



DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P.O. BOX 17300
FORT WORTH, TX 76102-0300

22 Dec 2022

REQUEST FOR STATEMENT OF INTEREST
Number W9126G-23-2-SOI-1033

Applicants must be a member in one of the Cooperative Ecosystem Studies Units (CESU):
Gulf Coast / Great Plains

**Project Title: Development and Application of Compound Flood Hazard
Estimation Method for Coastal Texas for USACE Galveston District**

Responses to this Request for Statements of Interest will be used to identify potential investigators for this project. Up to **\$602,000** is expected to be available to support this project for the **base year**. Additional funding may be available for additional tasks and/or follow on work in subsequent fiscal years to the successful Recipient/Awardee.

Background: Provide research, technical assistance and education to federal land management, environmental and research agencies and their potential partners; develop a program of research, technical assistance and education that involves the biological, physical, social sciences needed to address resource issues and interdisciplinary problem-solving at multiple scales and in an ecosystem context at the local, regional, and national level; and place special emphasis on the working collaboration among federal agencies and universities and their related partner institutions.

Type of Award:

In accordance with section 6305 – *Using cooperative agreements of the Federal Grant and Cooperative Agreements Act of 1977* (31 U.S.C. § 6301 et seq.), all CESU projects must carry out a public purpose of support or stimulation, instead of acquiring goods or services for the exclusive direct benefit of the United States Government.

In accordance with section 6305 – *Using cooperative agreements of the Federal Grant and Cooperative Agreements Act of 1977* (31 U.S.C. § 6301 et seq.), substantial involvement is expected between the federal partner and the nonfederal partner when carrying out the activities specified in the project agreement. The exact nature of the government's involvement will be defined in the statement of objectives, issued with a request for full proposal.

As a result, it is anticipated that a cooperative agreement through the CESU program will be awarded. Such awards may be administered through a CESU only upon mutual agreement and official authorization by both parties of the acceptance of the application of the CESU Network IDC rate (17.5%).

NOTE: Must be a non-federal partner in the Cooperative Ecosystem Studies Units (CESU) Program to be qualified for consideration.

Brief Description of Anticipated Work:

This research focuses on the following objectives:

“See Attached Statement of Objectives”

NOTE: At this time we are only requesting that you demonstrate available qualifications and skills for performing similar or same type of work. You will be evaluated for request for a proposal based on skills and qualifications demonstrated in your SOI.

Period of Performance. The base year of agreement will extend 12 months from date of award. There may be three 12 month follow-on periods of performance based on need and availability of funding.

Materials Requested for Statement of Interest/Qualifications:

Please provide the following via e-mail attachments (Maximum length: 2 pages, single-spaced 12 pt. font).

1. Name, Organization, Cage Code, Duns number, and Contact Information (Email)
2. Brief Statement of Qualifications (including):
 - a. Biographical Sketch,
 - b. Relevant past projects and clients with brief descriptions of these projects,
 - c. Staff, faculty or students available to work on this project and their areas of expertise,
 - d. Any brief description of capabilities to successfully complete the project you may wish to add (e.g. equipment, laboratory facilities, greenhouse facilities, field facilities, etc.).

Note: A full study proposal and proposed budget are NOT requested at this time.

Review of Statements Received: All statements of interest received will be evaluated by a board comprised of one or more people at the receiving installation or activity, who will determine which statement(s) best meet the program objectives. Based on a review of the Statements of Interest received, an investigator or investigators will be invited to prepare a full study proposal. Statements will be evaluated based on the investigator’s specific experience and capabilities in areas related to the study requirements.

Please send responses or direct questions to:

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Timeline for Review of Statements of Interest: RSOI's required to be posted on www.Grants.gov for 30 days, prior to the Government making a decision and requesting full proposals. Responses are due by 5:00 P.M., Central Time, on **22 January 2023**.

[End of RSOI]

STATEMENT OF OBJECTIVES
for
Development and Application of Compound Flood Hazard Estimation
Method for Coastal Texas
for
USACE Galveston District

1.0 PURPOSE

1.1 The Galveston District Civil Works program ensures military mission activities are conducted in compliance with all applicable environmental laws, regulations, and policies. Article I B of the master agreement states the objectives of the CESU are to: provide research, technical assistance and education to federal land management, environmental and research agencies and their potential partners; develop a program of research, technical assistance and education that involves the biological, physical, social sciences needed to address resource issues and interdisciplinary problem-solving at multiple scales and in an ecosystem context at the local, regional, and national level; and place special emphasis on the working collaboration among federal agencies and universities and their related partner institutions.

