

IV International Conference on El Niño Southern Oscillation: ENSO in a warmer Climate

16-18 OCTOBER 2018 Guayaquil, Ecuador

Conference Handbook

www.ensoconference2018.org

enso2018@clivar.org

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FOREWARD

On behalf of the entire Scientific Organizing Committee and our host, the Escuela Superior Politecnica del Litoral (ESPOL), we welcome you to Guayaquil and thank you for joining us for this event. We are over 200 scientists from 35 countries, coming together in this beautiful town to discuss the state of ENSO Research. With your support and participation, we hope to fulfil the Conference mission:

“To review the progress on the science of ENSO with a focus on examining the range of ENSO “flavors” (especially in regard to the longitudinal variations of warming), assess the existence of possible, and distinct precursors to the different flavors, and examine how the different oceanic and atmospheric processes that drive the different ENSO flavors and impact their predictability would vary in a warming world”.

The Scientific Organizing Committee has developed a programme designed to maximize your opportunities to share ideas, foster collaborations and develop future plans. Each day we have included poster sessions to give all participants an opportunity to discuss their work with colleagues and discover the many facets of ENSO research being presented.

A dedicated peer review team has selected oral presenters for six sessions from the over 200 abstracts that were submitted. One of the important aims of this conference is to engage the future generation and we are delighted that more than 100 students and early career scientists will participate in the conference. The level of interest from early career scientists bodes well for the future of climate and ocean science.

We thank ESPOL for generously hosting ENSO2018 and supporting the conference website, and the First Institute of Oceanography for providing a home and support to the International CLIVAR Project Office that has been instrumental in organizing this conference, and also for its support to abstract submission and review and registration processes. We thank our sponsors World Climate Research Programme, Inter-American Institute for Global Change Research, The National Oceanic and Atmospheric Administration, The Intergovernmental Oceanographic Commission of UNESCO, and The French Research Institute for Development for providing funds to support the participation of ECS and developing country scientists.

We believe that one of the most important outcomes of the conference will be the informal exchanges that take place in the poster sessions and social events, in the hallways and during lunches. We hope that in this way, and through the formal programme, the Conference will provide you with an interesting, fruitful and enjoyable experience.

Michael McPhaden

Andrew Wittenberg

Jose Santos

Rodney Martinez



Scientific Organizing Committee

Title	Institute
Mike McPhaden (Co Chair)	NOAA – Pacific Marine Environmental Laboratory. USA
Andrew Wittenberg (Co Chair)	NOAA – Geophysical Fluids Dynamics Laboratory. USA
Jose Santos (Co Chair)	International CLIVAR Project Office. China
Wenju Cai	Commonwealth Scientific and Industrial Research Organization. Australia
Kim Cobb	Georgia Institute of Technology. USA
William Kessler	NOAA – Pacific Marine Environmental Laboratory. USA
Eric Guilyardi	Institut Pierre-Simon Laplace. France
Boris Dewitte	Laboratoire d'Etudes en Géophysique et Océanographie Spatiales. France
Lisa Goddard	International Research Institute for Climate and Society. USA
Rodney Martinez	Centro Internacional para la Investigación del Fenómeno de El Niño. Ecuador
Ken Takahashi	National Meteorology and Hydrology Service in Peru. Peru
Jose Marengo	Centro Nacional de Monitoramento e Alertas de Desastres Naturais. Brazil

Local Organizing Committee

Title	Institute
M. Pilar Cornejo	Escuela Superior Politécnica del Litoral. Ecuador
Jonathan Cedeño	Escuela Superior Politécnica del Litoral. Ecuador
Mercy Borbor	Escuela Superior Politécnica del Litoral. Ecuador
Juan José Nieto	Centro Internacional para la Investigación del Fenómeno de El Niño. Ecuador

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1. BACKGROUND AND MOTIVATION

The El Niño Southern Oscillation (ENSO), which originates in the tropical Pacific Ocean, is Earth's most dominant source of year-to-year climate variability and exerts a profound impact that extends well beyond the Pacific basin. Knowledge about ENSO and its impacts help to strengthen prediction tools used in support of early warning systems. Therefore, improving our understanding of ENSO is fundamental in reducing societal vulnerabilities. Despite considerable progress in our understanding of the impact of climate change on many of the processes that contribute to ENSO variability, it is not yet possible to say whether ENSO activity will be enhanced or damped, or if the frequency or character of events will change in the coming decades.

