FY2009 Work Plan For
NOAA's Climate Observations Program

High Resolution Climate Data From Research and Volunteer Observing Ships

November 2008

Period covered by this workplan: Oct 1, 2008 - Sept 30, 2009

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PROJECT SUMMARY

This project involves the measurement of direct high-resolution air-sea fluxes on one to two cruises per year and the development of a roving standard flux measuring system to be deployed on a series of NOAA and UNOLS research vessels to promote the improvement of climate-quality data from those platforms. An adjunct task is maintenance and operation of the C-band scanning Doppler radar and the stabilized wind profiling radar on the NOAA ship *Ronald H. Brown*. Because buoys and most ships and satellites rely on bulk methods to estimate fluxes, another aspect of this project is the use of direct measurements to improve the NOAA/COARE bulk flux algorithm. Originally one cruise was the annual TAO buoy tending cruise to 95 and 110 W on the *Ronald Brown*, but that has been discontinued in favor of an annual cruise to the equatorial Atlantic Ocean with Dr. Bob Molinari (AOML) as part of the African Multidisciplinary Monsoon Analyses (AMMA) and Saharan Dust studies. The second cruise, which also occurs in the fall, is the annual excursion to turn around the Stratus climate buoy at 20 S 85 W. A full suite of direct, inertial-dissipation, and bulk turbulent fluxes are measured along with IR and solar radiative fluxes, precipitation, and associated bulk meteorological properties. This effort represents a partial transition of research from the OGP CLIVAR PACS program to operations under the Climate Observations Program (COP).

The project development is the result of a recent NOAA-sponsored workshop on high-resolution marine measurements (Smith et al., 2003, *Report and Recommendations from the Workshop on High-Resolution Marine Meteorology*, COAPS Report 03-01, Florida State University, pp38) which identified three important issues with the planned NOAA air-sea observation system: 1) the need for a data quality assurance program to firmly establish that the observations meet the accuracy requirements, 2) the need for observations at high time resolution (about 1 minute), 3) and the need to more efficiently utilize research vessels, including realizing their potential for the highest quality data and their potential to provide more direct and comprehensive observations. For seasonal time scales, the net air-sea flux (sum of 5 flux components) must be constrained within 10 Wm^{-2}. Buoys and VOS systems are required to operate virtually unattended for months, so considerations of practical issues (e.g., power availability, instrument ruggedness, or safe access) are balanced against inherent sensor accuracy and optimal sensor placement. As discussed above, an important function of the in situ measurements is to provide validation data to improve NWP and satellite flux fields. Here, high time resolution and more direct observations are invaluable for interpreting surface flux measurements and diagnosing the source of disagreements; such information can be provided by suitably equipped research vessels (R/V). Thus, the accuracy of buoy and VOS observations must be improved and supplemented with high-quality, high time resolution measurements from the US R/V fleet (which is presently underutilized). The necessity for both high time resolution and high accuracy places extreme demands on measurements because some sources of error (such as the effect of ship flow distortion on wind speed) tend to average out over a large sample. To accomplish this task will require a careful intercomparison program to provide traceability of buoy, VOS, and RV accuracy to a set of standards.

This project directly addresses the need for accurate measures of air-sea exchange (Sections 5.2 to 5.4, *Program Plan for Building a Sustained Ocean Observing System for Climate*. The project is a joint effort by ESRL and Dr. Robert Weller of the Woods Hole

