STATE OF CALIFORNIA

CONTRACT REQUESTS FORM (CRF)

CEC-94 (Revised 5/11) CALIFORNIA ENERGY COMMISSION

☒ New Contract 500-12-001 ☐ Amendment to Existing Contract: _____ Amendment Number: _____

Division	Contract Manager:	MS-	Phone	CM Training Date
Energy Research and Development	Guido Franco	43	916-327-2392	12/3/1997

Contractor's Legal Name	Federal ID Number
The Regents of the University of California on behalf of the San Diego Campus's Scripps Institution of Oceanography	95-6006144

Title of Project
Investigation of Discrepancies in Regional Climate Projections for California

Term	Start Date	End Date	Amount
New/Original Contract	8/15/2012	8/15/2014	$ 300,000

Line up the Amendment information as best as possible within the following table.

Amendment #	End Date *(mm/dd/yy)*	Amount

Business Meeting Information			
Proposed Business Meeting Date	7/11/2012	☐ Consent	☒ Discussion
Business Meeting Presenter	Guido Franco	Time Needed:	5 minutes

Agenda Item Subject and Description

Possible approval of Contract 500-12-001 for $300,000.00 with the Regents of the University of California on behalf of the San Diego campus's Scripps Institution of Oceanography to investigate the causes of discrepancies in regional climate projections generated for California by different climate models. This work will assist energy forecasting and planning. (PIER electricity funding.) Contact: Guido Franco (5 minutes)

Business Meeting approval is not required for the following types of contracts: *Executive Director's signature is required in all cases.*

☐ Contracts less than $10k *(Policy Committee's signature is also required)*

☐ Amendment for a no-cost time extension. Must be first extension, less than one year and original contract less than $100k.

☐ Contracts less than $25k for Expert Witness in Energy Facility licensing cases and amendments.

Purpose of Contract or Purpose of Amendment, if applicable

The purpose of this project is to use the global and regional models and database available to Scripps from prior PIER supported research to better understand 1) the differences between statistically and dynamically driven downscaled climate projections; 2) how particular large scale properties of different global climate models control future precipitation trends in California's climate; and 3) how more advanced treatment of aerosols in the models may shed some light on issues 1 and 2.

Findings from this project will help local and state-level decision makers to better interpret future climate projections for their planning activities, leading to better resource management decisions for Californians. This project will also assist Energy Commission's energy forecasting activities, which involve using climate projections to estimate impacts on peak electricity demand.

California Environmental Quality Act (CEQA) Compliance

1. Is Contract considered a "Project" under CEQA?
   ☐ Yes: skip to question 2 ☒ No: complete the following (PRC 21065 and 14 CCR 15378):
   Explain why contract is not considered a "Project":
   The contract will not cause a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because it consists entirely of modeling exercises using multiple global and regional climate models and archived databases .
2. If contract is considered a "Project" under CEQA:
   ☐ a) Contract **IS** exempt. (Draft NOE required)
   ☐ Statutory Exemption. List PRC and/or CCR section number: _____
   ☐ Categorical Exemption. List CCR section number: _____
   ☐ Common Sense Exemption. 14 CCR 15061 (b) (3)
   Explain reason why contract is exempt under the above section:
   ☐ b) Contract **IS NOT** exempt. The Contract Manager needs to consult with the Energy Commission attorney assigned to their division and the Siting Office regarding a possible Initial Study.

Budgets Information

Contract Amount Funded		Breakdown by FY			Funding Sources			
Funding Source	Amount	FY	Amount	Approved?	Funding Source	FY	Budget List No.	Amount
ARFVTF	$	12-13	$300,000	Yes	PIER-E	11-12	501.027J	$300,000
ECAA	$		$					$
State- ERPA	$		$					$
Federal	$		$					$
PIER - E	$300,000		$					$
PIER - NG	$		$					$
Reimbursement	$		$					$
Other	$		$					$
TOTAL:	$300,000	TOTAL:	$300,000				TOTAL:	$300,000
Reimbursement Contract #:					Federal Agreement			