As changes in ENSO have the potential to be one of the largest manifestations of anthropogenic climate change, such changes will have profound impacts on the reliability of regional attribution of climate variability and change. Two main reasons can be invoked for shortcomings in predicting such changes. First, there is a lack of long and comprehensive enough observations of the various ENSO processes to be able to reliably detect past changes. It may be that we need to observe ENSO for another several decades to detect and attribute significant ENSO changes. Second, as ENSO involves a complex interplay of numerous ocean and atmospheric processes, accurately modeling this climate phenomenon with coupled global climate models (CGCMs), and understanding, anticipating, and predicting its behavior on seasonal to decadal and longer time scales remains a great challenge. Even though the ability of CGCMs to simulate El Niño has largely improved over the last few years, the diversity of model simulations of present-day El Niño characteristics indicate current limitations in our ability to model this climate phenomenon and anticipate changes in its properties on a range of time scales. In this context, there is a pressing need to assess how we can use models to anticipate potential changes to ENSO in a warming climate.

During the boreal spring of 2014, a remarkable increase in warm water volume with a series of westerly wind bursts alerted ENSO experts to the possibility of a strong event, one which some thought could rival the intensity of the 1997-98 event, generating news headlines worldwide. However, while the equatorial Pacific remained anomalously warm, the expected Mega El Niño did not form. That failed expectation may in part be a reflection of our incomplete knowledge of extreme El Niño and its predictability, or perhaps the very nature of the ENSO system itself. Finally a very strong ENSO event did develop during 2015-16 (considered the third largest on record after the events of 1982-83 and 1997-98). However the expected impacts in countries like Ecuador and Peru never materialized.

Against this backdrop of progress, uncertainties, and ensuing greenhouse warming, it is timely to ask - what is the current state of understanding of ENSO in terms of its diverse behavior, extremity, impacts, and teleconnections?

Some of the remaining uncertainties are related with processes not well understood yet, which could provide potential contribution to improve model prediction skills. Some of these processes have been well explained by Kessler et al., 2014, in a White Paper ("ENSO Research: The overarching science drivers and requirements for observations" as part of the Tropical Observing System 2020 project) and include:

- a) Equatorial upwelling and rapid atmospheric feedback – scales and fronts
- b) Mechanisms by which subsurface ocean dynamics drive SST
- c) Atmospheric processes relevant for Tropical Observing System.
- d) Large-scale feedbacks driving ENSO variability
- e) Diurnal cycle and penetration of surface fluxes into ocean
- f) Recharge and discharge to subtropics Low latitude western boundary currents in the Pacific
- g) Tropical instability waves

This background highlights the need to address ENSO scientific challenges in the context of international climate research, assessments, and operational prediction efforts. As a catalyzing activity in this process, CLIVAR and CIIFEN propose the IV International Conference on El Niño Southern Oscillation: ENSO in a Warmer Climate. This conference is a follow-on to several events:

- The III International Conference on ENSO: “Bridging the gaps between Global ENSO Science and regional processes, extremes and impacts” held in November 2014, which focused in reviewing the progress on the science of ENSO and related regional processes in order to improve the prediction of regional impacts; and to contribute to development of decision support frameworks that allow timely and appropriate planning and response at national and local levels. The outcomes of the conference were used to support implementation of the Global Framework for Climate Services (GFCS) and inform action to increase resilience to natural climate variability in the four priority areas, agriculture and food security, disaster risk reduction, health and water
- The Second International “Workshop on ENSO, Decadal Variability and Climate Change in South America: Trends, teleconnections and potential impacts” held in October 2010. Which helped to consolidate a strong Institutional operational network which currently provides regular, tailored climate services for the agricultural and risk management sectors of the region. This effort is closely linked with the Regional Seasonal Forecast system, implemented and consolidated through the Western Coast of South America Climate Outlook Forum, supported by WMO and coordinated by CIIFEN.
- The First International ENSO Conference: “The El Niño phenomenon and its global impact” in May 2005, held in Guayaquil, Ecuador. Which had the participation of more than 150 scientists from 40 countries whose interdisciplinary mix turned out to provide an exciting atmosphere stimulating fruitful discussions. It was highly interdisciplinary in dealing with ENSO in all aspects related to the Ocean, Atmosphere, Climate, Biology and Human Dimensions, its impact in South America and teleconnections worldwide. Selected papers were published in a special volume of Advances in Geosciences

2. AIM AND OBJECTIVES

The main goal of the Conference is to review progress on the science of ENSO. This will include a focus on examining the range of ENSO “flavors,” (especially regarding longitudinal variations of ENSO sea surface warming), assessing precursors to the different flavors, and examining how the different oceanic and atmospheric processes that drive ENSO flavors and impact their predictability may change in a warming world.

The objectives are:

- Review the physical processes that influence ENSO and its diversity on decadal time scales.
- Examine the existing ENSO evaluation methods in GCMs.
- Review ENSO evaluation protocols and strategies for coordinated analysis of CMIP models.
- Discuss ENSO-specific analysis and/or simulations related to CMIP6 (“ENSOMIP”).
- Discuss the observations needed to better constrain ENSO processes, both for current and future climates (e.g. TPOS) and for past climates (e.g. historical reanalyses and paleo proxies).
- Review our understanding of how ENSO might change in the future.
- Examine current understanding of ENSO’s global teleconnection patterns and impacts.
- Review the global and regional challenges of ENSO prediction and climate information services.

3. FORMAT OF THE MEETING

The IV International Conference on ENSO will be organized into six plenary sessions, related poster sessions and an International Exhibition. The sessions will emphasize the following topics:

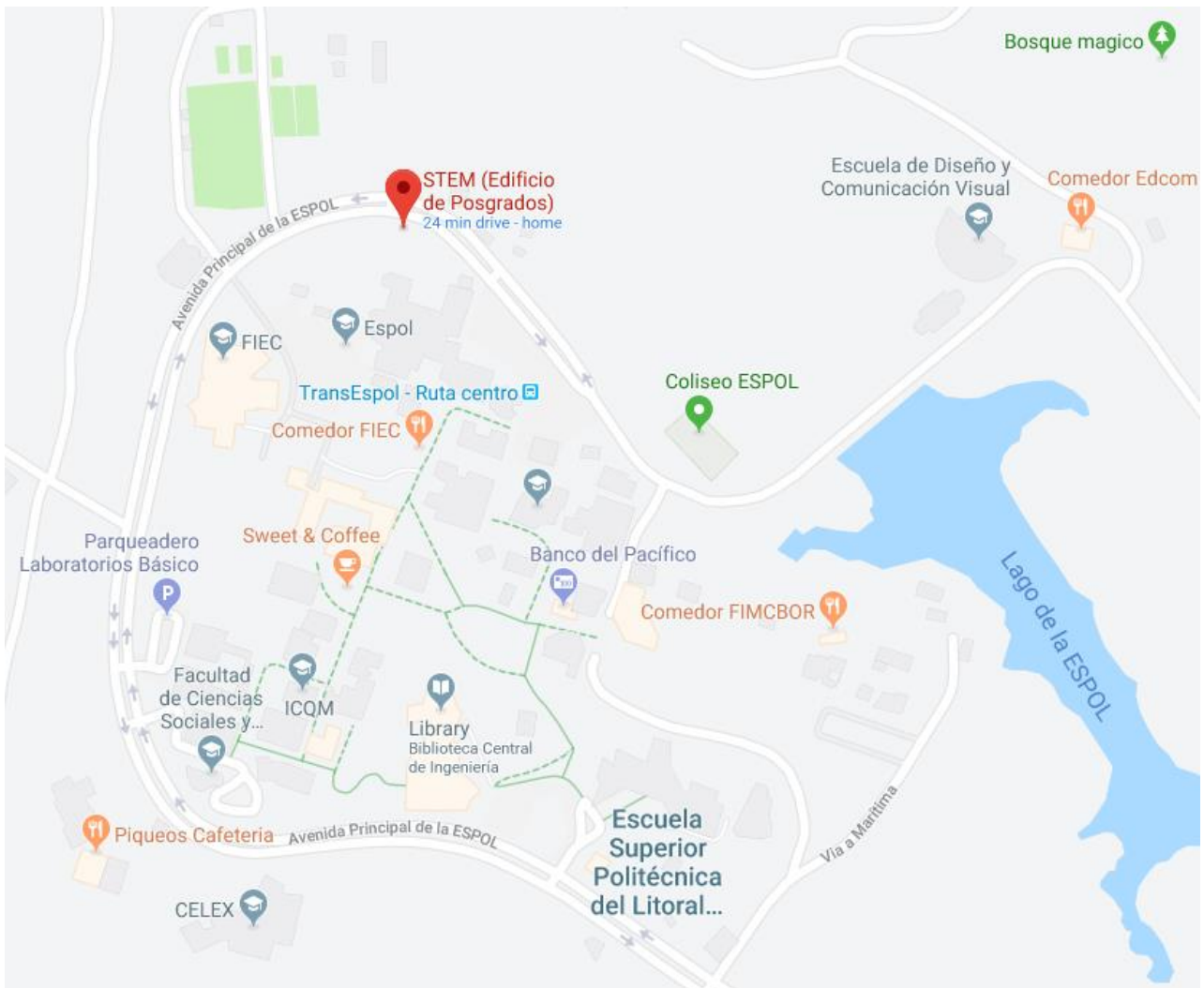
- Session I:** ENSO observations, including paleodata and analysis of recent events
(Among others this session will describe the links to TPOS2020 and satellite mission planning)
- Session II:** ENSO dynamics
(With a focus on the Equatorial dynamics of the recharge oscillator and the resulting ENSO diversity, and discussion on whether El Niño events with distinct locations of maximal SST anomalies differ in their underlying dynamics.)
- Session III:** ENSO and other modes of climate variability (intraseasonal, decadal, centennial)
(An important focus will be on the Madden–Julian oscillation, and its interannual variability, ENSO and Pacific Decadal Variability, etc.)
- Session IV:** ENSO modeling and prediction
(This session will deal with the links to modeling and operational center activities, and discuss the climate model results pertaining to ENSO)
- Session V:** ENSO impacts and regional processes
(Climate impacts, especially anomaly precipitation patterns and its relationship with regional oceanic and atmospheric processes will be discussed)
- Session VI:** Climate information and sustainable development and future of climate and ocean science
This section deals with the application side of ENSO research, and will give the opportunity for ENSO scientists to interact with end users from different sectors (agriculture, health, tourism, risk management, fisheries, among others)

4. VENUE

Edificio STEM (Posgrados)
Escuela Superior Politécnica del Litoral
Km. 30.5 vía Perimetral, campus “Gustavo Galindo V.”
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www.espol.edu.ec
Guayaquil, Ecuador



The Escuela Superior Politécnica del Litoral (ESPOL) is the best public university in Ecuador. Its main campus, Gustavo Galindo, where the ENSO2018 Conference meeting takes place is settled in a 1482 acre area surrounded by a tropical dry forest, which is a natural reserve. Its strategic location has let the university build a great infrastructure at the service of the students. Transportation to and from the campus is also available at specific hours.



Map of the Escuela Superior Politécnica del Litoral

5. REGISTRATION

5.1 Participants

Monday, October 16, 12:00 – 18:00 in CIIFEN

Tuesday, October 17, 08:00 – 10:00 in STEM Auditorium, ESPOL

5.2 Badges

All participants will be required to wear their badges to board the buses that will transport participants to ESPOL, and to have access to the ENSO2018 meeting rooms, reception and banquet.

