Evaluation of Meteorological and Oceanographic support for Joint Task Force Support Forces Antarctica (Operation DEEP FREEZE)

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Overview

- Purpose of Visit
- Meteorology Community, Products, and Equipment
- Key Findings
- JTF-SFA Commander Response Actions
- Formal requests for National Science Foundation
- Takeaways for Meteorological Community
- Acknowledgements

Purpose of Visit

The goal of this visit was to observe the meteorology and oceanography (METOC) program as a whole and determine what can be done to improve support to JTF-SFA.

Primary Focus Areas:

- Increase safety of flight, ground, and maritime missions
- Improve completion rate of intertheater missions

Meteorology Community

JMO
Lt Col Steven Randle

JMCC
17th Operational Wx Sq

Navy METOC SOPP
SRC

- **ROF (Charleston)**
  5 Forecasters
- **McMurdo Station**
  1 Met Manager
  1 Flight Briefer
  3 Forecasters
- **McMurdo Station**
  4 Observers
- **Williams Field**
  1 Observer
  (Night ops + Sunday)
- **Phoenix Field**
  1 Observer
  (During Ops only)

Field Camp METOC
ASC-PAE

- **A-S South Pole Station**
  3 Observers
- **Shackleton Glacier**
  2 Observer +
  Augmentee(s)
- **WAIS Divide**
  1 Observer +
  Augmentee(s)
- **Siple Dome**
  0 Cert'd Observers

AMRC
Dr. Matthew Lazzara

- **~56 AWSs**

Other Science Groups and LDB forecasters

- **AWSs**
- **Eyes-Forward Observations**

International Partners
New Zealand Forecasters
Italian Forecasters
UK Forecasters
AUS Forecasters

NOTE: This was specific to the 2017-2018 Season

Meteorology in direct support of JTF-SFA

JTF-SFA Meteorology not located in Antarctica

USAP Meteorology not directly aligned with JTF-SFA

Antarctic Meteorology not associated with USAP

Antarctic Meteorological Research Center (AMRC); Antarctic Support Contract (ASC); Automated Weather Station (AWS); Admunson-Scott (A-S); Joint METOC Coordination Center (JMCC); Joint METOC Officer (JMO); Long Duration Balloon (LDB); Meteorology and Oceanography (METOC); Remote Operations Facility (ROF); (Space and Naval Warfare Systems Command (SPAWAR); Scientific Research Center (SRC)

Organizations Supported

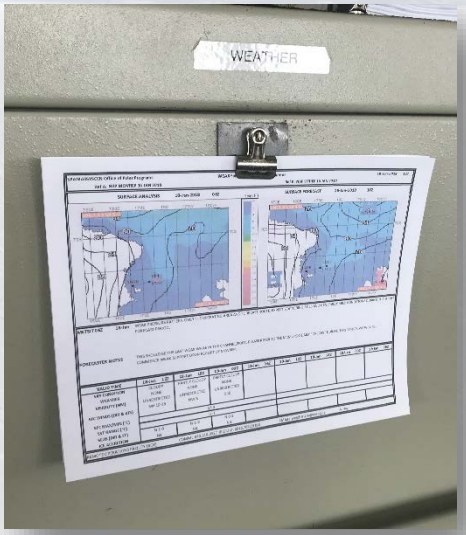
- Aviation
  - Fixed Wing
    - C-17s, LC-130s, Twin Otters (CAN), Baslers (CAN), SAF Air (S. African C-130), Contracted Airbus
  - Rotary Wing
    - PHI, Kiwi (Bell-212, A-Stars)

- Resource Protection
  - McMurdo Station, South Pole Station
  - Field Camps
    - LC-130 Landing Sites: Shackleton Glacier (SHG), WAIS Divide, South Pole Station, Siple Dome, etc
    - Scientific research camps
- Vessel Operations
  - Coastguard Cutter: Polar Star Ice Breaker
  - Container Vessel
  - Tanker Vessel
  - NSF Research Ships

**JTF-specific assets are denoted in Blue*

Products Provided

- Aviation:
  - 175-1's
  - TAFs *(McMurdo, Willie, Phoenix, S. Pole, Shackleton, WAIS, Siple Dome)*
  - Helo Forecast
  - VFR Forecast *(KBA fixed wing forecast for up to 15 prioritized locations)*
  - Augmented Observations
  - Automated Observations
- Resource Protection/Planning/SA:
  - Air Op Planning Board (AOPB) 4 day outlook
  - 24 Hr TV Forecast for MAC
  - Wx Conditions (1,2, & 3) – *Condition 1 approved by Station Manager*
  - 5 Day Outlook *(Provided last Winter, but stopped for Summer)*
  - Synoptic Observations
- Vessel Operations:
  - WEAX (Ship Forecasts)
- Other:
  - Case Studies
  - Forecast Reviews for missed events
  - Upper Air Soundings via McMurdo/S. Pole Wx Balloon Launch at 00Z and 12Z