1.2 This work requires an onsite support person located at SWG, Galveston, TX. USACE SWG will provide overall direction for the study, perform programmatic management, and resolve any significant programmatic issues outside the control of the project team, and as scoped here-in. In addition to providing overall direction, USACE SWG will provide technical reviews of Task 3, 4, 6, 9, and 12 products. USACE SWG will coordinate with task leads to ensure task products and/or data is available for review and collection to collaborators as needed. USACE SWG will coordinate internal and external meetings including scheduling, developing agendas, facilitating discussions, and providing meeting minutes.

2.0 AUTHORITY

2.1 This cooperative agreement will be awarded using one of the following authorities

- ☐ **16 U.S.C. § 670(c) (1) – (SIKES ACT)**, USACE Acquisition Instruction (UAI) Part 5101, Version 4 dated 25 Jan 2017, revised July 2018, re-delegation of Authority in 16 U.S.C. §670C-1.
- ☒ **10 U.S.C. § 2358** - Research and Development, UAI Part 5101.
- ☐ **10 U.S.C. § 2684a** - Agreements to limit encroachments and other constraints on military training, testing, and operations, UAI Part 5101.

- ☐ **10 U.S.C. § 2684** – Cultural Resources, Delegation of Authority under Title 10 United States Code, Section 2684 – Cooperative Agreements for Management of Cultural Resources.
- ☐ **10 U.S.C. § 2701d** - Responsibilities under the Defense Environmental Restoration Program (DERP), UAI Part 5101.
- ☐ **33 USC 2339 Water Resources Development Act of 2000** - Delegation of Authority under Section 213a of the Water Resources Development Act of 2000, dated 10 March 2015. **(SCA AGREEMENT) Assistance Listing: 12.010**

In agreement with the above stated goals, the recipient agrees to provide the necessary personnel, equipment, and materials required to implement, activities to support the installation's commitment toward environmental stewardship to manage natural and cultural resources in a responsible way that has the least impact on military missions and is beneficial to the region. In addition, the activities performed by the recipient must be completed in a manner conducive to guidelines outlined in the Endangered Species Act (16 USC 1531 et seq.), the Migratory Bird Treaty Act (16 USC 1361 et seq.), National Historic Preservation Act (54 U.S.C. 300101 et seq.), Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 et seq.), the Archaeological Resources Protection Act (16 U.S.C. 470 et seq.), the National Environmental Policy Act (42 U.S.C. 4321 et seq.), applicable implementing regulations, Army Regulations 200-1, and any other applicable regulatory guidelines.

2.2 In accordance with section 6305 – *Using cooperative agreements* of the *Federal Grant and Cooperative Agreements Act of 1977* (31 U.S.C. § 6301 et seq.), all CESU projects must carry out a public purpose of support or stimulation, instead of acquiring goods or services for the exclusive direct benefit of the United States Government. Examples of carrying out a public purpose may include, but are not limited to, the following:

- Project results are made available to a wide audience (including nonfederal entities)
- Project results/outputs add to the scientific literature/knowledge base, with applicability and utility beyond the scope of the project footprint/study area
- Academic and other nonfederal partner institutions (and their personnel) gain professional experience, increase knowledge, and develop skills and abilities
- Students benefit from direct interaction with federal scientists, program and technical staff, and field unit managers

2.3 In accordance with section 6305 – *Using cooperative agreements* of the *Federal Grant and Cooperative Agreements Act of 1977* (31 U.S.C. § 6301 et seq.), substantial involvement is expected between the Department of Defense and the recipient when carrying out the activity contemplated by the cooperative agreement. The DoD agrees to participate at a national level in support of the CESU program as accepted in the Master

MOU for the establishment and continuation of the CESU program Article II 1-4 and Article VI 1-7.

The installation further (hence DoD) agrees to provide substantial involvement as directed under the appropriate master agreement to include, but are not limited to, the following:

- District is involved in development of study methodology, data gathering, analysis, and/or report writing
- District actively participates and collaborates in carrying out the project plan of work, reviews and approves activities, helps train or select project staff or trainees
- District incurs in-kind or direct expenditures in carrying out the activities specified in the project agreement. Examples include, but are not limited to, the following: (Choose what applies must have at least 2 and you can add others that apply)
 - Providing computing services
 - Providing staff time to work on the project

3.0 DESCRIPTION OF OBJECTIVES

3.1 Task 1: TX Statewide High-resolution TC-Rainfall Generator and Rainfall Database.

Task T1.1: High-resolution statewide observational rainfall dataset

Develop downscaled high-resolution statewide observational rainfall dataset for tropical and non-tropical events based on PRISM and other datasets extending back to the 1980s.

