The Ebb and Flow of Antarctic Meteorological Data

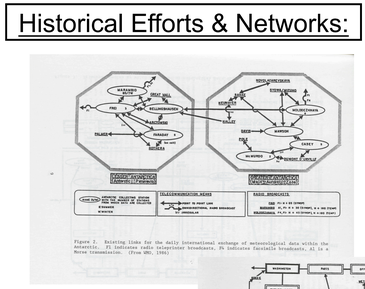
M.A. Lazzara[1], K.E. Willmot[1,2], L.M. Keller[2]
[1]Antarctic Meteorological Research Center, Space Science and Engineering Center, University of Wisconsin-Madison
[2]Department of Atmospheric and Oceanic Sciences, University of Wisconsin-Madison
http://amrc.ssec.wisc.edu/ United States Antarctic Program O-202

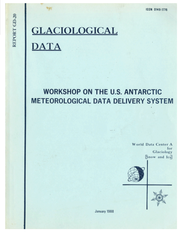
In Memoriam
Dr. Charles R. Stearns
1925-2010

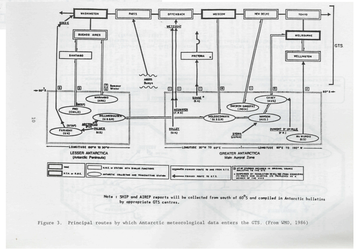
Abstract:

Antarctic meteorological data is provided via a variety of methods and frameworks to serve a diverse community. These data sets are critical for operational use such as weather forecasting. Case studies conducted in post event review by forecasters or by students learning about Antarctic phenomena rely on these data. Of course, research activities in both the meteorological and non-meteorological disciplines (such as glaciology, biology, etc.) require meteorological information. As a result of the diverse data types, data sources and user communities, various means with differing objectives are employed to provide and distribute meteorological data.

Historical Efforts & Networks:







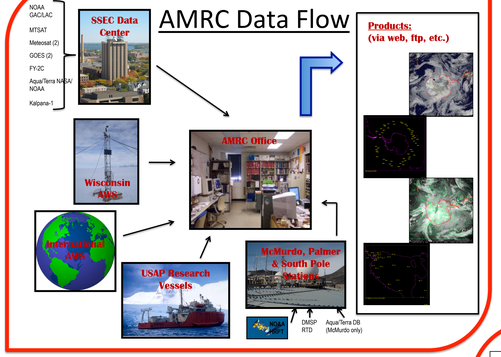
Historical Antarctic meteorology data and network issues are similar to those from 20 years ago to today:
- Distribution
- Archive
- Quality control
- Coordination

Sample Antarctic Meteorological Data Resources and National Data Centers:

Countries Reporting An Established NADC	NADC
Argentina	Argentinean Antarctic Institute (Instituto Antártico Argentino - Dirección Nacional del Antartico)
Australia	Australian Antarctic Data Centre
China	Chinese National Antarctic Data Center(CN-NADC) -Polar Research Institute of China (PRIC)
Italy	PNRA - SIRIA Project
Japan	Polar Data Center (PDC) in the National Institute of Polar Research(NIPR)
Netherlands	Royal Netherlands Institute for Sea Research (NIOZ)
Norway	NADC within the Norwegian Polar Institute (NPI)
Spain	Polar National Data Centre - located in the Spanish Geological Survey
United Kingdom	National Antarctic Data Centre (the AEDC) – within the Environment and Information Division of the British Antarctic Survey
United States of America	There is no "One" dedicated data center - a variety of Government funded institutions (National Science Foundation, National Oceanic and Atmospheric Administration, NASA) and Universities provide various levels of service.

