

Announcement of the FY10 NOAA's Internal and Directed Research Funding Opportunity

In support of the

Joint Center for Satellite Data Assimilation (JCSDA)

Executive Summary

- Federal Agency Name(s): National Oceanic and Atmospheric Administration (NOAA), Department of Commerce
- Funding Opportunity Title: Joint Center for Satellite Data Assimilation (JCSDA) Science Development and Implementation (JSDI)
- Dates: Proposals addressing the specific issues highlighted in this text are due December 31st, 2009. Information requests are welcome anytime before proposal submission.
- Point(s) of Contact: For additional information, please send an email to Dr Sid-Ahmed Boukabara, JSDI Program manager and Selecting official. sid.boukabara@noaa.gov, Tel. 301 763 8136 x 195.
- Available Funding: It is expected that the level of funding for this year's opportunity will be similar to previous years funding levels.
- Scope: This NOAA/NESDIS funded opportunity addresses the directed research part of the JCSDA program. It is aimed, as its name indicates, at developing and implementing science which addresses JCSDA-related NOAA's objectives. In particular, it aims at transitioning to operations, science related to data assimilation of current and planned sensors, with an emphasis on NOAA partner's needs (NESDIS/STAR and NWS/NCEP).
- Submission Method: Proposals are to be submitted by e-mail. A proposal template is included in the announcement.
- Eligibility: All JCSDA NOAA partners (NESDIS/STAR and NWS/NCEP) scientists are eligible to apply. Other scientists/institutions, if their expertise is not within NOAA partners but needed by NOAA partners, could be eligible at the discretion of the selecting official and the recommendation of the review panel.

Review Process:

The FY10 JSDI announcement is intended to be transparent and competitive within NOAA (NESDIS/STAR and NWS/NCEP). An independent review panel will be put in place to evaluate the JSDI applications. The review panel will be composed of five members: two members appointed by NESDIS/STAR, two members appointed by NWS/NCEP and the JCSDA director. To avoid conflict of interest, review panel members should not be applicants or co-applicants in the JSDI proposals. The average of the independent review board members scores will be used to produce a rank ordering of the proposals. The Selecting Official shall award in the rank order unless the proposal is justified to be selected out of rank order based upon one or more of the following selection factors *[(1) Availability of funding, (2) Balance and distribution of funds (by research area, by project type, by type of partners), (3) Duplication of other projects funded or considered for funding by NOAA/federal agencies, (4) Program priorities and policy factors, (5) Applicant's prior award performance]*. The Program Official and/or Selecting Official may negotiate the funding level of the proposal. The Selecting Official makes final recommendations for award to the appropriate NOAA/NESDIS representative who is authorized to obligate the funds and execute the award.

Other Information:

Three of the major criteria for the selection are:

- (1) The clear identification of the relevance of the proposed effort to the focus areas listed in this announcement.
- (2) The clear identification of a path leading from the research setting to the operational setting where a specific gap in the operational implementation was identified. It could either be a science shortcoming or the absence of a promising sensor in the operational assimilation system (especially if it has been shown by other centers that its impact is significant). For this reason, and in order to foster stronger collaboration between NESDIS and NCEP partners, joint proposals where scientists from both NESDIS/STAR and NWS/NCEP are listed as co-Investigators, will have a preference.
- (3) It is critical to have the appropriate science features in the assimilation systems in order to be able to assimilate satellite data. For instance, it is important to implement the science that handles the cloudy radiances in order to be able to assimilate cloud-impacted radiances. On the other hand, it is deemed necessary to assimilate real data from sensors in order to take

full advantage of an implemented science improvement. There is no point implementing an aerosol assimilation technique for instance if there is no plan to assimilate aerosol sensitive data. For this reason, the proposals that present a combination of satellite data assimilation and a science improvement and/or implementation to take advantage of the satellite data, will have an added preference.

Proposals Format: Proposals submitted in response to this announcement must follow the proposal template included in this text. This template has been significantly streamlined. Note that clearly defined milestones, paving the way to operational transition, and quarterly reporting should be part of the proposal content.

