NOAA20 Comparisons

ARM:

- **Vaisala processed radiosondes (sondewnpnC1.b1) & raw sondes**
- Microwave radiometer (mwrlosC1.b1 or mwr3cC1.b1)
- Ceilometer (ceilC1.b1)
- AERI (aeriengineerC1.b1, aerich1C1.b1, sgpaerisummaryC1.b1)
- CFH (cfhC1.b1)

JPSS:

- **SNPP & NOAA20 CrIS & ATMS RDR, SDR, EDR**

Misc:

- **RO dry temperature products (if they occur)**

Needs:

- **GRUAN processed RS92 & RS41 sonde files**

Notes:

- ARM Data available from ARM archive
- Data also available to RIVAL team (via UW ftp site)
- Datastreams in **red** will be integrated into NPROVS

Ceilometer



MWR



ARM Site Readiness: **ENA**

ENA: Awaiting permission to launch 1200g balloons from aviation authorities

- 2-ground systems now on site, both upgraded
- Received launch cart, stands, sondes, rigging, etc.

To Do:

- Receive/install mass flow controller (~2 week transit time + installation time)
- Perform practice launch(es). Balloon fill will be 'eye-balled' until controller installed.
- S01 data not being ingested by data center yet. Donna is following up on this.

Launch Strategies: coordinated w/NOAA20 (0300/1400 UTC)

- dual launch (RS92&41 on same balloon) day or night

Eastern North Atlantic (ENA)



ARM Site Readiness: **NSA**

NSA: Ready to go next week (May 1st start w/predicted RO w/METOPA)

- 3 upgraded ground systems on site
- Received cart, stands, sondes, rigging, etc.

To Do:

- Install mass flow controller
- Practice launch may happen prior to May 1st

NSA RO – 20180501 21:08:36UTC

NOAA20 OP: 20:30 & 22:11UTC

SNPP OP: 21:21UTC

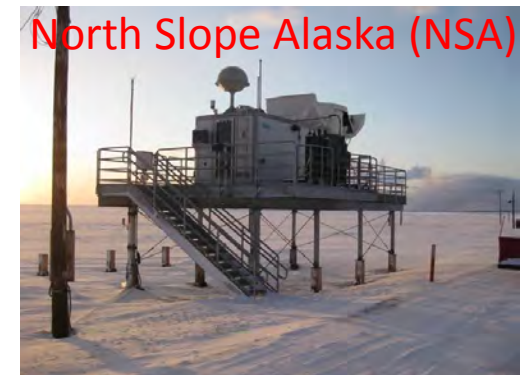
Sondes Launch: 21:26 & 22:06UTC

Launch Strategies: coordinated w/NOAA20 (2100 UTC)

- dual launch (RS92&41 on same balloon) day only
- dual-then-single day only

Thank you to Axel Von Engel for RO prediction files!

- RO predictions checked regularly for 3 ARM sites
- Launch schedules modified to target golden cases w/RO and NOAA20 overpasses within 2hours & 200km