Badges have three colours to identify the following categories:

Scientific Committee: **Green**

Speakers/posters/participants: **Blue**

Organizing committee: **Red**

6. SCIENTIFIC PROGRAMME

6.1 Programme at a glance

Date	Day 1 Tuesday, October 16	Day 2 Wednesday, October 17	Day 3 Thursday, October 18
AM	8:30 - 9:00 Registration		
	9:00 – 10:00 Opening Ceremony & Inaugural Keynote	9:00 – 10:00 Oral Session: Session 3: ENSO and Modes of Climate Variability	9:00 – 10:00 Oral Session: Session 5: ENSO impacts and Regional process
	10:00- 10:30 <i>Coffee Break</i>	10:00- 10:30 <i>Coffee Break</i>	10:00- 10:30 <i>Coffee Break</i>
	10:30- 12:30 Oral session: Session 1: ENSO Observations	10:30- 12:10 Oral Session: Session 3: ENSO and Modes of Climate Variability	10:30- 12:10 Oral Session: Session 5: ENSO impacts and Regional process
		12:10- 12:30 Poster Express: Session 3: ENSO and Modes	12:10- 12:30 Poster Express: Session 5: ENSO impacts and Regional process
Noon	12:30- 13:30 Lunch Climate Services Stage	12:30- 13:30 Lunch Climate Services Stage	12:30- 13:30 Lunch Climate Services Stage
PM	13:30- 14:10 Oral session: Session 1: ENSO Observations	13:30- 14:30 Poster viewing (Sessions 1, 2, 3)	13:30- 14:30 Poster viewing (Sessions 4,5,6)
	14:10- 14:30 Poster Express: Session 1: ENSO Observations		
	14:30- 15:30 Oral Session: Session 2: ENSO Dynamics	14:30- 15:30 Oral Session: Session 4: ENSO Modelling and Prediction	14:30- 15:30 Oral Session: Session 6: Climate information and sustainable development
	15:30- 16:00 <i>Coffee Break</i>	15:30- 16:00 <i>Coffee Break</i>	15:30- 16:00 <i>Coffee Break</i>
	16:00-17:40 Oral Session: Session 2: ENSO Dynamics	16:00-17:40 Oral Session: Session 4: ENSO Modelling and Prediction	16:00-17:40 Oral Session: Session 6: Climate information and sustainable development
	17:40- 18:00 Poster Express: Session 2: ENSO Dynamics	17:40- 18:00 Poster Express: Session 4: ENSO Modelling and Prediction	17:40- 18:00 Poster Express: Session 6: Climate information and sustainable development
			18:00-18:20 Closure & Poster awards