Contractor's Administrator/ Officer		Contractor's Project Manager	
Name:	Judy Zhao	Name:	Daniel R. Cayan
Address:	9500 Gilman Dr, Depr. 0210	Address:	9500 Gilman Dr
City, State, Zip:	La Jolla, CA 92093-0210	City, State, Zip:	La Jolla, CA 92093-0224
Phone/ Fax:	858-534-0841 / 858-534-5306	Phone/ Fax:	858-534-4507 / 858-534-5861
E-Mail:	jczhao@ucsd.edu	E-Mail:	Dcayan@ucsd.edu

Contractor Is

☐ Private Company *(including non-profits)*
☒ CA State Agency *(including UC and CSU)*
☐ Government Entity *(i.e. city, county, federal government, air/water/school district, joint power authorities, university from another state)*

Selection Process Used

☐ Solicitation Select Type Solicitation #: _____ # of Bids: _____ Low Bid? ☐ No ☐ Yes
☐ Non Competitive Bid *(Attach CEC 96)*
☒ Exempt Interagency

Civil Service Considerations

☒ Not Applicable (Contract is with a CA State Entity or a membership/co-sponsorship)
☐ Public Resources Code 25620, et seq., authorizes the Commission to contract for the subject work. (PIER)

☐ The Services Contracted:
- ☐ are not available within civil service
- ☐ cannot be performed satisfactorily by civil service employees
- ☐ are of such a highly specialized or technical nature that the expert knowledge, expertise, and ability are not available through the civil service system.

☐ The Services are of such an:
- ☐ urgent
- ☐ temporary, or
- ☐ occasional nature

that the delay to implement under civil service would frustrate their very purpose.

Justification:
This is a UC Contract.

Payment Method

☒ A. Reimbursement in arrears based on:
☐ Itemized Monthly ☒ Itemized Quarterly ☐ Flat Rate ☐ One-time
☐ B. Advanced Payment
☐ C. Other, explain:

Retention

1. Is contract subject to retention?	☒ No	☐ Yes
If Yes, Do you plan to release retention prior to contract termination?	☐ No	☐ Yes

Justification of Rates

The rates identified in this contract are under the standard negotiated rates between the University of California and the Energy Commission.

Disabled Veteran Business Enterprise Program (DVBE)

1. ☒ Not Applicable
2. ☐ Meets DVBE Requirements DVBE Amount:$ _____ DVBE %: _____
   - ☐ Contractor is Certified DVBE
   - ☐ Contractor is Subcontracting with a DVBE: _____
3. ☐ Requesting DVBE Exemption (attach CEC 95)

Is Contractor a certified Small Business (SB), Micro Business (MB) or DVBE?	☒ No	☐ Yes
If yes, check appropriate box: ☐ SB ☐ MB ☐ DVBE		

Is Contractor subcontracting any services?	☒ No	☐ Yes
If yes, give company name and identify if they are a Small Business (SB), Micro Business (MB) and/or DVBE:		

Miscellaneous Contract Information

1. Will there be Work Authorizations?	☒ No	☐ Yes
2. Is the Contractor providing confidential information?	☒ No	☐ Yes
3. Is the contractor going to purchase equipment?	☒ No	☐ Yes
4. Check frequency of progress reports		
☐ Monthly ☒ Quarterly ☐ _____		
5. Will a final report be required?	☐ No	☒ Yes
6. Is the contract, with amendments, longer than a year? If yes, why?	☐ No	☒ Yes

The Department of General Services has agreed to give the Commission blanket authority to execute multi-year contracts to support the Commission's RD&D Programs.

The following items should be attached to this CRF		
1. Scope of Work, Attach as Exhibit A.	☐ N/A	☒ Attached
2. Budget Detail, Attach as Exhibit B.	☐ N/A	☒ Attached
3. CEC 96, NCB Request	☒ N/A	☐ Attached
4. CEC 30, Survey of Prior Work	☐ N/A	☐ Attached
5. CEC 95, DVBE Exemption Request	☒ N/A	☐ Attached
6. Draft CEQA Notice of Exemption (NOE)	☒ N/A	☐ Attached
7. Resumes	☐ N/A	☒ Attached
8. CEC 105, Questionnaire for Identifying Conflicts		☒ Attached

Contract Manager	Date	Office Manager	Date	Deputy Director	Date

The following signatures are only required when contract approval is delegated to the Executive Office and not approved at a Business Meeting. See Business Meeting Information Section.