A. Funding Opportunity Description

The mission of the Joint Center for Satellite Data Assimilation (JCSDA) is to *accelerate and improve the quantitative use of research and operational satellite data in weather, ocean, climate, and environmental analysis and prediction systems*. This opportunity broadly supports this mission. This opportunity also supports the JCSDA short-term goal to *contribute to making the forecast skill of the operational NWP systems of the JCSDA partners internationally competitive by assimilating the largest possible number of satellite observations in the most effective way*. The implementation of the JCSDA program consists of four major elements: (1) an internal (directed) research (this announcement addresses this component); (2) a visiting scientist program; (3) an external research; and (4) a training, education and outreach program. The Directed Research Program is aimed at near-term efforts to bring recent developments and new satellite data to the threshold of operational implementation. The visiting scientist program allows the JCSDA and its partners to benefit from direct interaction with some of the experts in the field of data assimilation and numerical modeling. The External Research Program is designed to support longer-term research and development projects and to take advantage of the knowledge in the broader research community in areas where there are gaps in the expertise internally available amongst the JCSDA partners.

The Directed Research Program, the object of this announcement, primarily supports development activities at the partner agencies, in this case NOAA. It takes advantage of the in-house expertise in satellite remote sensing, radiative transfer, data assimilation, and numerical environmental models. Priorities for the program are assigned on a year-to-year basis and projects are focused on rapidly transitioning research to operations and on developing and exploiting the major JCSDA coding and computational infrastructure capabilities of the JCSDA partners. The funding available from this announcement constitutes the NOAA internal dedicated contribution. For reference, the JCSDA Memorandum Of Agreement (MOA) lists a number of strategic objectives that give the overall areas where the JCSDA should put its effort.

1. Optimize the utilization of current and future satellite data in environmental analysis and prediction (numerical weather, climate, oceanographic, and, in the future, space weather);
2. Effect the transition of maturing research and development results into the operational environments;
3. Reduce the average time required to implement the use of satellite data in operations following the launch of a new instrument;

4. Assess the impacts of data from advanced satellite sensors and relevant in situ observing systems on operational analysis and prediction;
5. Contribute to the planning of future observing systems and develop tools for effective integration of future satellite observations into environmental models, including performing Observing System Simulation Experiments;
6. Adapt, implement, and develop the scientific algorithms needed to assimilate data from the advanced satellite sensors;
7. Advance common numerical weather prediction models and data assimilation infrastructure;
8. Develop and implement a community radiative transfer model for satellite data assimilation.

A primary measure of potential impact in this solicitation will be the acceleration of satellite data usage into NOAA forecast systems, and the improvement of forecasts from those systems. More precisely, according to the most recent Annual Operating Plan adopted in FY09 by the JCSDA Management Oversight Board (MOB), the performance of JCSDA will be monitored via two types of quantitative indicators:

- I. Forecast skill measures:
 - a. A composite JCSDA skill index calculated from key forecast parameters for each system operated by the JCSDA partners.
 - b. 500 hPa anomaly correlation coefficients at day 5, both hemispheres.
- II. Satellite data utilization measures:
 - a. Total number of satellite observations assimilated on average per 24-hour period in a fixed set of partner data assimilation systems.
 - b. Total number of individual satellite sensors contributing to forecast skill.

B. Identification of Focus Areas:

A thorough identification of gaps was undertaken to come up with a list of focus areas. These focus areas and specific scientific objectives mentioned in the announcement text below, have been identified using a combination of different JCSDA sources: (1) the JCSDA Memorandum of agreement (MOA), (2) the JCSDA working groups identified focus areas, (3) the JCSDA program plan, (4) the JCSDA sensors priority list and (5) the most recent JCSDA annual operating plan as approved by the JCSDA Management Oversight Board (MOB).

These focus areas are a mixture of:

- 1. Short-term Goal Driven Objectives:

This set of focus areas were adopted from the most recent JCSDA Annual Operating Plan as agreed upon by the JCSDA Management Oversight Board (MOB), to achieve the short-term goal of the JCSDA.

1. Data impact assessment. For each major system change and each major change to the Global Observing System, a comprehensive suite of data denial experiments for all major component of the observing system should be carried out. A sustained data impact assessment effort involving both Observing System Experiments (data denial) and adjoint sensitivity tools is a necessary tool for monitoring progress and overall health of the systems and for tracking how well we are doing compared to other centers.

