

Interim Progress Report on SEARCH Project:

Correction of Systematic Errors in TOVS Radiances

P.I. Jennifer Francis, Rutgers University

74 Magruder Rd, Highlands NJ 07732

Tel: 732 708 1217, Fax: 732 872 1586, francis@imcs.rutgers.edu

Co.-P.Is.: Tony Reale, NOAA/NESDIS

Axel Schweiger, University of Washington

Statement of Purpose

In this project we will attempt to identify, quantify, and mitigate errors in TOVS radiances caused by changes to satellite orbits, instruments, and/or calibration method. We expect to produce a 22-year (or more) record of TOVS radiances and retrieved products that are as error-free as is practicable, given available resources. Many of the known errors should be regionally and seasonally independent, but we suspect that some may be peculiar to or exacerbated by Arctic conditions. Thus while our efforts will be global, our focus will be primarily Arctic. The expected product of this investigation will be a data set of tremendous value both for geophysical retrievals with sufficient accuracy to identify changes since 1979, as well as for direct assimilation by numerical atmospheric models.

Accomplishments to Date

Our first year has been focussed on assessing the status of existing Arctic radiosonde data sets in the NOAA archive and searching for data sets that were not ingested into the GTS operational weather system. Through personal inquiries, internet searches, and an internet list-server request for data via the ArcticInfo network, we have been able to identify and obtain thousands of additional Arctic radiosondes that were not part of the standard archive. Already the interest level by the community has been high for the eventual compilation of these data.

Following is a more detailed listing of our achievements, delineated by institution:

NOAA/NESDIS (Reale)

- Investigated various sources of radiosonde datasets within NOAA archives as well as in other data centers. Data sets with high-latitude or mid-latitude winter radiosondes are listed in Table 1.
- Interacted with several worldwide weather organizations (ECMWF, U.K. Met. Office, NCAR, etc.) in charge of collecting upper air data.
- Collected various dataset sources of GTS and special field experiments (Table 1).
- Recompiled unique NCAR decoding application to enable creation of readable text files.
- Developed several software drivers to access text files and create data bases for subsequent analysis (i.e., graphical and tabular summaries).
- Collaborated with colleagues on the enhancement of different database tools and procedures for web site development (to be completed by June 2004).

Table 1: Radiosonde data sets obtained or pursued by NOAA/NESDIS

Data set name	Spatial Coverage	Temporal Coverage	Notes
NCAR ds353.4	global	1973 - July 2003	
ARM	Oklahoma	Apr '94 - Nov 2002	
ERA-40	global	tbd	source identified
DSD5	global	polar-orbiter record	
UK Met. Office	global	1990 - 2001	
Antarctic Meteorological Research Center	Antarctica, mostly coastal stations	1956 - present	few stations until 1980s
JOSS Field Experiment Archive	global	1980 - 1990	approx. 200 cases
First ISLSCP Field Experiment (FIFE)	USA	1985 - 1988	
GAME/HUBEX Field Obs.	Asia	Summer 1994	

University of Washington (Schweiger) (please note initial funding was received in Oct. 2003)

- A source for 8315 radiosondes from 1982 to 2002 launched by the German research vessel *Polar Stern* during its Arctic cruises has been identified. Data locations and times are being matched against existing records and preparations for ingest into the bias corrections are being made. Figure 1 is a graphical depiction of the ship's tracks. An inventory of HIRS and MSU Level 1b data archived at the U. of Washington was created. Gaps and overlap periods were identified. (See Fig. 2).
- Suitable radiative transfer models are being acquired and implemented to be used for intercomparison of regional biases. The RT-TOVS and "3R" models are now in-house.
- A possible source for radiance biases in the new ECMWF reanalysis has been identified in the form of their feedback files
- The sensitive of trends in cloud fraction retrievals to possible calibration errors has been investigated. Trends in cloud fraction have been found to be relatively insensitive to biases. A paper summarizing this work will be submitted to *Geophysical Research Letters*.