Presiding Policy Committee	Date	Associate Policy Committee	Date	Executive Director	Date

Exhibit A
SCOPE OF WORK

TECHNICAL TASK LIST

Task #	CPR	Task Name
1	N/A	Administration
2		Statistical and Dynamical Climate Model Downscaling Over California and the Western U.S.
3		Large-Scale Controls on Future Precipitation Over California and the Western U.S.
4		Advanced Modeling of Aerosols
5		Technology Transfer Activities

KEY NAME LIST

Task #	Key Personnel	Key Subcontractor(s)	Key Partner(s)
1	Dan Cayan		
2,3,5	David Pierce, Dan Cayan		
4	Kim Prather, David Pierce, Dan Cayan		

GLOSSARY

Specific terms and acronyms used throughout this work statement are defined as follows:

Acronym	Definition
CMIP-5	Coupled Model Intercomparison Project (fifth phase)
CPR	Critical Project Review
Energy Commission	California Energy Commission
PAC	Project Advisory Committee
PIER	Public Interest Energy Research
UCC.1	Uniform Commercial Code (Financing Statement)

Problem Statement

Climate change is affecting California's temperature and precipitation patterns. These changes affect the state's energy generation and consumption, water resources, agricultural production, public health, and biodiversity. Regional climate models are an

essential tool for estimating how California's climate may change throughout this century. The scientific community is improving climate modeling techniques to project future trends for resources planning and strategizing mitigation and adaptation measures. However, climate projections (depending upon the models, techniques, variables, and parameters used) are not consistent with each other and are embedded with considerable uncertainties. This inconsistency occurs even when regional climate models are driven by outputs from the same global climate models.

There is an acute need to better understand the reason for the differences in climate projections, how to correctly interpret the differences in modeling outputs, and to improve the current understanding of important meteorological processes such as the role of aerosols in precipitation. The California Energy Commission's Public Interest Energy Research (PIER) has supported this line of research for many years and is partially responsible for important new insights and improvements that have been made in this area. Past PIER research has shown that the energy sector is vulnerable to climate change. However, more work is needed to improve the accuracy of the future climate projections because of the complexity of the factors involved in climate modeling and meteorological processes.

Goals of the Agreement
The goal of this Agreement is to better understand why various regional climate models are inconsistent in their climate projections for California.

Objectives of the Agreement
The objectives of this Agreement are to understand: 1) the differences between statistically and dynamically-driven downscaled climate projections; 2) how particular large-scale properties of different global climate models control future trends in California's climate; and 3) how more advanced treatment of aerosols in the models may shed some light on issues 1 and 2.

TASK 1.0 ADMINISTRATION

MEETINGS

Task 1.1 Attend Kick-off Meeting
The goal of this task is to establish the lines of communication and procedures for implementing this Agreement.

The Contractor shall:
- Attend a "kick-off" meeting with the Commission Contract Manager, the Contracts Officer, and a representative of the Accounting Office. The Contractor shall bring their Project Manager, Contracts Administrator, Accounting Officer, and others designated by the Commission Contract Manager to this meeting. The administrative and technical aspects of this Agreement will be discussed at the

meeting. Prior to the kick-off meeting, the Commission Contract Manager will provide an agenda to all potential meeting participants.

The administrative portion of the meeting shall include, but not be limited to, the following:

- Terms and conditions of the Agreement
- CPRs (Task 1.2)
- Match fund documentation (Task 1.7)
- Permit documentation (Task 1.8)

The technical portion of the meeting shall include, but not be limited to, the following:

- The Commission Contract Manager's expectations for accomplishing tasks described in the Scope of Work;
- An updated Schedule of Deliverables
- Progress Reports (Task 1.4)
- Technical Deliverables (Task 1.5)
- Final Report (Task 1.6)

The Commission Contract Manager shall designate the date and location of this meeting.