6.2 ENSO2018 Daily Programme

Day 1: Tuesday, October 16

8:30- 9:00	<i>Registration</i>
9:00- 10:00	Opening Ceremony (30 min) Inaugural Keynote (30 min) ENSO science and predictions and the UN Decade of Ocean Science. Salvatore Arico. IOC
10:00- 10:30	<i>Coffee Break</i>
10:30- 12:30	Oral Session Session 1(a): ENSO Observations <i>Chairs: Wenju Cai, Matthieu Lengaigne</i> <ul style="list-style-type: none"> • Michael McPhaden: The 2015-16 El Niño and Climate Change (<i>Keynote</i>, 30 min) • Kim Cobb: Advances in paleo-ENSO: A past to future perspective (<i>Keynote</i>, 30 min) • Magdalena Balmaseda: ENSO complexity: A monitoring and forecasting perspective (20 min) • Shineng Hu: El Niño diversity, cross-equatorial winds, and the intertropical convergence zone (20 min) • Julia Cole: ENSO variability in Galápagos corals: New insights on variability and trends (20 min)
12:30- 13:30	<i>Lunch. Climate Services Stage</i>
13:30- 14:10	Oral Session Session 1(b): ENSO Observations <i>Chairs: Wenju Cai, Matthieu Lengaigne</i> <ul style="list-style-type: none"> • Gandy Rosales: Impacts of the Pacific Equatorial Undercurrent on the Northern Peruvian Coast (20 min) • Scott Power: The impact of global warming on ENSO is clearer now than ever before (20 min)
14:10- 14:30	Poster Express Session 1
14:30- 15:30	Oral Session Session 2(a): ENSO Dynamics <i>Chairs: Andrew Wittenberg, Kim Cobb</i> <ul style="list-style-type: none"> • Ken Takahashi: El Niño in the far-eastern Pacific: Concepts, impacts and dynamics (<i>Keynote</i>, 30 min) • Shayne McGregor: Understanding ENSO event precursors (<i>Keynote</i>, 30 min)
15:30- 16:00	<i>Coffee Break</i>
16:00-17:40	Oral Session Session 2(b): ENSO Dynamics <i>Chairs: Andrew Wittenberg, Kim Cobb</i> <ul style="list-style-type: none"> • Christina Karamperidou: A hierarchy of models for ENSO diversity in past, present and future (20 min) • Sulian Thual: A stochastic skeleton model for the MJO and ENSO (20 min) • S.A. Dixit: Decrypting the nonlinearity in ENSO observations, potential for skillful predictions (20 min) • Ruihuang Xie: ENSO modes-annual cycle interaction and ENSO complexity (20 min) • Petrova Desislava: The Role of the Western Pacific Heat Buildup in the Development and Prediction of El Niño (20 min)
17:40- 18:00	Poster Express. Session 2
18:00	<i>Adjourn</i>

Day2: Wednesday, October 17

9:00- 10:00	<p>Oral Session Session 3(a): ENSO and Modes of Climate Variability <i>Chairs: Michael McPhaden, Ken Takahashi</i></p> <ul style="list-style-type: none"> • Matthieu Lengaigne: The role of intraseasonal variability in ENSO (<i>Keynote</i>, 30 min) • Antonieta Capotond: Decadal Variability of ENSO (<i>Keynote</i>, 30 min)
10:00- 10:30	<i>Coffee Break</i>
10:30- 12:10	<p>Oral Session Session 3(b): ENSO and Modes of Climate Variability <i>Chairs: Michael McPhaden, Ken Takahashi</i></p> <ul style="list-style-type: none"> • Samantha Stevenson: Extreme El Nino events and 21st century climate change: Attributing inter-model differences in future projections (20 min) • Yuko Okumura: Decadal modulation of ENSO and the linkage to tropical Pacific decadal variability (20 min) • Aaron Levine: Atlantic Impacts on Multi-decadal ENSO diversity and Amplitude Variability (20 min) • Gerald Meehl: The role of interannual ENSO events in decadal timescale transitions of the Interdecadal Pacific Oscillation (20 min) • Anika Arora: Effect of increasing atmospheric resolution on prediction skill of ENSO in coupled forecast system (CFS). (20 min)
12:10- 12:30	<p>Poster Express Session 3</p>
12:30- 13:30	<i>Lunch. Climate Services Stage</i>
13:30- 14:30	Poster viewing (Sessions 1, 2, 3)
14:30- 15:30	<p>Oral Session Session 4 (a): ENSO Modelling and Prediction <i>Chairs: Antonieta Capotondi, Jose Santos</i></p> <ul style="list-style-type: none"> • Andrew Wittenberg: ENSO in climate models: Progress and opportunities (<i>Keynote</i>, 30 min) • Eric Guilyardi: Consensus climate model evaluation for end users: an example with ENSO metrics (<i>Keynote</i>, 30 min)
15:30- 16:00	<i>Coffee Break</i>
16:00- 17:40	<p>Oral Session Session 4 (b): ENSO Modelling and Prediction <i>Chairs: Antonieta Capotondi, Jose Santos</i></p> <ul style="list-style-type: none"> • Michelle L'Heureux: A Bird's Eye View of Operational ENSO Prediction: Methods, Challenges, and Paths Forward (20 min) • Sarah Larson: Does the equatorial recharge/discharge increase ENSO predictability? (20 min) • John Mejia: Improved skill in North American multi-model ensemble for the Americas (20 min) • Matthew Newman: Characterizing tropical Pacific SST predictability (20 min) • Tobias Bayr Tobias: Tuning ENSO in a Climate Model (20 min)
17:40- 18:00	<p>Poster Express Session 4</p>
18:00	<i>Adjourn</i>