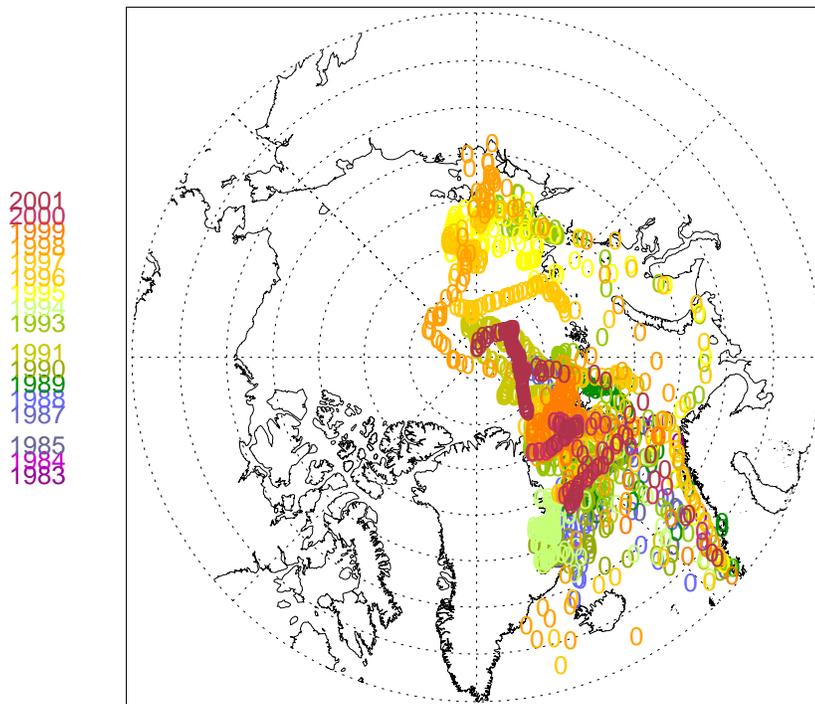


Figure 1: Locations of radiosonde data obtained by A. Schweiger from the *RV PolarStern* spanning 1983 to 2001.

Rutgers University (Francis) (please note funds received December 2003)

- Searched archives at the National Snow and Ice Data Center, Atmospheric Radiation Measurement Program, and other sources identified on the internet for Arctic radiosondes not included in the GTS data set. Several source of field data were found.
- Broadcast request for Arctic radiosonde data on the ArcticInfo listserver that is maintained by the Arctic Research Consortium of the United States (ARCUS). Approximately 30 responses were received and several new data sets identified and obtained.
- New data sources are listed in Table 2. Radiosondes compiled and sent to T. Reale at NOAA/NESDIS on CDROM. New data sets still arriving.

Plans for coming year

All three groups involved in this project are on track (with allowances for delayed receipt of funding), as outlined in the milestone chart included in our project proposal. The only task that has been delayed is the evaluation of the CARDS data set by NOAA/NESDIS. This data set has not yet been obtained, but a source has been identified and we have been promised that the data set will be made available to us.

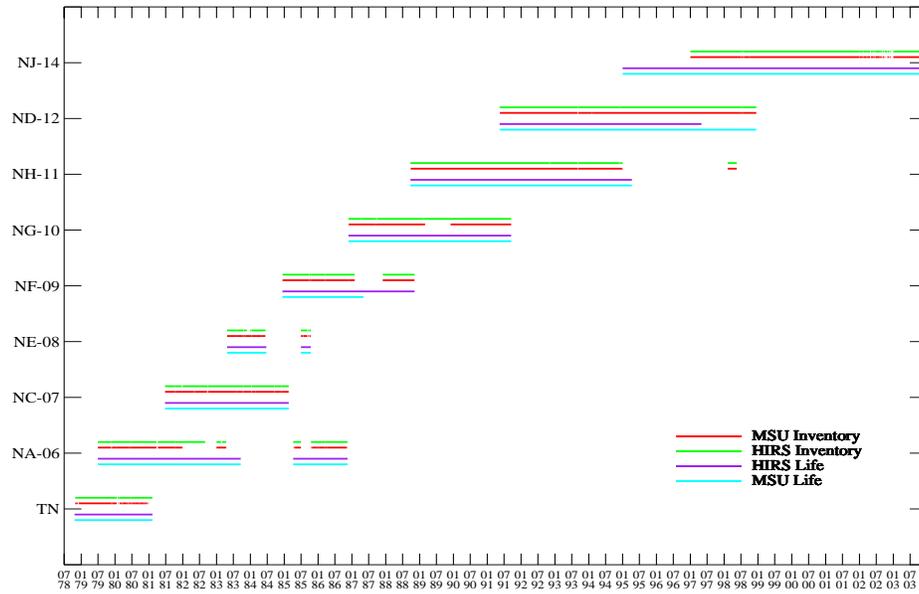


Figure 2: Inventory of data from the High-Resolution Infrared Sounder (HIRS) and the Microwave Sounding Unit (MSU), which are part of the TOVS instrument.