- T 1.1.1: Downscaling of PRISM daily precipitation to hourly scale across Texas.
- T 1.1.2: Evaluation of this product with respect to available hourly rain gages or other appropriate datasets.
- T 1.1.3: Develop progress PPT slide-decks, provide all data, codes and results, and develop draft and final reports.

Deliverables: Data Package (including rainfall dataset, codes); PPT slide-decks; Draft and Final reports.

Task T 1.2: High-resolution statewide parametric TC rainfall generator

Develop a high-resolution rainfall generator that can be used statewide to generate rainfall fields for all synthetic TCs used in the EJPM-OS framework.

- T 1.2.1: Quantification of IPET TC rainfall model uncertainty and bias by leveraging datasets from Task T1.1, and development of a high-

resolution (hourly, 0.05-degree) probabilistic TC rainfall generator for Texas.

- T 1.2.2: Creation of deterministic (i.e., bias-corrected) and stochastic rainfall fields for all 660 synthetic TCs in the JPM set.
- T 1.2.3: Develop progress PPT slide-decks, provide all data, codes and results, and develop draft and final reports.

Deliverable: Data Package (including rainfall fields, codes and data); PPT slide-decks; Draft and Final reports.

3.2 Task 2: Update Coastal Joint Probability Method-Optimal Sampling for TX (No rainfall) Review Support

Apply updated climatological data sources for screening historical storms at locations along the coastline to conduct storm recurrence analysis and update marginal and joint probability distributions of TC parameters for coastal forcing.

Task 2.1: Update storm climatology review support

- o T 2.1.1: Collect historical TC data from the HURDAT2, ATCF, and EBTRK databases (to update storm probability masses).
- o T 2.1.2: Perform data imputation to fill in gaps in historical central pressure deficit and radius of maximum wind data using Gaussian process metamodeling (GPM) techniques
- o T 2.1.3: Screen historical TCs at Texas coastal reference locations (CRLs).

Task 2.2: Update parameterizations (JPM) review support

- o T 2.2.1: Compute storm recurrence rates (SRR) of TCs at CRLs (will include latest model developments).
- o T 2.2.2: Update marginal probability distributions of TC atmospheric forcing parameters at CRLs.

Task 2.3: Synthesis of updated results review support

Assess and incorporate correlation between inland parameters and TC parameters for joint probability model

- o Apply meta-Gaussian copula to compute the correlations between TC parameters
- o Compute correlation between TC forcing parameters (central pressure deficit, forward velocity, radius of maximum wind, heading direction, location).
- o Integrate results to develop updated TC hazard curves
- o Revised bias and uncertainty, incorporation any additional validation TCs completed within the schedule of this task
- o Combine tropical and non-tropical hazard curves

Deliverable: Data Package (including data, models/codes, error/bias estimates), PPT slide-decks, draft and final report.

3.3 Task 3: Extend Joint Probability Method-Optimal Sampling for TX to include Rainfall

Framework development:

- o T 3.1: Support establishment of dependencies (using coincident analysis) for the three Pilot regions and the RGV BLE domain between TC and inland hydrological/hydraulic parameters. This task will include non-tropical storm selection, correlation between coastal water level and precipitations, development of a generalized stage hydrograph, and hydrograph timing based on lag between coastal water levels and peak streamflow.
- o T 3.2: Evaluate statistical differences between LWI and CHS PCHA/Tier-2 approaches and implement where appropriate. This assessment includes (i) comparisons of the use of spatially-varying storm recurrence rates to global recurrence rates over the study region with a frequency distribution for landfall location; (ii) alternative functional forms for TC parameter marginal distributions (including dependencies); (iii) use of the meta-Gaussian copula versus a conditional independence structure; and (iv) methods for dry-node correction and response surface predictions of surge and waves.
- o T 3.3: Assess suitability of stratifying TCs by High/Medium/Low intensity in joint marginal fits. Compare with alternative approaches (global fit, moving window, inverse weighting, etc).
- o T 3.4: Develop framework for incorporating bias and uncertainty terms from RAS runs into statistics. Note: bias and uncertainty may not be already accounted for in surge statistics when selecting a reduced storm set (RSS), as this depends on the target hazard curves used for the RSS selection, among other considerations.
- o T 3.5: Develop rainfall reference set using historic record; this may require equiprobable rainfall fields or may be done analytically using the Gaussian mixture model fit to produce the fields. Development of rainfall reference set should also lead to "reference" rainfall hazard curves. A "reality-check"/ground-truthing/bias evaluation should also be conducted for the rainfall (marginal) distributions.
- o T 3.6: Develop appropriate methodology (optimal sampling) for storm set reduction algorithm to select on surge and rainfall jointly, with the objective of improving/developing a robust, well-vetted optimal sampling approach.
- o T 3.7: For initial event selection, evaluate the appropriate balance between fewer realizations of many synthetic storms and more realizations of fewer synthetic storms. This includes comparison of a large number of HMS simulations versus using a lower-resolution RAS model.