Kenn Borek Air (KBA) – Twin Otter/Baslar aircraft from Canada

JTF-SFA Instrumentation/Systems

- FMQ-19 *(SOPP)*
  - Williams/Phoenix/S. Pole (x2)
- PMQ-3 *(SOPP)*
  - Williams/Phoenix/MACWX/Balloon Inflation Facility (BIF) + 7 spare
- Campbell Automated Wx Station
  - 13 total
  - Herbie Alley N, N. Crevasse, Cape Royds, Biesiada Crevasse, White Island S, Williams Whiteout, Cape Spencer, Ford Rock, Tent Island, Erebus Cones, Jules, Butter-Point-Ferrar
  - 3 sensors have attached webcams: Cape Spencer, N. Crevasse, Cape Royds
  - No ceilings/visibility
- Vaisala Upper Air System: Weather Balloon and Radio Sonde
  - MAC/S. Pole
- Kestrel 4500
- Polar Portable Meteorology Kit (PPMK) *(8)*
  - @ LC-130 Field Camps + @ Hut Point during Ship Ops
  - Sensors without ceilings/visibility
  - Visibility of data currently limited to SOPP forecasters/observers only*
- R2FX (Satellite receivers- pull data directly off of METSAT) @ Pole
- ASI BB1 Barograph
- Ceiling-recording balloons @ Pole and LC-130 Outstations
- Campbell Stokes Sunlight Recorder @ Pole
- Aero2/LIKA Handheld ceilometer (Pulse laser range finder) @ WAIS

Limiting Factors for JTF-SFA METOC

- Sparse data set
- METSAT gap (1000-1500L)
- Model accuracy
- Lack of 12 Z model verification
- Limited Bandwidth
- Limited personnel vs. wide spectrum of support
- Varied terrain causing mesoscale/microscale wx features
- Extreme wx conditions/limited access impacting equipment
- AWSs cannot provide visibility or ceilings
- Dual Role Observers and priority of effort
  - (LAWRS + Augmentees)
- Local Forecast Experience ***(Crucial)***

Summary of Findings

1. Significant amount of severe weather and increased impacts to operations

- Local forecaster experience (ie. retention) is CRITICAL

2. Integration/trust between weather team and aircrew could be improved

- Many opportunities to increase coordination both ways

3. Complex terrain features present in main operating areas w/minimal familiarization

- Understanding of terrain features and impacts are crucial to an accurate forecast
- Lack of familiarization of features outside McMurdo Station (reliance on maps)
- Minimal eyes forward (web cams, observers at airfields, observers in field, etc)