Oceanographic Institution (WHOI). NOAA COP funds the ESRL component and Dr. Weller is seeking NSF fund for the WHOI component. The ESRL Air-Sea Interaction Group website can be found at: http://www.etl.noaa.gov/et6/air-sea/. ESRL also cooperates with Dr. Andy Jessup (APL University of Washington) on radiative sea surface temperature measurements, Dr. Frank Bradley (CSIRO, Canberra Australia) on precipitation, Drs. M. Cronin and N. Bond (PMEL) on buoy-ship intercomparisons and climate variability analysis, and Dr. Mike Reynolds (DOE BNL) on radiative fluxes. A new website is under construction for this project (High Resolution Climate Observations http://www.esrl.noaa.gov/psd/psd3/air-sea/oceanobs/). An associated website (http://www.esrl.noaa.gov/psd/psd3/wgsf/) contains a handbook on best practices for flux measurements plus a database of high-resolution flux data. This work will be closely monitored by the WCRP Working Group on Surface Fluxes (WGSF) which is chaired by C. Fairall. This will give the project high visibility in the CLIVAR, GEWEX, and SOLAS programs. This project will be managed in cooperation with JCOMM (and other) panels as per instructions of Mike Johnson.

FY2009 PLANS

The major effort in FY09 will be execution of one climate cruise (NTAS WHOI climate buoy cruise), one NOAA/UNOLS research vessel flux system calibration cruise, and continued work on the *Ronald Brown* C-band radar. Approximately 30 days of air-sea flux data will on the WHOI buoy (15 N 51 W http://uop.whoi.edu/projects/NTAS/ntas.html) cruise (NTAS2009). The second component will be the redeployment of the roving flux standard. Our plan is coordinate with the SAMOS project to select the next ship for calibration and to try to select a ship where the work will also contribute to an OCO project. One possibility is to install the system in May 2009 on the University of Hawaii R/V *Kilo Moana* as part of the WHOI/UH WHOTS (23 N 158W http://uop.whoi.edu/projects/WHOTS/whots.html) buoy cruise (WHOTS-6). We will also participate in the fall 2008 R/V *Ronald Brown* cruise to the WHOI Stratus buoy as part of the VOCALS field program.

We plan to do another round of solar radiometer calibrations in Boulder to sort out the discrepancy between Eppley and Kipp & Zonen pyranomters.

We have been advising the US Coast Guard on meteorological instrumentation for the Icebreaker R/V *Healy*. In January 2008 they installed a completely new instrument suite. Dan Wolfe made two trips to Seattle, including a test cruise. We plan to write a report on our results and continue consulting with the *Healy* on their observations.

Construction will continue on the High Resolution Climate Observations website. Since the flux handbook has been completed, the main task will be creating an online version (in cooperation with Shawn Smith at FSU). We updated our ship data base so that all cruises through 2008 are publicly available but will continue with future cruises. Joint analysis projects with WHOI and PMEL will continue.

For the Ronald Brown radar systems project, a major maintenance is not planned this year for the C-Band radar. The Vaisala (formerly SIGMET) IRIS software licenses and maintenance will also need to be continued (this is k$9 per year). This year we plan to evaluate upgrading to a completely new version of the software at significant expense. This may also require hardware upgrades. We are pursuing separate funds to do this.

We will continue our cooperation with Huai-Min Zhang of NOAA NCDC on the SURFA project (http://www.ncdc.noaa.gov/oa/rsad/air-sea/surfa.html). The SURFA project is in an exploratory/setup phase. We have started archiving surface flux fields from the ECMWF, the German DWD, and NCEP operational global forecast models. During the next year we will expand the archiving of surface data sets and do some preliminary evaluations of the data.

Outreach efforts during the reporting period center on educational contacts through the University of Colorado CIRES Outreach program and the NOAA Teacher-at-Sea program. The fall 2008 WHOI climate buoy cruise will have one NOAA Teacher-at-Sea on board. In 2009 the PI will participate in a CIRES Outreach program for local middle school teachers.

FY2009 BUDGET SUMMARY

The total ESRL request to OCO for this project is k$356 in FY2007. This is augmented by k$29 in PI salary and about 50 k$ in other ESRL base contributions (salary, travel, etc). The OCO budget breakdown is as follows

Salaries, including overhead	161
Capital equipment	70
Travel	23
Shipping	18
Supplies	7
Sondes	18
Misc	5
IT support	27
Admin support	31

The breakdown of this budget is as follows: operations - 70%, data management - 10%, R&D - 20%. The program supports 0.75 federal FTE and 0.32 non Federal FTE; 0.30 Fed FTE are devoted to the project but not funded by it. See attached budget page for details.