Contractor Deliverables:

- An Updated Schedule of Deliverables
- An Updated List of Match Funds
- An Updated List of Permits

Commission Contract Manager Deliverables:

- Final Report Instructions

Task 1.2 CPR Meetings

The goal of this task is to determine if the project should continue to receive Energy Commission funding to complete this Agreement and if it should, are there any modifications that need to be made to the tasks, deliverables, schedule or budget.

CPRs provide the opportunity for frank discussions between the Energy Commission and the Contractor. CPRs generally take place at key, predetermined points in the Agreement, as determined by the Commission Contract Manager and as shown in the Technical Task List above and in the Schedule of Deliverables. However, the Commission Contract Manager may schedule additional CPRs as necessary, and, if necessary, the budget will be reallocated to cover the additional costs borne by the Contractor, but the overall contract amount will not increase.

Participants include the Commission Contract Manager and the Contractor, and may include the Commission Contracts Officer, the PIER Program Team Lead, other Energy Commission staff and Management as well as other individuals selected by the Commission Contract Manager to provide support to the Energy Commission.

The Commission Contract Manager shall:

- Determine the location, date and time of each CPR meeting with the Contractor. These meetings generally take place at the Energy Commission, but they may take place at another location.
- Send the Contractor the agenda and a list of expected participants in advance of each CPR. If applicable, the agenda shall include a discussion on both match funding and permits.
- Conduct and make a record of each CPR meeting. One of the outcomes of this meeting will be a schedule for providing the written determination described below.
- Determine whether to continue the project, and if continuing, whether or not to modify the tasks, schedule, deliverables and budget for the remainder of the Agreement, including not proceeding with one or more tasks. I
- Provide the Contractor with a written determination in accordance with the schedule. The written response may include a requirement for the Contractor to revise one or more deliverable(s) that were included in the CPR.

The Contractor shall:

- Prepare a CPR Report for each CPR that discusses the progress of the Agreement toward achieving its goals and objectives. This report shall include recommendations and conclusions regarding continued work of the projects. This report shall be submitted along with any other deliverables identified in this Scope of Work. Submit these documents to the Commission Contract Manager and any other designated reviewers at least 15 working days in advance of each CPR meeting.
- Present the required information at each CPR meeting and participate in a discussion about the Agreement.

Contractor Deliverables:

- CPR Report(s)
- CPR deliverables identified in the Scope of Work

Commission Contract Manager Deliverables:

- Agenda and a List of Expected Participants
- Schedule for Written Determination
- Written Determination

Task 1.3 Final Meeting

The goal of this task is to closeout this Agreement.

The Contractor shall:

- Meet with the Energy Commission to present the findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement.

  This meeting will be attended by, at a minimum, the Contractor, the Commission Contracts Officer, and the Commission Contract Manager. The technical and administrative aspects of Agreement closeout will be discussed at the meeting,

which may be two separate meetings at the discretion of the Commission Contract Manager.

The technical portion of the meeting shall present findings, conclusions, and recommended next steps (if any) for the Agreement. The Commission Contract Manager will determine the appropriate meeting participants.

The administrative portion of the meeting shall be a discussion with the Commission Contract Manager and the Contracts Officer about the following Agreement closeout items:

- What to do with any state-owned equipment (Options)
- Need to file UCC.1 form re: Energy Commission's interest in patented technology
- Energy Commission's request for specific "generated" data (not already provided in Agreement deliverables)
- Need to document Contractor's disclosure of "subject inventions" developed under the Agreement
- "Surviving" Agreement provisions, such as repayment provisions and confidential deliverables
- Final invoicing and release of retention

- Prepare a schedule for completing the closeout activities for this Agreement.

Deliverables:

- Written documentation of meeting agreements and all pertinent information
- Schedule for completing closeout activities

REPORTING

See Exhibit D, Reports/Deliverables/Records.

Task 1.4 Quarterly Progress Reports

The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the research objectives of this Agreement.