4. Sparse data set available in comparison to typical operating locations

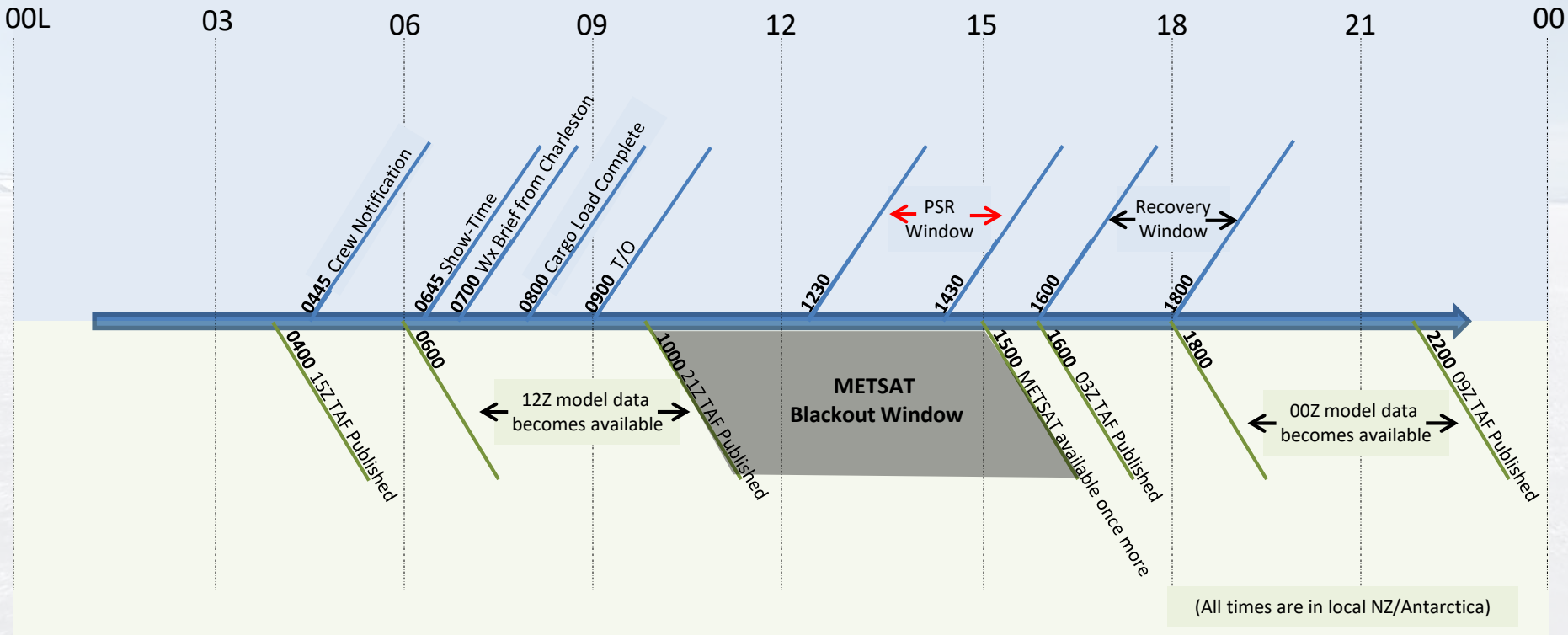
- Decent amount of automated wx, though a lot of that data is not available/shared/real-time (scientific weather stations, etc)

5. METSAT blackout window during key operating hours and decision points

- Southbound PSR during gap; intra-continental turnaround during window
- Window driven by satellite agencies maximizing coverage over mid-latitude locations during “daylight” hours

Typical Southbound Wx Spt Timeline

BLUF: *21Z TAF and 09Z TAF have highest fidelity based off availability of newest model run data assuming that model data has initialized and verified well. 03Z TAF has lowest fidelity based off lack of new model data or METSAT to verify model data.*