Sonde Launches at NSA

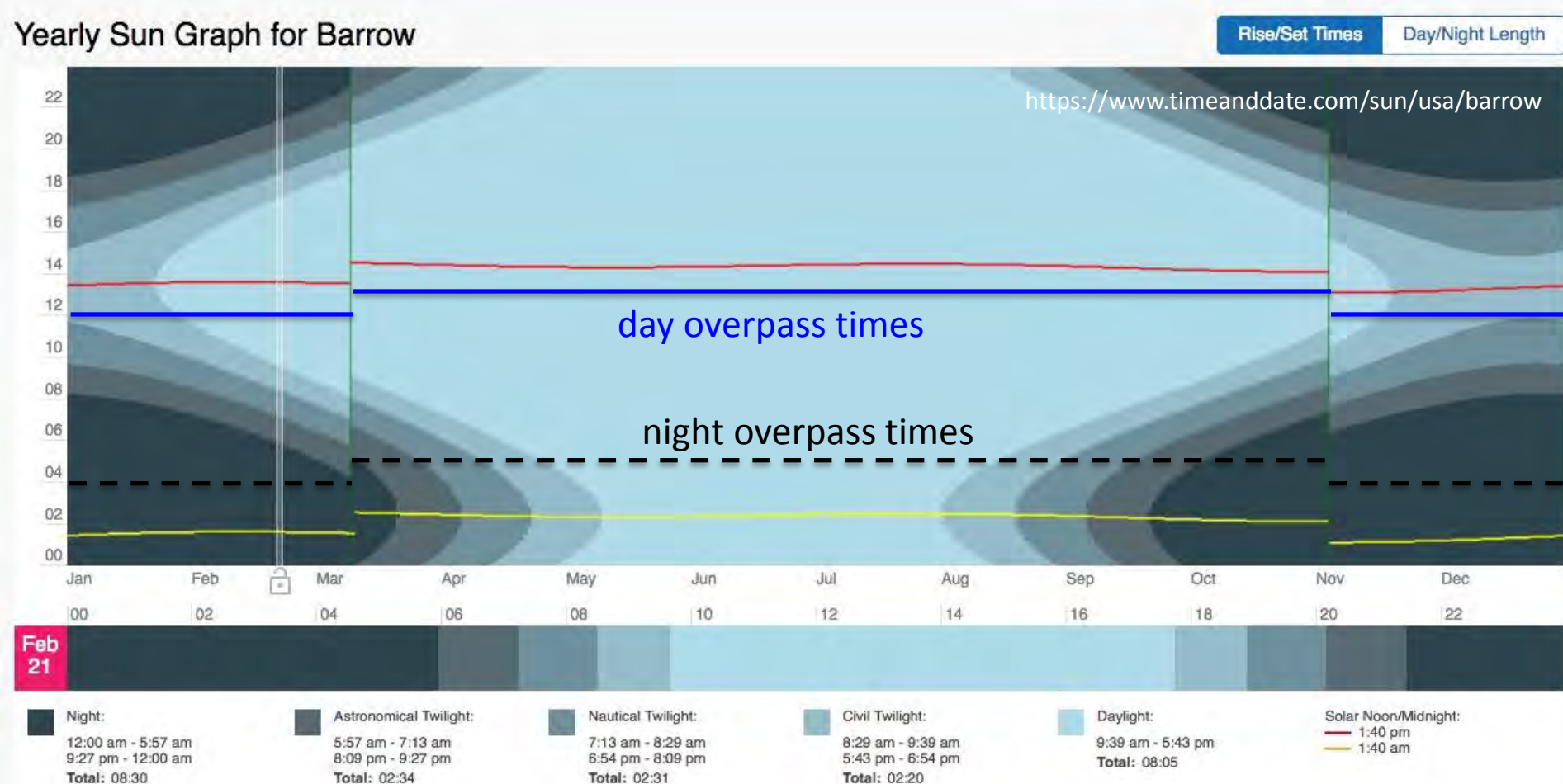
Cold, windy, dangerous = NO night launches



**Donna Holdridge
Sonde Instrument Mentor - ARM**

Launch Logistics: at NSA

- NSA: NO launches at NOAA20 'night' time overpasses (dashed black line)
- Daytime NOAA20 overpass & Night time NOAA20 overpass (ignore red and yellow)
- Between mid-Nov & mid-Jan we will get some civil/nautical twilight launches