- AMRC (see right)
- Antarctic Mesoscale Prediction System Archive
- Global Change Master Directory (Antarctic Master Directory)
- USAP Data Coordination Center
- National Antarctic Data Centers
- National Snow and Ice Data Center
- National Climatic Data Center
- READER

AMRC Data Flow



Meteorological Data User Communities:

Researchers
Forecasters
Logistics planners
Educators
Tourist expeditions

AMRC Data, Servers, & Services

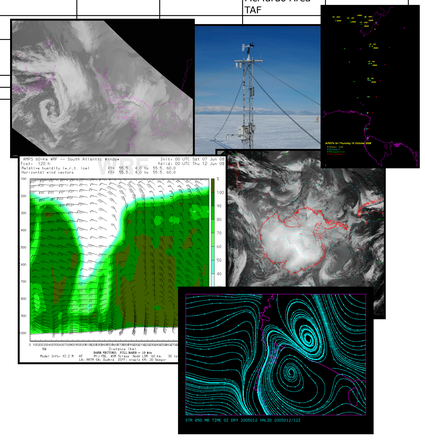
Browser
- Web
  - That standard, required, essential, and needs power from items below…
- McWeb
  - Return of a 15 year old concept – creating displays on the fly – real-time data.
- Web interface Postgres Database
  - Marriage of web and data hugely powerful (old idea from 1990s – still needs exploring…)
- RAMADDA
  - (with and without Postgres database under the hood) – New idea for 2000s – not widely used, future development & support TBD.

Distribution
- FTP
  - 1980s/90s standard – waning – but still around to serve (goes with rsync servers too…)
- ADDE
  - For the specific meteorological community –
  - McIDAS-X, McIDAS-V, IDV, VisAD, and perhaps Matlab and IDL….
- LDM – Antarctic-IDD
  - Real-time data interface only – meteorology community only
- E-mail, Twitter, Facebook (IM?, Skype, YouTube, etc.)
  - Delivery of data to you…notifications, information, etc.

AMRC/SSEC/UW-Madison
Data Archive Holdings (Date: January 2011)

Dervied and Generated Products	Surface Observations	Upper Air Observations	Polar Satellite Observations	Polar Satellite Navigation	Numerical Model Output and Forecast	Climate Summary
AMRC Antarctic composites: Infrared, Water Vapor, experimental visible, psuedo-color	University of Wisconsin AWS (10 minute, 1 hourly, 3 hourly, summary, etc.)	Raw radiosonde launch from McMurdo and South Pole	AVHRR LAC	Two Line Elements	Realtime Global Forecast System	McMurdo: Spreadsheets via MacWX and NCDC
Atmospheric Motion Vectors - GIF imagery via CIMSS (GMS/GOES/MTSAT)	USAP - South Pole 2 minute obs; Palmer 2 minute obs; McMurdo	Manditory and some significant level radiosonde observations around Antarctica, etc.	AVHRR HPRT	McIDAS SYSNAV navigation	Real-time Wnd and Wave Forecast Model (NCEP)	South Pole: LCD, CLIMAT, CLIMAT TEMP, NCDC
Composite Atmospheric Motion Vectors - Experimental	From NOAAport: METAR, Synoptic, Ship & Buoy, Synoptic	Aircrafft reports (AIREP)	AVHRR GAC (Project FROST only)		Real-time UK Met. Office Model	Palmer Station: Spreadsheet, text, CLIMAT, NCDC
	USAP Research Vessel SITREPs	Palmer, South Pole and McMurdo NCDC	AVHRR and MODIS (Iceberg project only)		ECMWF	
	AGO Weather				McMurdo Area TAF	
	USAP Field Camps					
	McMurdo Area networks (MAWS, etc.)					
	USAP Runways					
	SPAWAR AWS					

January 2011

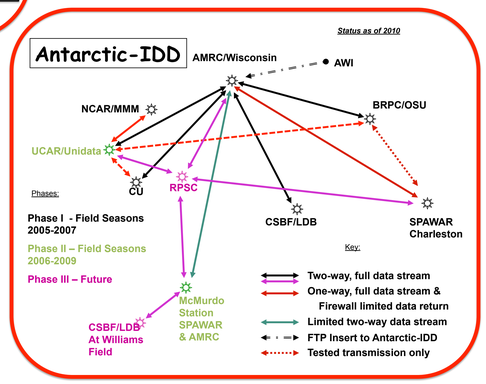


Challenge: Data Archive Media

- Moving target
  - Critically needed
  - Protecting the investment!
- Media used to archive data since 1992 at AMRC:
  1. Magneto-optic disks
  2. 8 millimeter Exabyte tapes
  3. 4 millimeter DDS3 tapes
  4. Compact disks (CD)
  5. Digital video disks (DVD)
  6. 3590 IBM tapes
  7. LTO tapes
  8. RAID/5 (on-line)

Example Data Networks, Communications Relays and Data Flow:

- Antarctic-Internet Data Distribution (IDD)/Local Data Manager (LDM)
- Global Telecommunications System (GTS)/ Aeronautical Fixed Telecommunications Network (AFTN)
- High Frequency (HF) Radio Relay
- Constellation satellite relay: e.g. Iridium
- Geostationary satellite relay: e.g. Inmarsat
- Polar orbiting satellite relay: e.g. Argos




```
Apr 28 22:15:07 pqutil INFO:    91819 20110428221506.834    EXP 000  USAP.AMRC.MD.SYN.20110428.bz2
Apr 28 22:15:07 pqutil INFO:   8783112 20110428221506.863    EXP 000  USAP.AMRC.MD.SYN.20110428
Apr 28 22:20:06 pqutil INFO:    73091 20110428222006.321    EXP 000  USAP.AMRC.MD.METAR.20110428.bz2
Apr 28 22:20:06 pqutil INFO:  16068836 20110428222006.396    EXP 000  USAP.AMRC.MD.METAR.20110428
Apr 28 22:25:04 pqutil INFO:    15059 20110428222504.330    EXP 000  USAP.AMRC.MD.SHIP.20110428.bz2
Apr 28 22:25:04 pqutil INFO:   4828288 20110428222504.355    EXP 000  USAP.AMRC.MD.SHIP.20110428
```

Recommendations:

✓Science community accept significant datasets as an EQUAL to peer-reviewed publications (Comparable to standard peer reviewed papers)

✓Funding agencies recognize a balance of data and science….in proportion…in funding portfolios

✓Overall: Need to have both funding agency and community "buy-in"
- ✓ Break out of the "for experiment only" mentality
- ✓ Involvement of groups interested in long term measurements for future science yet to be formulated
- ✓ There is a place for a coordinated regional data center
- ✓ NSF Data Management Plan (DMP) requirements may only be a first step…
- ✓ Concern #1: Participating in SCAR funded projects may require a National Antarctic Data Center (NADC)
- ✓ Concern #2: No Pan Antarctic Observing System
- ✓ *Lets meet the challenge set forth by Finney, 2010 and not into the pitfalls outlined in Dean et al., 2008*

Stewardship:

- ✓ Support – respect – observation datasets!
- ✓ Data is important…care for data is important
- ✓ Operational data sets have an afterlife in research! (Once data has "done" its job in the operational environment)

✓Get data right the first time…reduce costly quality control later (Lazzara et al., 2011a; Lazzara et al., 2011b)

✓Lack of coordination between agencies within US on Antarctic data (SCAR, 2009; Finney, 2010)

References:

Dean, K., S. Naylor, S. Turchetti, and M. Siegert, 2008: Data in Antarctic science and politics. Social Studies of Science, 38, 571-604. DOI: 10.1177/0306312708090693 [http://sss.sagepub.com/content/38/4/571.full.pdf]

Finney, K., 2010: A strategy for data and information management in the 21st century. Joint SCAR/COMNAP Delegates Meeting, Buenos Aires, Argentina, 1 August 2010. [http://scadm.scar.org/0files/scadm2_arg2010/delg_meeting/lecture_data_mgt.ppt]

Lazzara, M.A., L.M. Keller D.J. Rasmussen, and K. E. Willmot, 2011a: Antarctic meteorological data: access, distribution, and challenges. *27th Conference on Interactive Information Processing Systems*. 91st American Meteorological Society Annual Meeting, Seattle, WA.

Lazzara, M.A., and L.M. Keller, 2011b: Fifty-year Amundsen-Scott South Pole Station climatology: quality control and analysis, 11th Conference on Polar Meteorology and Oceanography, Boston, MA.

Parson, M.A., R. Duerr, and J.-B. Minster, 2010: Data citations and peer review, *Eos*, **91**, 297-298.

SCAR, 2009: Data and Information Management Strategy (DIMS). Scientific Committee on Antarctic Research Report #34. [http://www.scar.org/publications/reports/Report_34.pdf]

Poster by Matthew Lazzara

Thanks to the
National Science Foundation
Office of Polar Programs
Grant #ANT-0838834
&
National Oceanic and Atmospheric Administration
Riverside Technology Inc, subcontract #1070
for support of the
Antarctic Meteorological Research Center