The Contractor shall:

- Prepare progress reports which summarize all Agreement activities conducted by the Contractor for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due to the Commission Contract Manager within 10 working days after the end of the reporting period. Attachment A-2, Progress Report Format, provides the recommended specifications.

Deliverables:

- Quarterly Progress Reports

Task 1.5 Test Plans, Technical Reports and Interim Deliverables
The goal of this task is to set forth the general requirements for submitting test plans, technical reports and other interim deliverables, unless described differently in the Technical Tasks. When creating these deliverables, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

http://www.energy.ca.gov/contracts/pier/contractors/index.html

The Contractor shall:

- Unless otherwise directed in this Scope of Work, submit a draft of each deliverable listed in the Technical Tasks to the Commission Contract Manager for review and comment in accordance with the approved Schedule of Deliverables. The Commission Contract Manager will provide written comments back to the Contractor on the draft deliverable within 10 working days of receipt. Once agreement has been reached on the draft, the Contractor shall submit the final deliverable to the Commission Contract Manager. The Commission Contract Manager shall provide written approval of the final deliverable within 5 working days of receipt. Key elements from this deliverable shall be included in the Final Report for this project.

Task 1.6 Final Report
The goal of this task is to prepare a comprehensive written Final Report that describes the original purpose, approach, results and conclusions of the work done under this Agreement. The Commission Contract Manager will review and approve the Final Report. The Final Report must be completed on or before the termination date of the Agreement. When creating these deliverables, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

http://www.energy.ca.gov/contracts/pier/contractors/index.html

The Final Report shall be a public document. If the Contractor has obtained confidential status from the Energy Commission and will be preparing a confidential version of the Final Report as well, the Contractor shall perform the following subtasks for both the public and confidential versions of the Final Report.

Task 1.6.1 Final Report Outline

The Contractor shall:

- Prepare a draft outline of the Final Report.
- Submit the draft outline of Final Report to the Commission Contract Manager for review and approval. The Commission Contract Manager will provide written comments back to the Contractor on the draft outline within 10 working days of receipt. Once agreement has been reached on the draft, the Contractor shall submit the final outline to the Commission Contract Manager. The Commission Contract

Manager shall provide written approval of the final outline within 5 working days of receipt.

Deliverables:
- Draft Outline of the Final Report
- Final Outline of the Final Report

Task 1.6.2 Final Report

The Contractor shall:
- Prepare the draft Final Report for this Agreement in accordance with the approved outline.
- Submit the draft Final Report to the Commission Contract Manager for review and comment. The Commission Contract Manager will provide written comments within 10 working days of receipt.

  Once agreement on the draft Final Report has been reached, the Commission Contract Manager shall forward the electronic version of this report for Energy Commission internal approval. Once the approval is given, the Commission Contract Manager shall provide written approval to the Contractor within 5 working days.
- Submit one bound copy of the Final Report with the final invoice.

Deliverables:
- Draft Final Report
- Final Report

MATCH FUNDS, PERMITS, AND ELECTRONIC FILE FORMAT

Task 1.7 Identify and Obtain Matching Funds
The goal of this task is to ensure that the match funds planned for this Agreement are obtained for and applied to this Agreement during the term of this Agreement.

The costs to obtain and document match fund commitments are not reimbursable through this Agreement. While the PIER budget for this task will be zero dollars, the Contractor may utilize match funds for this task. Match funds shall be spent concurrently or in advance of PIER funds during the term of this Agreement. Match funds must be identified in writing, and the associated commitments obtained before the Contractor can incur any costs for which the Contractor will request reimbursement.

The Contractor shall:
- Prepare a letter documenting the match funding committed to this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:

  1. If no match funds were part of the proposal that led to the Energy

Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state such in the letter.

2. If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:
    - A list of the match funds that identifies the:
        - Amount of each cash match fund, its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied.
        - Amount of each in-kind contribution, a description, documented market or book value, and its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Contractor shall identify its owner and provide a contact name, address and telephone number, and the address where the property is located.
    - A copy of the letter of commitment from an authorized representative of each source of cash match funding or in-kind contributions that these funds or contributions have been secured.