2. CRTM maintenance and development. Radiative transfer simulation is a critical element of modern satellite data assimilation, and the Community Radiative Transfer Model is the most important jointly owned and operated JCSDA system component. A sustained effort to maintain and develop the CRTM, involving contributions and staff from all partners, is a vital part of the Joint Center's effort to improve the utilization of current sensors and to prepare for the data assimilation of future sensors. The specific tasks to address this objective are listed in the *Experts Focus Areas* section.
3. Monitoring and improvement of satellite data utilization. Dedicated personnel within each JCSDA partner (in this case NOAA) must be assigned to each major satellite data type, e.g. infrared sounding, microwave sounding, feature tracking winds, surface winds, GPSRO. The work of the staff assigned to a given data type does not stop once these data become operational for the first time. Success in NWP requires continuous monitoring and fine-tuning of the assimilation of each individual data type. In order to facilitate the exchange of information and avoid unnecessary duplication of effort, the Joint Center will create and maintain a central repository containing information from all partners about calibration, bias correction, quality control, data screening, typical impact and observation minus background statistics for all major satellite sensors.
4. Preparation for new sensors. Issues related to data flow, data formatting, CRTM performance and error covariance modeling must be resolved and assimilation efforts must be resourced well in advance of launch of upcoming sensors. A robust OSSE effort must also be developed in order to be able to assimilate simulated measurements from the new sensors before they are launched.

- **2. Experts Focus Areas:**

A number of the JCSDA working groups have suggested focus areas for the JCSDA to work on in their respective areas. These areas were generally provided by the working groups co-chairs and are deemed to represent the JCSDA internal experts opinions on what the JCDA should focus on. These objectives are listed below:

- 1- Community Radiative Transfer Model (CRTM) Working Group:
 - a. Spectroscopy improvements to benefit CRTM (implementation of FFO-funded projects).
 - b. Capability of maintaining a high-quality spectroscopy data base from ultraviolet to microwave wavelengths. CRTM fast models need to be periodically updated using the new line by line data base.
 - c. PC RTM or generalized spectral sampling method for hyper-spectral sensors.
 - d. Efforts in CRTM to facilitate Cloudy radiance assimilation (to be coordinated with data assimilation of cloudy radiances).
 - e. Land surface emissivity.
 - f. CRTM for Visible/UV sensors. The Vis./UV component is already implemented in CRTM version 2. But it is expected there will be many issues once the model starts being used, especially the surface BRDFs. Currently we do not have a set of BRDFs for various surface types.
 - g. Complete the implementation of the new ocean microwave emissivity model for the CRTM. (suggested by the Microwave Working group)

- h. Complete CRTM transmittance coefficients for upcoming new satellite sensors including SMOS, SMAP, MIS and GMI (*suggested by the Microwave Working group*).
 - i. CRTM enhancements and developments including test and evaluation of version release, NLTE effects for IR shortwave, preparing for new sensors such as SMOS, SMAP, and surface microwave and IR emissivity updates and improvements, etc (*suggested by the JCSDA senior scientist*)
- 2- Air Quality JCSDA Working Group:
- a. Expand CRTM to cover the UV/visible region to facilitate aerosol assimilation work.
 - b. Development of and Operational implementation of global geostationary based biomass burning emissions.
 - c. Modify GSI code so satellite (MODIS or GOES or any future satellite dataset) can be assimilated into either a global or a regional model.
 - d. Development of QA/QC procedures for satellite-based aerosol data assimilation across multiple platforms.
 - e. Development of partial ozone columns and assimilation of partial ozone columns for air quality forecasting applications
- 3- Microwave Sensors Working Group:
- a. Complete tangent linear, adjoint, and forward model codes of GFS moisture microphysics schemes and incorporate them into GSI system.
 - b. Complete examination of the impact of the moisture microphysics tangent linear, adjoint, and forward models on the GSI strong constraints.
 - c. Complete developments of the two-layer microwave snow emissivity model impact test in the GFS system
- 4- GPS/RO:
- a. Improvement of the forward operator (and consequently, quality control procedures and observation error characterization),
 - b. Monitoring of the current GPS RO instruments
 - c. Preparation for new RO sensors.
- 5- Land (*from the executive team*):
- a. Testing and validation of land surface data sets such as surface albedo, vegetation fraction
 - b. Assimilation of soil moisture and preparation for SMAP
- 6- Oceans Working Group (*and from the executive team*):
- a. Improved use of altimetry observations for ocean data assimilation. More explicitly: Data quality in coastal areas, particularly representation / removal of tidal signatures, assimilation in ocean models that explicitly model tides and internal tides, real time QC, synthetic TS profile data from altimeters. Focus should be on Jason-2 and fast delivery products
 - b. Transition to operations of advanced SST assimilation and ocean surface layer modeling. Assessment of data quality at high latitudes, particularly ice-free Arctic Ocean in the summer.
 - c. Observing, modeling and assimilation of diurnal cycle in SST
 - d. Consolidating wind wave data assimilation approaches between NOAA and Navy, tentatively focusing on variational approaches. Using wave physics and possibly wave ensemble data in assimilation schemes. Assimilate spectral ASAR data into wave model. QC and data quality assessment of ASAR data.