- o T 3.8: Modify non-tropical event selection approach to match tropical (i.e., replace Latin hypercube sample with the same screening methodology as for tropical).
- o T 3.9: General improvements to storm set reduction algorithms (i.e., convert greedy algorithm to genetic). Greedy algorithm is already highly accurate, but should be tested as to whether an improved algorithm is needed when selecting a RSS on the basis of joint surge and rainfall (i.e., using metrics developed as part of T2.5).
- o T 3.10: Quantify probabilistic uncertainty (error and bias) components of framework. This subtask encompasses implementation of the model error and bias estimates into the statistical framework, not the quantification of model errors and biases themselves.
- o T 3.11: Incorporate epistemic uncertainty related to rainfall model and discharge and associated bias correction (revisit optimal storm-selection) to inform storm selection.

Deliverable: Data Package (including data, models, codes, error/bias estimates), PPT slide-decks, Draft and Final reports.

3.4 Task 4: H&H modeling for uncertainty quantification support

- o T 4.1: Quantify uncertainty related to TCs, including errors and any biases, of system components support.
- o T 4.2: Quantify uncertainty related to non-TCs, including errors and any biases, of system components support.

3.5 Task 5: Recurrence Analysis

- o T 5.1: Perform recurrence analysis (and develop AEP surfaces) for combined TCs and non-TCs for East, Central, West Pilot and RGV BLE domains (sampled as per inundation mapping guidance).

Deliverable: Data Package (including data, models, error/bias estimates), PPT slide-decks, Draft and Final reports.

3.6 Task 6: Coast-wide Deployment Scope Development Review Support

- o T 6.1: Scope development for coast-wide implementation of EJPM-OS, including inundation mapping and alternatives analysis. Please note that no alternative analysis will be done as part of this task, rather the task will develop scope for alternative analysis that would need to be done and how it'll be done using EJPM-OS models, results etc. review support.

Deliverable: Draft and Final scope document.

3.7 Task 7: Management, coordination, and meetings

Includes planning all relevant internal and external meetings, scheduling, developing agendas, facilitating discussions, meeting minutes, dissemination etc.

- o T 7.1: Hour-long semi-monthly team meetings (total of 11), and 2-hour long monthly team meetings (total of 6).
- o T7.2: Four 2-hour meeting with GLO regional vendors at kick-off, mid-way, presentation of draft-final reports and results and final report(s) and results: these meetings will seek feedback from regional vendors on their preference of E-JPM product format for use in their alternative analysis; An overview of data/model/reports for their regions as relevant to this study will be provided after the completion of the study.

3.8 Task 8: Knowledge/Technology Transfer

This task involves the preparation and delivery of a short training course to train students and other analysts to execute an extended JPM-OS recurrence analysis using the products (e.g., codes, input data) of other tasks.

- o T 8.1: Develop training materials, lesson plans, and associated prep for a short course to train others in the execution of the extended JPM-OS analysis and interpretation/visualization of results.
- o T 8.2: Delivery of a short course (up to 5 days).

Deliverable: Data sets (including data, models, codes, error/bias estimates), lesson plans, technical documentation, PPT slide-decks.

3.9 Task 9: Coastwide (except phase 1 test-beds) Coincident Analysis for TCs and Inland hydrologic/hydraulic parameters.

- o T 9.1: Establish dependencies (using coincident analysis) for coastwide (except phase 1 test-beds) between TC and inland hydrological/hydraulic parameters

3.10 Task 10: Storm Surge modeling improvement for Coastal Texas Region.

- o T 10.1: Improve methods for better representation of topographic and bathymetric data in the storm surge model. This includes but not limited to automated data processing for inclusion of relevant riverine, ship channel, and other coastal structure features in the model.
- o T10.2 Develop modeling approaches for better characterizations and representations of riverine forcing and transition region (i.e., area between hydrologic and coastal dominated regions) in the storm surge model
- o T 10.3 Generate tools and methods for storm surge model data management and dissemination for sharing with diverse stakeholders.