DELIVERABLES

*Flux standard deployment (Ship to be selected) 2009.
*WHOI NTAS cruise – Obtain flux data, April - May cruise to Western Atlantic, *NOAA Ship Ronald H. Brown*.
*Process and post IPY ICEALOT2008 and AMMA2009 data to ESRL/PSD data archive.
*Process data and write report on R/V *Healy* and R/V *Knorr* measurements.
*Write a report on evaluation of climate quality meteorological observations on R/V *Ronald H. Brown* based on entire PSD database on that ship.
*Submit (jointly with WHOI) paper on intercomparison of ship-based and buoy fluxes at WHOI stratus buoy site.
*Perform pyranometer calibrations in Boulder.
*Perform intercomparison of SURFA data with WHOI Stratus buoy and ESRL R/V *Ronald H. Brown* observations.

OTHER NOAA BUDGET PROPOSAL

BUDGET COVERS FISCAL YEARS:	FY 2009
AMOUNT:	$360,010.89
PERIOD OF PERFORMANCE FOR FUNDS:	
PROJECT NAME:	ESRL Base Project: Ocean Obs
PROJECT NUMBER:	NEW
SPONSOR:	NOAA - Office of Climate Observations
PRINCIPLE INVESTIGATOR:	C. Fairall

BUDGET ESTIMATE FEDERAL LABOR	MO RATE	UNITS	QTY	AMOUNT
Wolfe	9,884	month	2	19,768
Welsh	9,093	month	1	9,093
Pezoa	5,956	month	5	29,780
Hazen	7,893	month	1	7,893
TITLE/NAME		month		0
Subtotal, NOAA Federal salaries	**32,826**	**months**	**9**	**66,534**
Subtotal, NOAA leave	21.0%			**13,972**
Subtotal, NOAA Federal Adjusted Labor Base				**80,506**
(31.07% exempt from NOAA Proposals) NOAA Support	32.4%			**26,084**
Benefits, NOAA (charged on NOAA labor)	25.0%			**20,126**
TOTAL FEDERAL LABOR				**126,716**

CIRES LABOR	AMOUNT PER MONTH	UNITS	OF MONTHS	AMOUNT
Bariteau	4,425	month	2	8,850
Hare	8,517	month	1.7	14,480
		month		0
		month		0
TITLE/NAME		month		0
Subtotal, CIRES labor	**12,942**	**months**	**4**	**23,330**
FICA, TIAA, Work Comp.	21.6%			**5,039**
Subtotal Cires Labor and Benefits				**28,369**
CIRES Support	20.0%			**5,674**
TOTAL CIRES LABOR				**34,043**

CONTRACT LABOR	AMOUNT PER MONTH	UNITS	OF MONTHS	AMOUNT
TITLE/NAME		month		0
TITLE/NAME		month		0
Subtotal, CONTRACT labor	**0**	**months**	**0**	**0**
Estimated Average for Contractor Benefits and Overheads	65.0%			**0**
TOTAL CONTRACT LABOR				**0**

OTHER DIRECT COSTS	AMOUNT
Shipping (R/V UNOLS 13; NTAS 5)	18,000
Field Site Expenses	0
Publications	5,000
Contracts	0
Travel ((R/V UNOLS - 10 ; Workshop - 3; NTAS 10)	23,000
Supplies & Materials (field - 7; sondes - 18)	25,000
Equipment [x] Capital [ ] Expendable	70,000
IT Support	26,582
Administrative Support	31,670
TOTAL OTHER DIRECT COSTS	**199,252**
TOTAL	**360,011**

Preparer of Budget Sheet: Jo Novosel, Management Analyst, 303 497 6588 fax: 303 497 7287 email: josephine.c.novosel@noaa
Organization: DoC/NOAA/OAR/ ESRL/Physical Sciences Division
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Director of Physical Sciences Division, William D. Neff
Comments: The overheads have been adjusted to reflect "other NOAA" proposal.