Establishing operational ENVISAT ASAR data stream using algorithms that do not depend on wave model data.

- e. Ocean data assimilation (Going toward unified assimilation approaches for low-resolution and eddy resolving models, Consolidate NOAA and Navy assimilation methods to maximize leveraging of efforts, Development of next-generation operational assimilation schemes. Note that NOAA is mostly focusing on hybrid variational approaches).

- **3. Sensor-Driven Objectives:**

Many sensors, including from NOAA, NASA, US, DoD and international partners are either not utilized, under utilized or utilized reasonably well but areas of improvements have been identified. The JCSDA has established a master version of sensors (current and upcoming) and their relative importance for each partner. The list also includes the expected impact of these sensors (on global NWP forecast, on mesoscale forecast and on climate applications). Access to the master version of the sensors priorities is possible upon request. Efforts are sought to ensure that the most promising, high-priority sensors are optimally assimilated in NWP assimilation systems. Efforts should be made to streamline the process of assimilating sensors data. This will facilitate the repetition of this process for future sensors.

- **4. Science-Driven Objectives:**

Science-driven focus areas have been collected by polling the different JCSDA executive team members, experts and senior scientists. Only those relevant to NOAA immediate needs are listed in this section.

- 1- Snow/soil moisture assimilation work for LIS. LIS is/will be common at NCEP, NASA, AFWA.
- 2- OSE from microwave (AMSR-E, F-16/18 SSMIS UPP data), infrared (IR water vapor etc) and some pre-operational tests, GPS data sets.
- 3- Cloudy radiances assimilation focusing on developments of moisture physics tangent linear and adjoints and uses of microwave cloud-affected data.
- 4- Review of Quality Control (QC) and pre-processing procedures in NWP assimilation systems, to come up with the best strategy that will maximize the forecast skill.
- 5- Quality control of GOES (and other) geostationary winds.
- 6- In light of recent experiments, efforts are sought to improve the issue of assimilating radiances by carefully assessing the assimilation of retrievals, in the JCSDA operational systems, identifying the elements of retrieval algorithms that enhance the impact of retrievals in analyses and NWP skill, a careful comparison with the procedures used in radiance assimilation, and modification of the radiance assimilation procedures if warranted.
- 7- Efforts are sought to improve the height assignment of feature-tracked winds.

- **5. Technical Implementation Objectives:**

These objectives aim at working on the development and implementation of formatting tools, visualization tools, monitoring tools, databases, etc. Although these efforts are not necessarily improving the science of the data assimilation per se, they are however critical in ensuring that the system, the interfaces, etc are all functioning optimally. Part of these efforts, it is expected that tools and software packages will be made portable to

facilitate their transition to any platform and to be made flexible, in order to make them re-usable and expandable. This will help minimize the overall cost over time.

- 1- Unified Satellite data handling for getting data BUFRed from DMSP, SMOS, ADM, FY3, etc.
- 2- Complete processing of NPP simulated ATMS BUFR ingests and dump into repository for EMC and STAR users to test (*from Microwave Working group*)
- 3- Complete the implementation of the F16 SSMIS UPP data at low atmospheric sounding channels into the operational GFS (*from Microwave Working group*)
- 4- Efforts are sought to help establish the JCSDA infrastructure (software integration, reception, testing, portability, as well as hardware)

C. Evaluation Criteria:

The review criteria have the twofold objective of identifying the projects that fall within JCSDA priorities and to rank them by priorities. This priority setting is dictated by the limited resources available. To maximize their chances, the project PIs should demonstrate their track-records in transitioning science and software into operational systems.