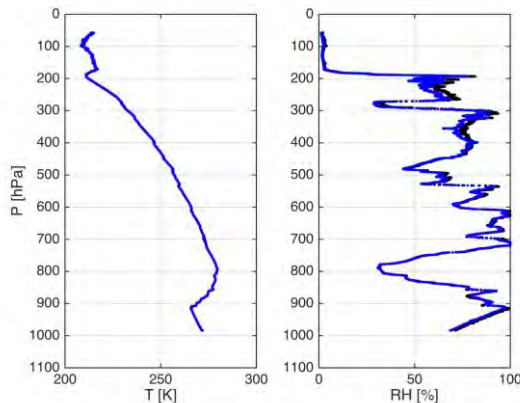
ARM Site Readiness: **SGP**

SGP: RIVAL launches began 13 February 2018

- Loaned Vaisala ground system is at SGP
- 2 practice RIVAL launches:
 - 20171222.1730 (left figure)
 - 20180124.1720 (right figure)
- Weekly launches alternating between 0800/1900 UTC

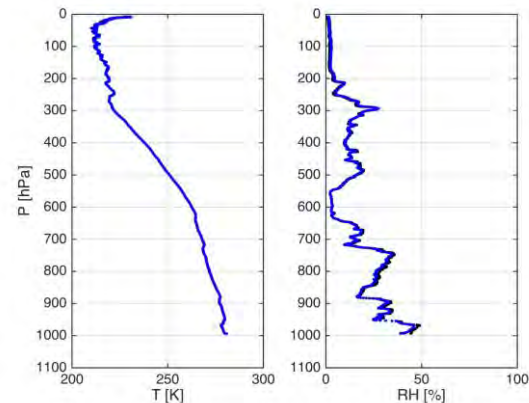


20171222.1730



- dual RS41 & RS92 launch
- not coordinated w/NOAA20
- ascent rate too low
- burst at 57mb

20180124.1720



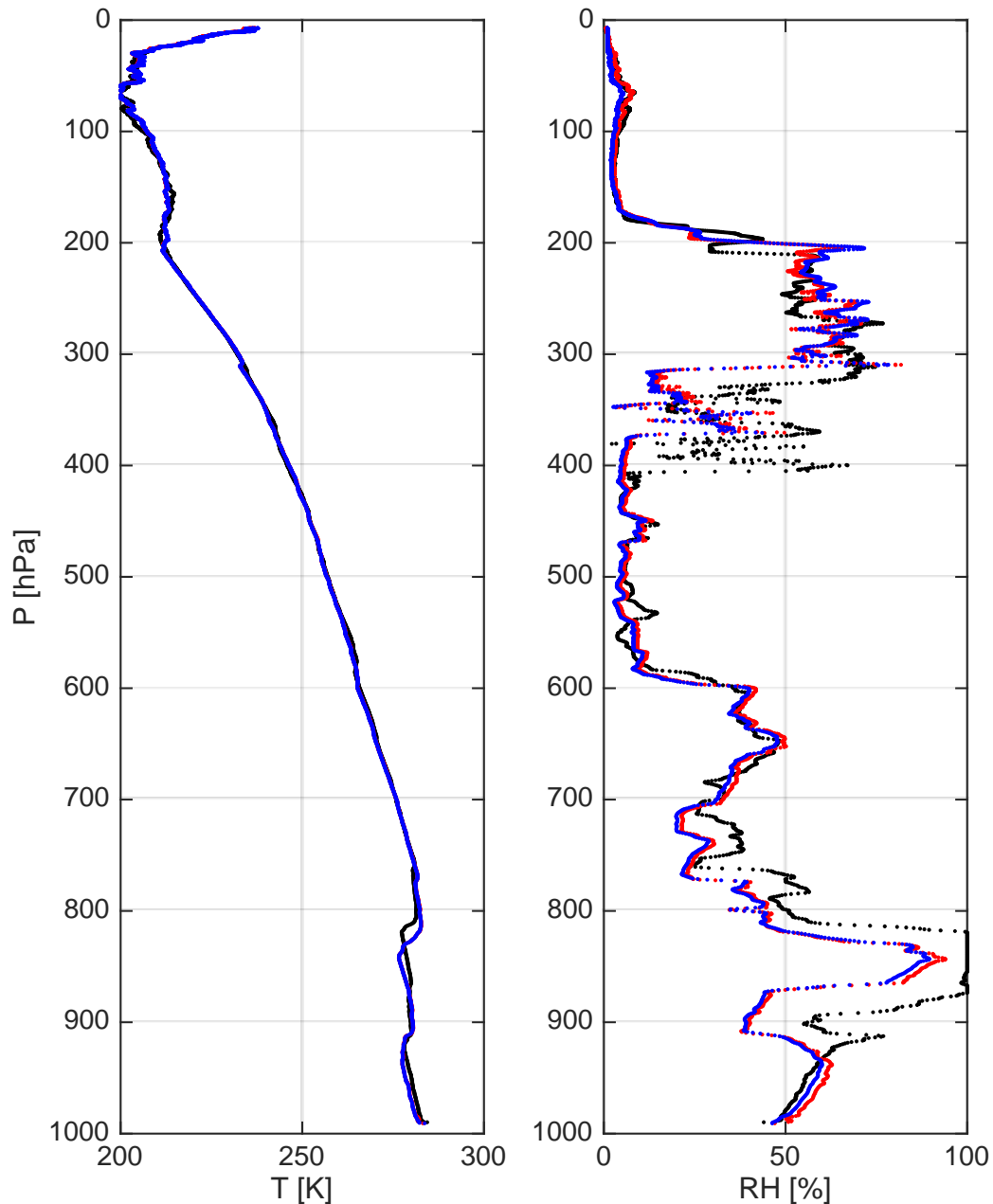
- dual RS41 & RS92 launch
- not coordinated w/NOAA20
- ascent rate: 5.9 m/s
- burst at 7mb