- T10.4 Investigate, recommend and/or implement methods for coupling with diverse models

4.0 QUALIFICATIONS

4.1 Desired qualifications include expertise in meteorologic, hydrologic, inland hydraulic and coastal hydraulic data generation, data analysis (gap, statistical, uncertainty), modeling, and mapping and the application of these principals to compound flood hazard analysis.

5.0 GOVERNMENT FURNISHED MATERIALS OR PROPERTY

5.1 Physical Data: NA

5.2 Facility: NA

5.3 Equipment: NA

Government furnished materials or property is governed by 2 C.F.R. Part 200.312 which states that a) Title to Federally owned property remains vested in the Federal government. The non-Federal entity must submit annually an inventory listing of Federally owned property in its custody to the Federal awarding agency. Upon completion of the Federal award or when the property is no longer needed, the non-Federal entity must return the property to the Federal awarding agency for further Federal agency utilization.

6.0 BASE PERIOD and OPTIONS

The Base: 12-months and up to approximately \$602,000 is expected to be available to support this project for one (1) year.

Follow-On Agreements: The Government intends to consider follow-on agreements based on results of the work performed on the initial agreement/previous period of performance for a maximum of an additional three (3) 12-month periods of performance and a maximum cost of \$396,000. Award will be based upon satisfactory performance, Government need and funds availability.

7.0 COORDINATION

USACE Project Manager (Primary)

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8.0 DELIVERABLES

8.1 A kickoff meeting, arranged by the Cooperator and including the installation POC and USACE Project Manager, shall be held via telephone or virtually within 30 days of the award and prior to September 30th of the Award year.

8.2 Progress Reports - One (1) typed letter report describing progress on the project. The report shall be due within 10 days of the end of each 3-month period (**quarterly**) and shall be transmitted via electronic mail, facsimile, or regular mail no later than the 10th calendar day following the end of the reporting period. Invoices for partial payment shall be submitted to coincide with receipt of the quarterly progress reports. No partial payment will be approved unless the government has received all progress reports which are due.

8.2 Annual Inventory –Federally owned property - an annual inventory listing Federal property (to include description of the property, a serial number or other identification number) that is in the custody of the recipient; Copies to be sent to USACE – SWF and the Galveston District.

8.3 Annual Inventory – Required under 2CFR for Grants and Cooperative Agreements - Acquired Property purchased with funding from award - property records must be maintained that includes description of the property, serial number or other identification number, source of funding, who holds title, acquisition date, cost of property, percentage of Federal participation in project costs, location, use and condition of property, and ultimate disposition including date of disposal and sale price. A physical inventory must

be taken, and results reconciled every two years. Copies of the inventory to be sent annually to USACE – SWF and the Galveston District.

8.4 Annual Report per 2CFR. One (1) paper copy of a annual report should be submitted no later than one month before end of each year. At a minimum, the report shall contain an introduction section, and one section for each Task identified in your proposal. For each Task, the report shall summarize work accomplished for the Task. Galveston District staff will review and provide comments, if any, within fifteen (15) calendar days after receipt.

8.5 Draft Final Project Report. One (1) paper copy of a draft final report should be submitted no later than one month before end of the project. At a minimum, the report shall contain an introduction section, and one section for each Task identified in your proposal. For each Task, the report shall summarize work accomplished for the Task. Galveston District staff will review and provide comments, if any, within fifteen (15) calendar days after receipt. Must provide an electronic copy to the USACE POC at the time this document is submitted to the Installation POC.

8.6 Final Project Report. One (1) paper copy of the final report, incorporating Galveston District review comments on the draft, if any, shall be submitted no later than fifteen (15) days after receipt of the Galveston District comments. Additionally, one (1) copy of the final report shall be submitted in a MSWord file(s), on digital media. Must provide an electronic copy to the USACE POC at the time this document is submitted to the Installation POC.

8.7 Comprehensive numerical and probabilistic analysis models, associated datasets and other products (codes, scripts, software) which will be developed as part of this project. A full report describing the methodology and results, including the quantification of flood hazards for coastal Texas region.

9.0 This cooperative agreement may be administered through CESU only upon mutual agreement and official authorization by both parties of the acceptance of the application of the CESU Network IDC rate (17.5%).

Any resulting cooperative agreement will be subject to and recipient/cooperator shall comply with 2 CFR 200.313 “Equipment”, 200.314 “Supplies”, and 200.315 “Intangible Property” which includes use of research data.