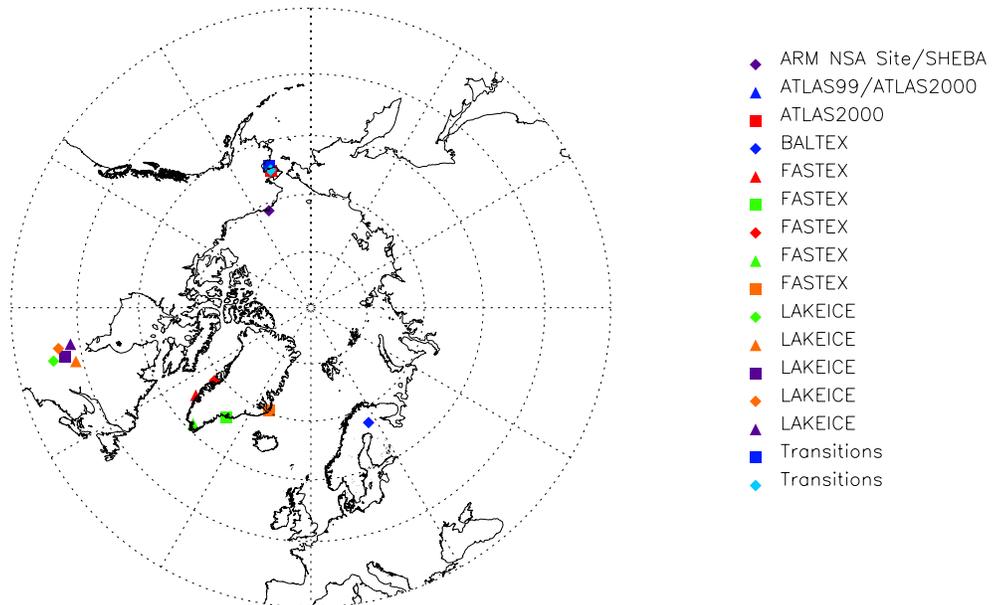


Figure 3: Locations of radiosonde data obtained by Rutgers group. See Table for time periods covered by each data set.

Financial Expenditures in 2003 and planned in 2004

NOAA/NESDIS

Funding for 2003 was received in July '03. The \$126,200 received was spent as follows: 85% for contractor technical personnel, 7% for NOAA/ORR overhead, and 8% for software, data storage devices, a laptop computer, and data acquisition. Funds for 2004 will be spent according to the NOAA budget submitted with the proposal.

University of Washington

Funding was received about 5 months ago, and since then it has been used to support salaries and benefits for Axel Schweiger and Mark Ortmeier. Approximately 1/3 of the funds have been committed to date. The remainder of 2003 funds and those for 2004 will be spent according to the U. of Washington budget submitted with the proposal.

Rutgers University

Funding was received about 4 months ago, and since then it has been used to support salaries and benefits for Jennifer Francis and Jaclyn Secora. Approximately 1/4 of the funds have been committed to date. The remainder of 2003 funds and those for 2004 will be spent according to the Rutgers budget submitted with the proposal.

Table 2: New Arctic radiosonde data sources identified by Rutgers

Name	Lat	Lon	Start	End	Notes
airs	71.323	-156.616	6/22/02	2/10/04	
aoe_2001			Jun-01	Aug-01	
arm	71.323	-156.616	5/19.1998	12/31/03	excluding 9/24/ 1998-8/2/1999, 12/ 30/1999-1/2/2000, 12/30/2000-1/2/ 2001,12/30/2001- 1/2/2002
atlas99	64.841	-163.7	7/23/99	8/11/99	
atlas 2000	64.841	-163.7	6/29/00	7/12/00	excluding July 3,4,5
atlas 2000	64.882	-163.681	6/29/00	7/12/00	excluding July 3,4,5
baltex	67.37	26.63	7/1/01	9/30/01	
cwv			0/0/1945	0/0/1991	
fastex	64.65	-52.72	1/1/97	2/19/97	excluding Jan 4,5,6,7,20,21,22,28 ,29,30,31, Feb 1
fastex	65.62	-37.65	1/1/97	3/1/97	excluding Jan 25
fastex	68.7	-52.87	1/1/97	3/1/97	
fastex	61.16	-45.44	1/1/97	3/1/97	
fastex	70.5	-22	1/1/97	3/1/97	
lakeice	45.535	-78.268	12/4/97	1/25/98	
lakeice	48.908	-77.119	12/2/97	1/24/98	
lakeice	47.39	-78.7	12/3/97	1/25/98	
lakeice	46.623	-80.793	12/4/97	1/25/98	
lakeice	48.568	-81.37	12/2/97	1/25/98	
np			4/19/54	7/31/90	
sheba	~71.323	~- 156.616	10/16/97	10/31/98	
transitions	64.112	-163.681	6/22/00	7/12/00	
transitions	64.841	-163.7	6/29/00	7/12/00	
cearex			9/17/88	5/19/89	
mizex-83			7/14/83	7/30/83	
mizex-84			6/3/84	7/21/84	
mizex-87			3/19/87	4/9/87	