Practice Launch at SGP – 20180124.1720

Practice launch at SGP: 20180124 (5.9 m/s, balloon burst at 7mb)



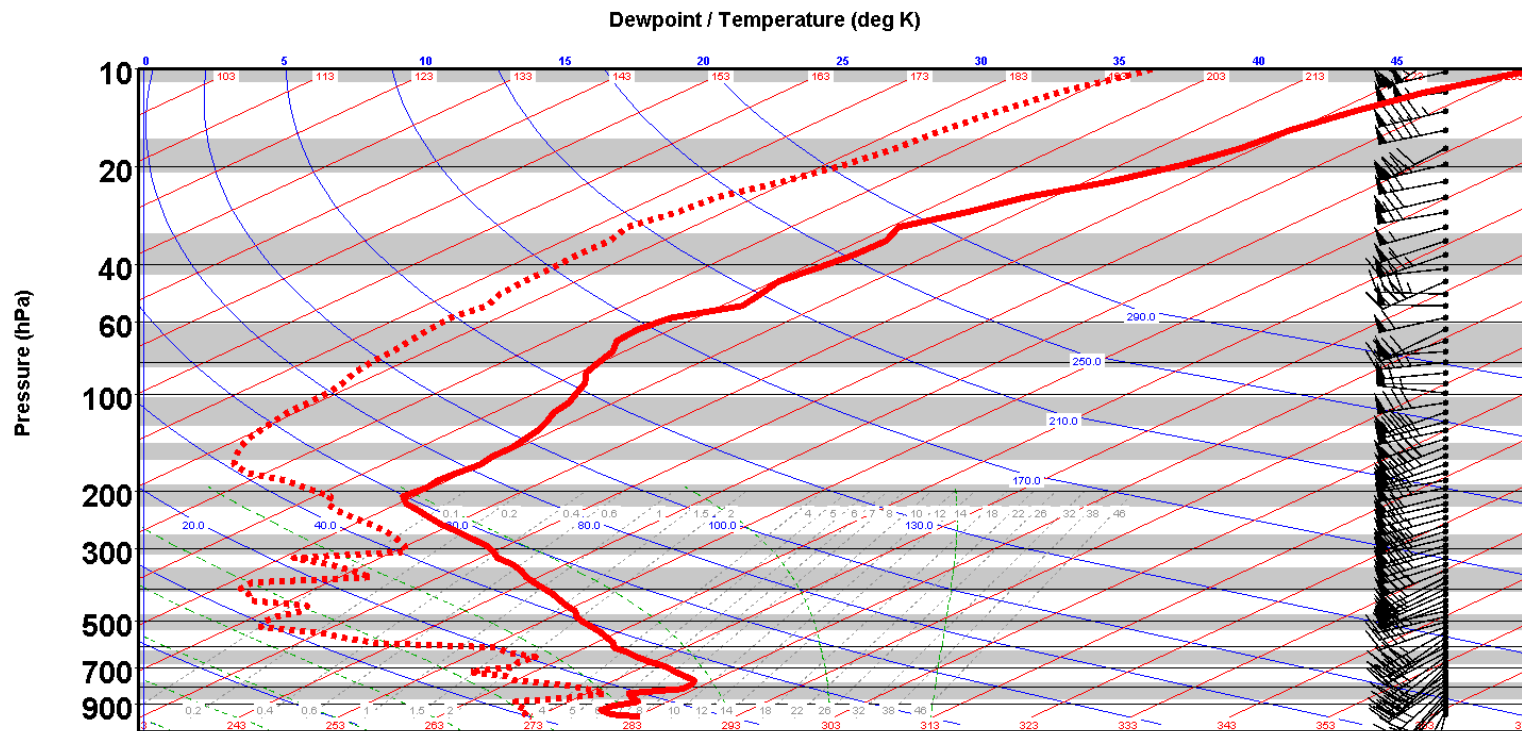
First RIVAL launch at SGP – 20180213.1922