- Discuss match funds and the implications to the Agreement if they are significantly reduced or not obtained as committed, at the kick-off meeting. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide the appropriate information to the Commission Contract Manager if during the course of the Agreement additional match funds are received.
- Notify the Commission Contract Manager within 10 working days if during the course of the Agreement existing match funds are reduced. Reduction in match funds may trigger an additional CPR.

Deliverables:

- A letter regarding Match Funds or stating that no Match Funds are provided
- Letter(s) for New Match Funds
- A copy of each Match Fund commitment letter
- Letter that Match Funds were Reduced (if applicable)

Task 1.8 Identify and Obtain Required Permits

The goal of this task is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track.

Permit costs and the expenses associated with obtaining permits are reimbursable under this Agreement. Permits must be identified in writing before the Contractor can incur any costs related to the use of the permit(s) for which the Contractor will request reimbursement.

The Contractor shall:

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:
  1. If there are no permits required at the start of this Agreement, then state such in the letter.
  2. If it is known at the beginning of the Agreement that permits will be required during the course of the Agreement, provide in the letter:

     - A list of the permits that identifies the:
       - Type of permit
       - Name, address and telephone number of the permitting jurisdictions or lead agencies
     - Schedule the Contractor will follow in applying for and obtaining these permits.
- The list of permits and the schedule for obtaining them will be discussed at the kick-off meeting, and a timetable for submitting the updated list, schedule and the copies of the permits will be developed. The implications to the Agreement if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in the progress reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, then provide the appropriate information on each permit and an updated schedule to the Commission Contract Manager.
- As permits are obtained, send a copy of each approved permit to the Commission Contract Manager.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the Commission Contract Manager within 5 working days. Either of these events may trigger an additional CPR.

Deliverables:

- A letter documenting the Permits or stating that no Permits are required
- Updated list of Permits as they change during the Term of the Agreement
- Updated schedule for acquiring Permits as it changes during the Term of the Agreement
- A copy of each approved Permit

Task 1.9 Electronic File Format

The goal of this task is to unify the formats of electronic data and documents provided to the Energy Commission as contract deliverables. Another goal is to establish the computer platforms, operating systems and software that will be required to review and approve all software deliverables.

The Contractor shall:

- Deliver documents to the Commission Contract Manager in the following formats:
  - Data sets shall be in Microsoft (MS) Access or MS Excel file format.

- PC-based text documents shall be in MS Word file format.
- Documents intended for public distribution shall be in PDF file format, with the native file format provided as well.
- Project management documents shall be in MS Project file format.

- Request exemptions to the electronic file format in writing at least 90 days before the deliverable is submitted.

Deliverables:

- A letter requesting exemption from the Electronic File Format (if applicable)

TECHNICAL TASKS

The Contractor shall prepare all deliverables in accordance with the requirements in Task 1.5. Deliverables not requiring a draft version are indicated by marking "(no draft)" after the deliverable name.

Task 2 STATISTICAL AND DYNAMICAL CLIMATE MODEL DOWNSCALING OVER CALIFORNIA AND THE WESTERN U.S.

The goal of this task is to better understand the differences in the projections produced by statistical and dynamical downscaling, in order to help decision makers properly interpret various model projections.

The Contractor shall:

- Determine the validity of using simple statistical downscaling assumptions (e.g., the assumption that currently observed temperature and precipitation distributions are temporary shifts). Investigate statistical and dynamical downscaling using existing results from dynamical downscaling modeling efforts (such as the 2009 Scenarios Project and the results from a partially funded project with Prof. Phil Mote (500-09-025)) as "perfect model" experiments.
  - The statistical methods will be evaluated using historical observations and the results from regional dynamical simulations. This will entail training the statistical downscaling scheme on the dynamical models' historical period, and then applying the method to the same regional model's future period. The duration of the modeling runs will depend upon the available regional dynamical data simulations.
- Clarify how dynamically-downscaled projections differ from the original global model.
- Quantify the effect of global model bias correction procedures on statistically downscaled trends.
- Explore whether any of the advantageous techniques from some methods can be used to improve other methods. Several statistical downscaling techniques are available, such as bias correction with spatial disaggregation (BCSD) and bias correction with constructed analogues (BCCA).
- Produce a report entitled "A Statistical/Dynamical Downscaling Evaluation" and submit it to a scientific journal for publication.