#	Specific Criteria	Maximum Score	Actual Score
1	Importance, relevance and applicability of proposal to the short-term goal -driven objectives. Does this proposal address one, or some of the listed objectives?	30	
2	Importance, relevance and applicability of proposal to the experts focus areas listed in the text above. Does this proposal address one, or some of the listed focus areas?	30	
3	Importance, relevance and applicability of proposal to the sensors-driven objectives listed in the JCSDA sensors master list. Does this proposal offer to extend the assimilation to one, or some of the NOAA sensors?	20	
4	Importance, relevance and applicability of proposal to science-driven objectives listed in the text above. Does this proposal address one, or some of the objectives?	20	
5	Importance, relevance and applicability of proposal to technical implementation -driven objectives listed in the text above. Does this proposal address, one, or some of the objectives	10	
6	Technical and Scientific Merit: This criterion assesses whether the approach is technically sound, if the methods are appropriate, and whether there are clear project goals and objectives.	25	
7	Appropriate partnerships within JCSDA's NOAA partners (NESDIS/STAR, NWS/NCEP) to achieve the highest quality content and maximal efficiency in transitioning research to operations	10	
8	Identification in the proposal of the path and process that will allow a proper monitoring of the progress and maximize the likelihood of successfully transitioning the work into NWP operations (reviews, milestones, deliverables, reporting, etc)	15	
9	Budget and staffing narrative justify project personnel associated with each task	30	
10	Overall Qualifications of Applicants. This criterion ascertains whether the applicant and supporting personnel possess the necessary education, experience, training, facilities, and administrative resources to accomplish the project.	10	
Total Score		200	

JCSDA SCIENCE DEVELOPMENT AND IMPLEMENTATION TASK PROPOSAL

Proposal Title
Date

Principal Investigator (s):
Co-Investigator(s):
STAR Point(s) of Contact:
EMC Point(s) of Contact:

1. PROPOSAL DESCRIPTION

Please give a brief description of the project, prior research results or literature references indicating sufficient maturity and the clear potential for transition to NWP operations. How does the suggested project contribute to JCSDA goals and focus areas as listed in the call full text? Describe technical backgrounds of the task support scientists involved in this project.

2. TASK(S) DESCRIPTION & REQUIREMENTS

While section 1 describes the general concept of the proposed work, summarize in this section the specific work activities, or tasks. What do you intend to accomplish for this effort? The proposals could be part of a multi-year effort, but the period of performance reported in this proposal is one year. First, give a description of the technical details of the tasks, then list in the table below (1) the key milestones to be accomplished (key milestones will be used to track the status of the project), (2) the deliverables and who will receive the items (this should support the technology transition plan in next section), (3) the staffing required to support the particular task (names and percent FTE should be identified in here) and (4) the required budget to achieve that task's objectives (to support the contractors). The following format is suggested:

Task#1: Technical Details...(show how this task addresses one or some of the focus areas in the JSDI call, give rationale for the required budget and staffing to achieve the objectives of this task, briefly mention the technical background of support personnel, etc)

Task#2: Technical Details...

	PI (s) & co-Is	Key Milestones	Deliverables (if any)	Contrac. Staffing (names & % FTE)	Required Budget
Task #1: Implementing Tool X		- Pre-Operational implementation completed June 2010 - Operational testing completed in Sept 2010	- Final version of tool (June 2010)	Contractor#1: 0.3 FTE Contractor#2: 0.1FTE	\$50K
Task #2: Developing Technique Y		...Etc..	...Etc..	...Etc..	\$70K
Total					\$120K

Table 1. Sample table containing the major requirements needed to assess the proposed effort.

3. TRANSITION TO OPERATION

Summarize your concept for technology transition. This section should state what would be the steps and timeline to transition the work to operations. What reviews will you perform to assess the tasks progress? When will development phase start/end? When will the task be tested in pre-operational mode? When will the work be transitioned to operations? The plan should also clearly identify the mechanism for collaboration of your proposed efforts within NOAA (between NESDIS/STAR and NCEP/EMC).

4. REPORTING

Quarterly reports describing the status of the project should be part of the proposal. A sample quarterly report is provided in the annex of this document to facilitate the implementation of this requirement. In addition, results from the proposed work are expected to be presented at conferences, review meetings, workshops, etc. Please list what the plans are for reporting the suggested project results to the scientific community and JCSDA partners.

5. ADDITIONAL BUDGET

If there is an additional budget requirement for this proposal (besides the contractors budget listed in section 2), include it in this section along with the purpose (travel, training, publication, hardware, software).

JCSDA Science Development and Implementation (JSDI)
Nth Quarterly Report (Period between Month 1 and Month 2)

Date

PI Name (s):

Co-I Name (s):

Support Contractor (s):

Proposal Title:

1. Quarterly Highlights

In this quarter, the following tasks have been completed:

- ...
- ...
-

2. Technical Descriptions

A couple of paragraphs in each area with some figures, divided by individual contributions

Contractor support #1:

Contractor support #2:

Etc

3. Publications/Presentations/Conferences/Meetings

4. Plans for Next Quarter

We will investigate the following topics....

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