- dual-then-single launch:
- coordinated w/1922UTC NOAA20 overpass
- ascent rate: 6m/s
- burst at: 7mb

RS-92

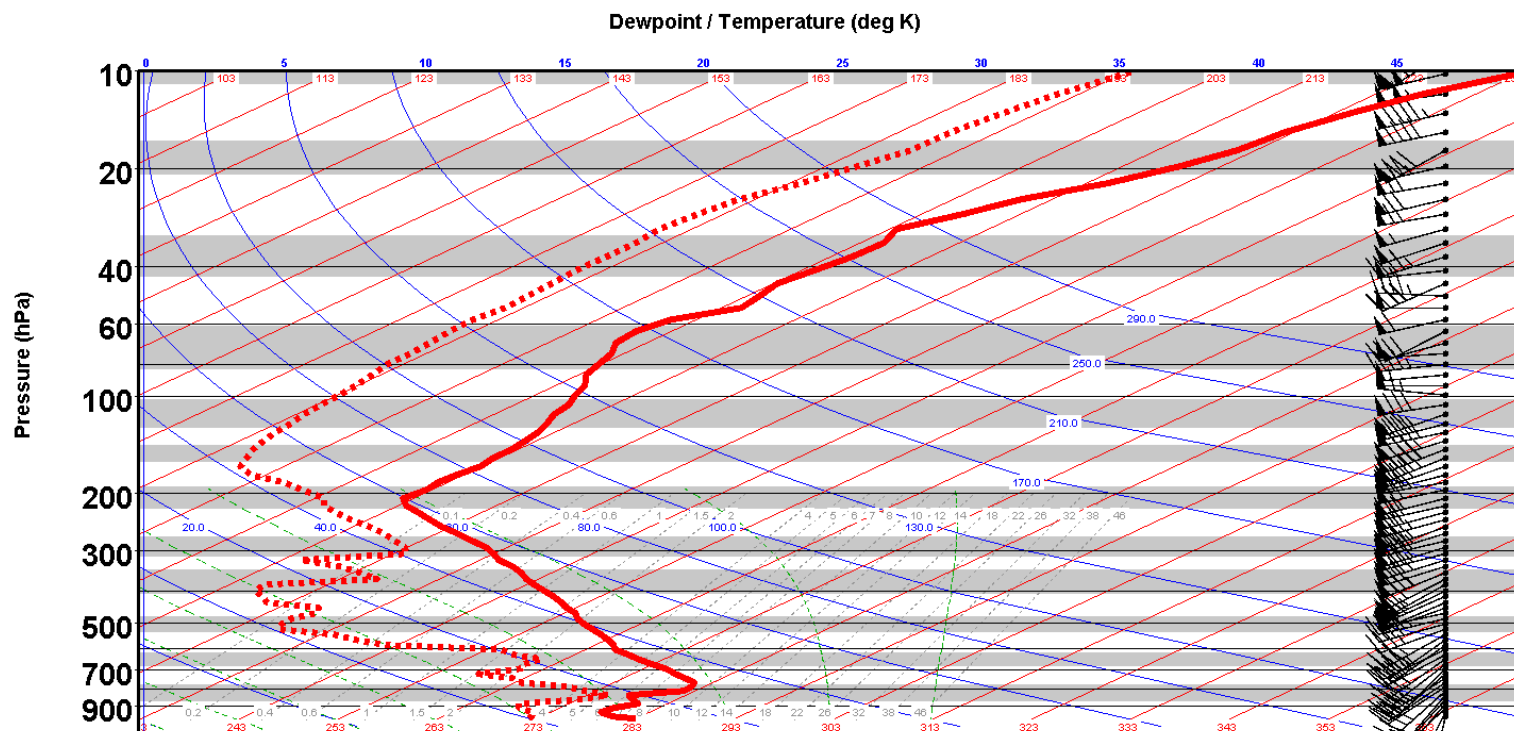
NOAA Products Validation System (NPROVS)