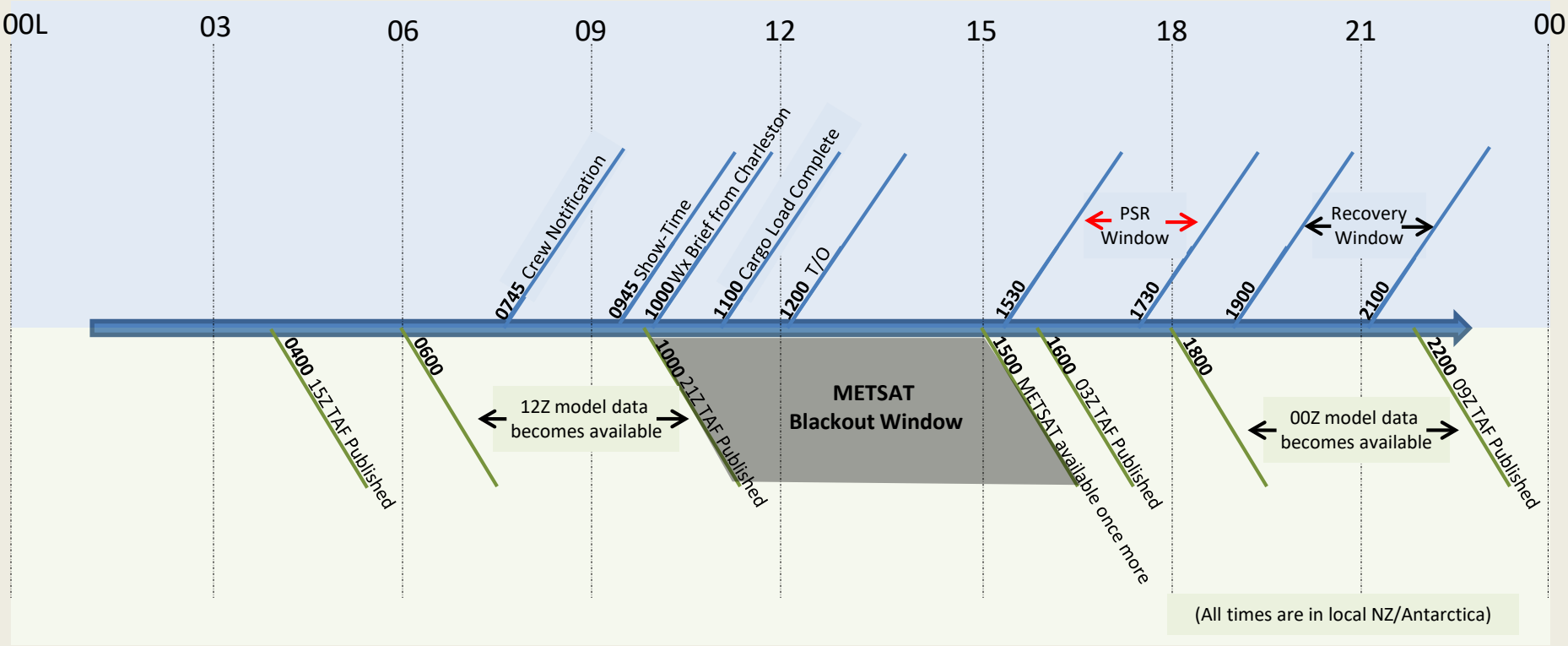


NOTES:

- 15Z TAF based off of same 00-12 hr model data as 09Z TAF, with new model data for > 18 hrs.
- 21Z TAF written based off of new 12Z model run, METSAT, observations, and web cameras. Less fidelity in >18 hr forecast since that model data may/may not yet be available by published time.
- Forecaster for 03Z TAF *may* have 1 usable METSAT image prior to publishing TAF. Otherwise, they are basing forecast off of the same model data as 21Z TAF for first 12 hrs, verification of the model using observations, and web cameras. **Lowest fidelity forecast for 0-12hr period*.*
- 09Z TAF written based off new 00Z model run, METSAT, observations, and web cameras. Less fidelity in >18 hr forecast since that model data may/may not yet be available by published time.
- *PSR Forecast completed during METSAT blackout, with no new model data from 21Z TAF.

Optimal Southbound Wx Spt Timeline

BLUF: *Recommend shifting the timeline of Southbounds to 1200L takeoff (3 hrs right). This will allow wx brief to occur prior to limited-data window and PSR and recovery to occur once METSAT data starts becoming available again and model data can be verified.*



NOTES:

- Wx Brief at 1000L would now occur after 12Z model starts coming in. This should give Charleston forecasters more ammo to give a more accurate Go/No Go msn forecast prior to launch. This should decrease likelihood of boomerang.
- PSR window shift to the right will allow forecasters to get a new METSAT image or a few and verify 12Z model run prior to giving PSR forecast. This should provide AC and SOF better fidelity in PSR decision and decrease the number of unneeded boomerangs

Summary of Findings

6. Vessel Operations are vital to entire operation with peak of risk being the turn into port

- Previous to visit, transit through sea ice and port ops provided minimal METOC support causing safety issues
- Temporary on-site fix occurred during visit, though future support needs to be solidified and prioritized

7. Communication between METOC agencies was strained and could be improved

- Great opportunity for synergistic relationship

8. Both forecasters and aircrew were extremely cautious and very conservative

- Lack of suitable alternates, High risk whiteout landings
- Heavy reliance on single model, lack of confidence in long-range forecast

9. Limited manpower vs. wide spectrum of support

10. No official observer located at primary operating skiway

- Reliance on dual-role ATC personnel

11. Bandwidth limitations restrict data access

- Significantly improved thanks to prioritization during 2017-2018 season

Joint Task Force Response Actions

- Approval for LC-130 familiarization flights for contract forecasters
- Takeoff, recovery, and waypoint PIREPS (pilot reports) now required in pilot ‘Blue Book’
- Port operations METOC support outlined in 2018-2019 DEEP FREEZE Operations Order
- Annual attendance to Antarctic Meteorology and Climate Workshop
- Formal Requests to NSF

Joint Task Force Formal Requests to NSF

- **Fund DoD portable Doppler RADAR to Phoenix Airfield**
  - Extended outlook & hone timing on fog/precip events
- **Deploy AF Weather Forecaster during season**
  - Provide tactical weather, limited data forecast expertise
  - Further integration efforts with aircrew
- **Research methods of decreasing/mitigating McMurdo METSAT blackout window**
  - JPSS data
  - Update downlink hardware to improve resolution
- **Visibility markers & location-specific visibility charts at DoD operating airfields**
  - Operationalize web cameras, provide observers improved data source
- **Seasonal refresher briefings**
  - Strengthen pilot-forecaster relationship
  - Educate pilots on local weather forecast challenges & capabilities

Takeaways/Conclusion

- Antarctic environment is one of the most difficult places to forecast on the planet
- Experience and professionalism of METOC community is essential
- Communication - exploit key expertise in forward locations to improve forecasts
- Continue to share knowledge, data, info to consolidate efforts

Challenge for METOC Community:

We need to continue to focus on technological advancement, but don't become reliant on technology.