Deliverables:

- Report: A Statistical/Dynamical Downscaling Evaluation

Task 3 LARGE-SCALE CONTROLS ON FUTURE PRECIPITATION OVER CALIFORNIA AND THE WESTERN U.S.

The goal of this task is to explore ways to reduce uncertainty in future projections of California's climate by evaluating the newest generation of global climate models (the CMIP-5 archive) to determine what they indicate are the strongest large-scale controls on future precipitation changes within California.

Models differ considerably in how well they represent atmospheric moisture in the region equatorward of California (which supplies much of the moisture for our precipitation). There is some suggestion that models with a good representation of this moisture field show systematically different projections of future precipitation changes over California compared to models that do a poor job of simulating the current atmospheric moisture burden. Identification of model-quality parameters that are both physically motivated and have a relationship to future climate projections may at some point enable reducing the spread of uncertainty in future projections of California's climate.

The Contractor shall:

- Evaluate the newest generation of global climate models (the CMIP-5 archive) to determine what they indicate are the strongest large-scale controls on future precipitation changes throughout California.
- Examine whether differences in projections for key California locations are caused by systematic differences in the frequency vs. intensity of precipitation events projected by the statistical vs. dynamical downscaling. Possible causes are the treatment/representation of precipitation on rainy (precipitating) days, the difference in the number of days with precipitation (frequency) or intensity, or some combination of the two.
- Evaluate strengths and weaknesses of different techniques.
- Perform analyses of the existing model fields within the available computational and data storage resources.
- Produce a report entitled "Investigation of Large-Scale Controls on Regional (California) Structure of Precipitation and Other Variables and their Effects on Climate Projections" and submit it to a scientific journal for publication.

Deliverables:

- Report: Investigation of Large-Scale Controls on Regional (California) Structure of Precipitation and Other Variables and their Effects on Climate Projections

Task 4 ADVANCED MODELING OF AEROSOLS

The goal of this task is to develop a modeling system that can capture the impact that aerosols have on the microphysical properties in orographic mixed-phase wintertime clouds. An accurate modeling system such as the one proposed will complement the in-

situ and remotely sensed observations of the CalWater campaign and help answer whether anthropogenic aerosols are reducing wintertime precipitation in the Sierra Nevada. Past PIER-funded climate projections for California have used regional climate models that do not simulate aerosols.

The Contractor shall:

- Prepare a modeling system that accurately represents local California emissions, transport from non-local sources, radiative forcing due to aerosols, cloud condensation and ice nuclei, and snow growth through riming.
- Perform modeling simulations.
- Examine the relative impact of locally-produced emissions compared to aerosols transported via intercontinental transport aloft.
- Use the modeling system to explore how the advanced treatment of aerosols alters or confirm the findings from Tasks 2 and 3.
- Produce a report entitled “Exploration of Advanced Modeling of Aerosols as a Way to Reduce the Uncertainty in the Climate Projections and the Discrepancies Between Models” and submit it to a scientific journal for publication.

Deliverables:

- Report: Exploration of Advanced Modeling of Aerosols as a Way to Reduce the Uncertainty in Climate Projections and the Discrepancies Between Models

Task 5 TECHNOLOGY TRANSFER ACTIVITIES

The goal of this task is to make the knowledge gained and lessons learned available to the scientific community, decision-makers, and interested public.

The Contractor shall:

- Present the findings of this project at the annual PIER Science Conference held in Sacramento, California.
- Provide the Energy Commission Contract Manager with project-related informational materials such as PowerPoint files and project factsheets, as requested.

Deliverables:

- PowerPoint file(s) and other project-related informational materials, as requested by the Commission Contract Manager (no draft)