Reference/Dedicated 74646 (80) Reference/Dedicated 2/13/2018 18:35:00Z 36.6 N / 97.5 W

RS-41

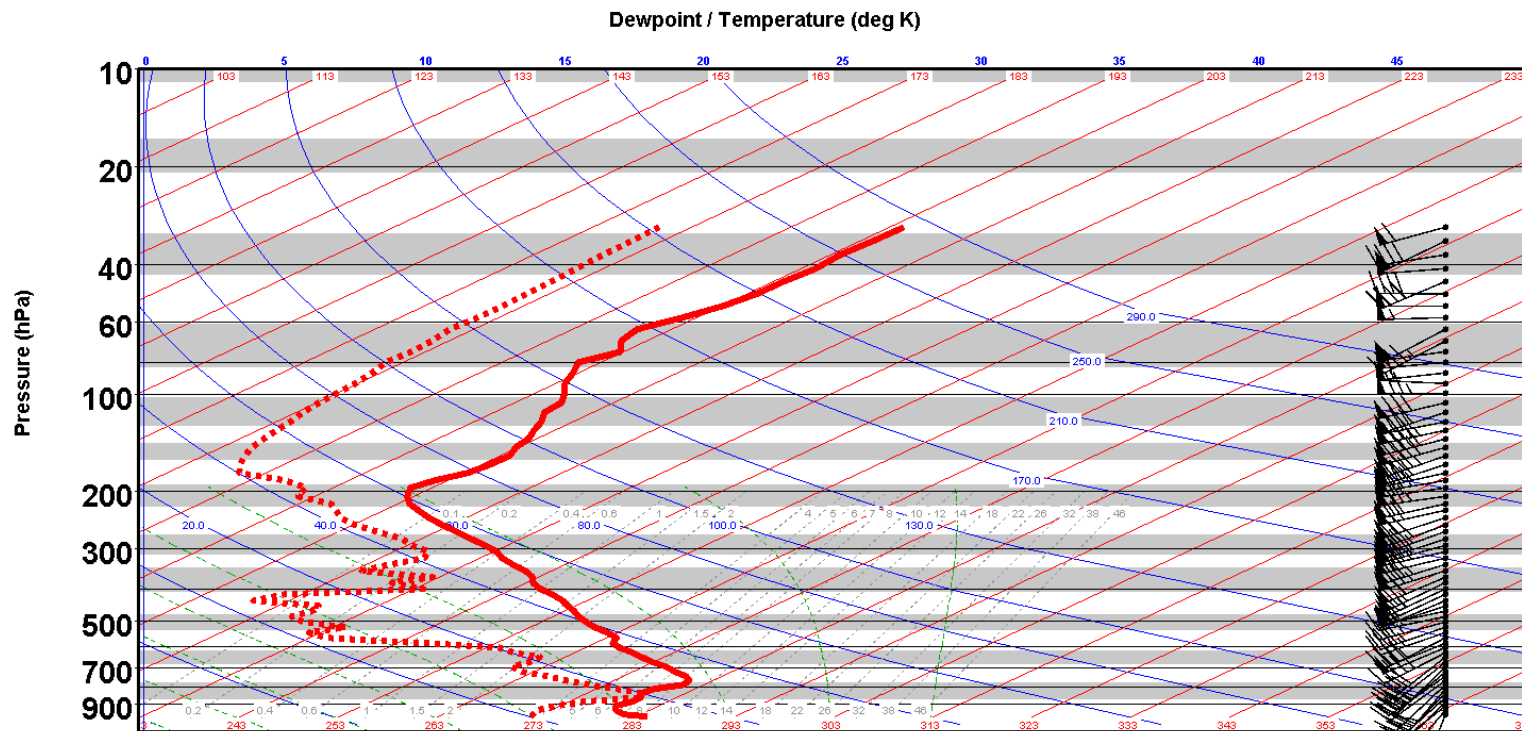
NOAA Products Validation System (NPROVS)