Don't forget your 'old school' observing and forecasting techniques…

Observation trends
Cloud recognition & patterns
Terrain influences
Rules of thumb
Past events

Acknowledgements

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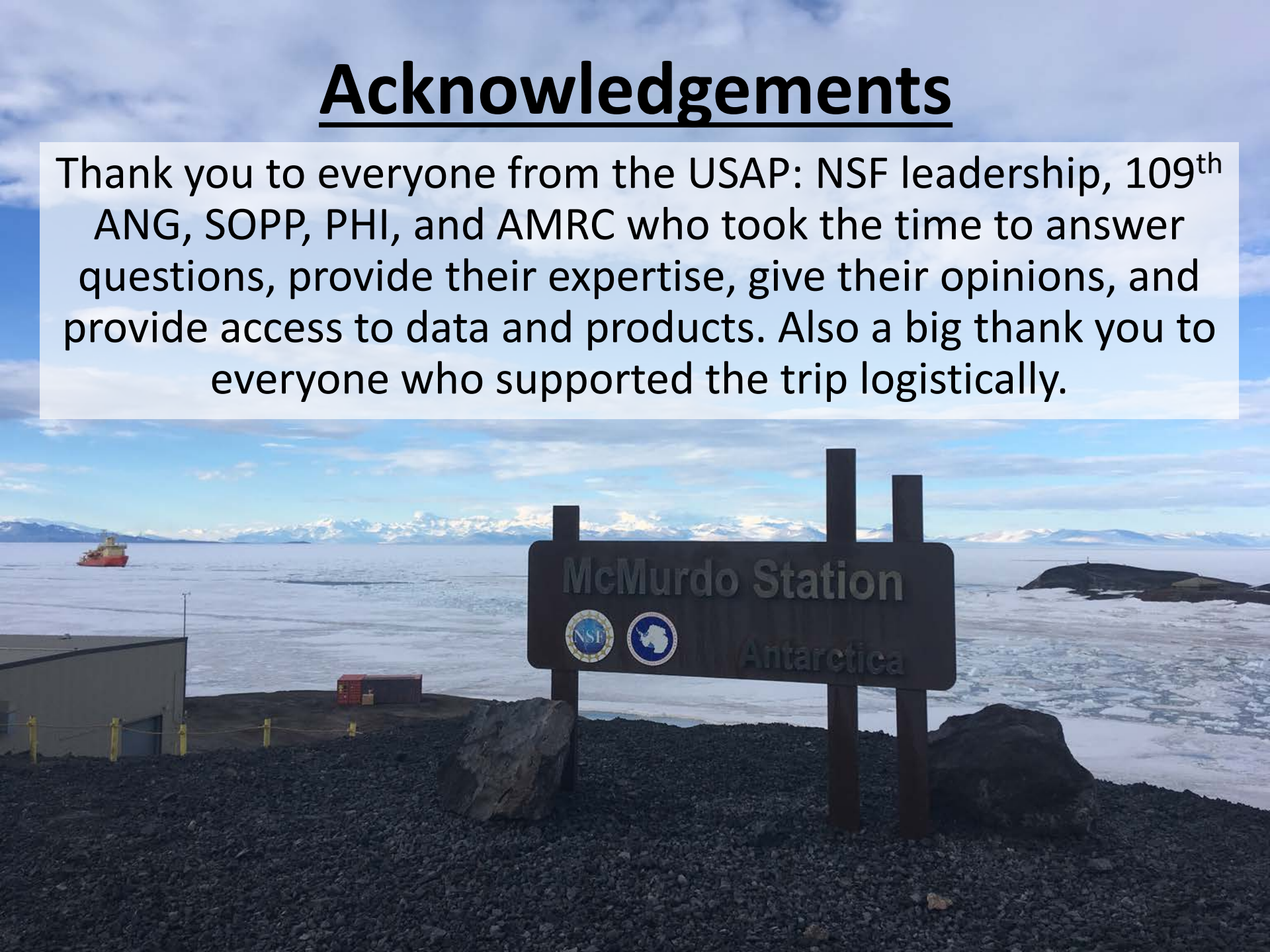


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