Reference/Dedicated 74646 (80) Reference/Dedicated 2/13/2018 18:36:00Z 36.6 N / 97.5 W

RS-41

NOAA Products Validation System (NPROVS)



Reference/Dedicated 74646 (80) Reference/Dedicated 2/13/2018 19:17:00Z 36.6 N / 97.5 W

CFH Collaboration w/RIVAL at SGP: METOP-A/B

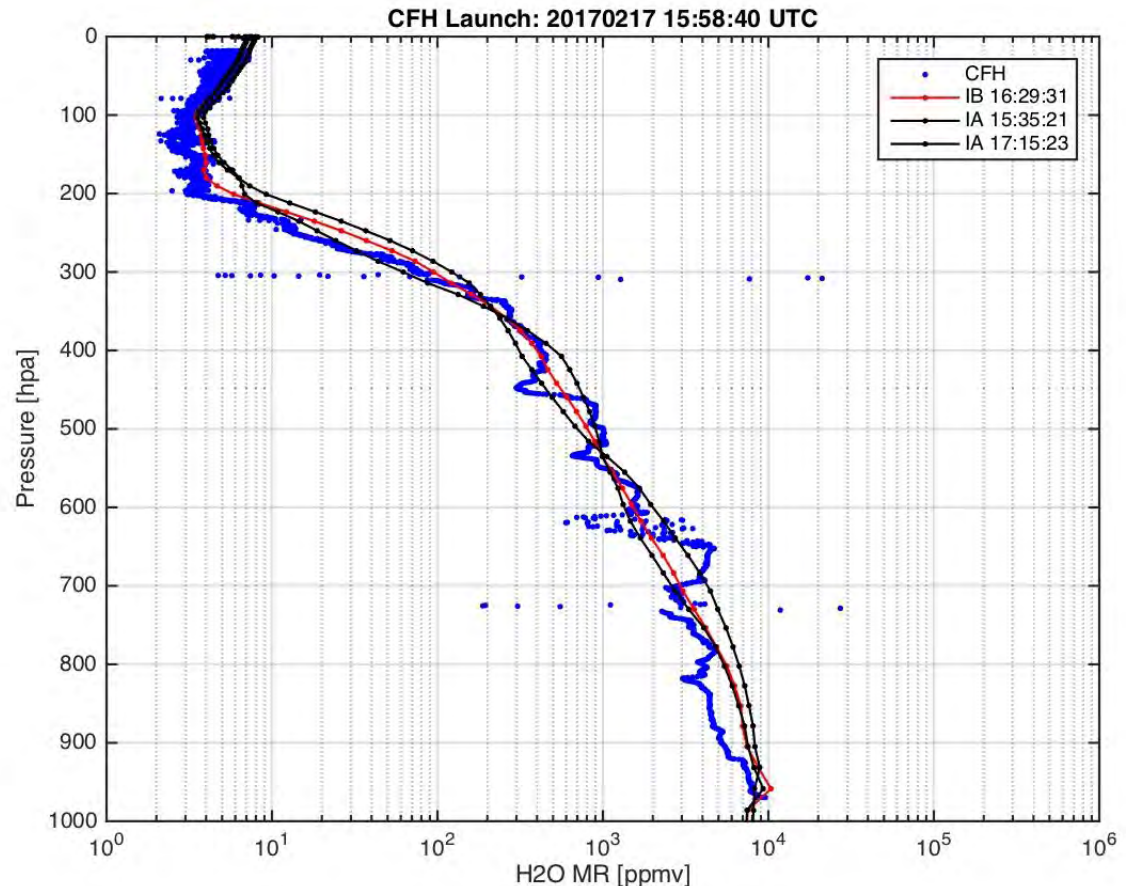
CFH Launches: (Martin Stuefer is ARM Instrument Mentor for the CFH at ARM)

- CFH launches occur once a month at SGP
- Restricted to morning launches (overtime & sun angle)
- Previously included RS92 & iMET sondes w/CFH
- Martin has replaced iMET sonde w/RS41 (package includes: CFH, RS92, RS41)

Future CFH Launches:

- Coordinated w/METOP A/B
- Occur: ~1600 UTC
- Overpass times provided to Martin each month
- RO predictions checked

**CFH launches will be added to
RIVAL dataset**



RIVAL Milestones

Is LC receiving RIVAL data?

| | | |
|----------------------|-------------|---------|
| 1. Launch Scheduling | Owner: Borg | Due: M1 |
|----------------------|-------------|---------|

| | | |
|------------------------------------|----------------------|---------|
| 2. Data flow using RsLaunchcClient | Owner: DWD (Dirksen) | Due: M1 |
|------------------------------------|----------------------|---------|

| | | |
|---|---------------------------|---------|
| 3. Data available via ARM data repository | Owner: Dirksen, Holdridge | Due: M3 |
|---|---------------------------|---------|

| | | |
|--|--------------------|-----------|
| 4. Initial report on statistical properties of the co-launches | Owner: Fasso, Wang | Due: ~Sep |
|--|--------------------|-----------|

| | | |
|---|---------------------------|-----------|
| 5. Initial report on the potential insights from satellites and on satellite validation | Owner: Borg, Reale, Tobin | Due: ~Sep |
|---|---------------------------|-----------|

| | | |
|---|-------------|-----------|
| 6. Initial study on the impact of the transition, etc | Owner: Wang | Due: ~Sep |
|---|-------------|-----------|

| | | |
|-----------------|----------------|-----------|
| 7. Final report | Owner: Dirksen | Due: ~Sep |
|-----------------|----------------|-----------|

Needed for request to extend RIVAL for year 2



RIVAL Path Forward

Extension of RIVAL field campaign for 2nd year:

- Submit by late September for Oct1st review?
- Requires final report from year-1 including justification for year-2
- **Will GRUAN processing of RS92 & RS41 RIVAL sondes be available?**

Ancillary & Satellite Data for RIVAL:

- How to provide ancillary and satellite data to LC?
- RIVAL & CFH sondes collocated w/JPSS or METOP (w/in NPROVS)
 - Does LC want: Satellite RDR, SDR, EDR?
 - Original files? File subsets (~500km radius)? Collocation file?
 - Should sondes converted to 100 layers be provided?
 - Does LC want satellite collocations for other sites GRUAN sites?