Day 3: Thursday, October 18

9:00- 10:00	<p>Oral Session Session 5(a): ENSO impacts and Regional process <i>Chairs: Eric Guilyardi, Rodney Martinez</i></p> <ul style="list-style-type: none"> • Boris Dewitte: Air-sea interactions off Peru and Ecuador and the development of Eastern Pacific El Niño events (<i>Keynote</i>, 30 min) • Bor-Ting Jong: ENSO teleconnections and impacts on North America during la Niña summers (<i>Keynote</i>, 30 min)
10:00- 10:30	<i>Coffee Break</i>
10:30- 12:10	<p>Oral Session Session 5(b): ENSO impacts and Regional process <i>Chairs: Eric Guilyardi, Rodney Martinez</i></p> <ul style="list-style-type: none"> • Victor Aguilera: Oceanography, total alkalinity and pCO₂ levels during El Niño 2015-16 in a subtropical coastal upwelling area of Humboldt Current (20 min) • Anderson Weston: How relevant is ENSO to global crop production? (20 min) • Boyin Huang: The role of buoy and Argo observations in ENSO in two SST analyses (20 min) • Eleftheria Exarchou: Impact of Tropical Atlantic variability on Tropical Pacific predictability (20 min) • Juan Sulca: Impacts of different ENSO flavors and tropical Pacific convection variability (ITCZ, SPCZ) on austral summer rainfall in South America, with a focus on Peru (20 min)
12:10- 12:30	Poster Express Session 5
12:30- 13:30	<i>Lunch. Climate Services Stage</i>
13:30- 14:30	Poster viewing (Sessions 4,5,6)
14:30- 15:30	<p>Oral Session Session 6(a): Climate information and sustainable development <i>Chairs: Boris Dewitte, Fangli Qiao</i></p> <ul style="list-style-type: none"> • Rodney Martinez: Keeping climate science fundable: Challenges and opportunities of the 2030 Agenda for Sustainable Development (<i>Keynote</i>, 30 min) • Jose Santos: Towards an ENSO Early Warning System in Ecuador: Lessons learned (<i>Keynote</i>, 30 min)
15:30- 16:00	<i>Coffee Break</i>
16:00- 17:40	<p>Oral Session Session 6(b): Climate information and sustainable development <i>Chairs: Boris Dewitte, Fangli Qiao</i></p> <ul style="list-style-type: none"> • Luis Icochea Salas: Differences between ENSO 2014-2017 and another strong ENSO events (20 min) • Khalid Bushra: Impacts of ENSO and summer monsoon rainfall on riverine flooding in Upper Indus Basin of Pakistan (20 min) • Mercy Borbor-Cordova: Climate Services for Public Health: the use of El Niño and other climate modes for arbovirus forecasting in Latin America and the Caribbean (20 min) • Caballero Espejo Maria Esther: Climate System Interactions for Climate Risks Management in Developing Countries (20 min) • Fangli Qiao: Ocean and climate models improvements by including the surface wave (20 min)
17:40- 18:00	Poster Express Session 6
18:00- 18:20	Closure & Poster awards
18:20	<i>Adjourn</i>

7. POSTERS

7.1 Overall schedule

Each Poster will be on display during the whole conference, poster presenters are encouraged to be present at their poster during coffee breaks and/or leave a note indicating when they will be available. In addition, poster presenters are required to stay alongside their poster during the poster viewing sessions, according to the schedule shown below:

Day	Wednesday, 17 October	Thursday, 18 October
Time	13:30-14:30	13:30-14:30
Sessions	1, 2, 3	4, 5, 6

Posters should be put up between 8:00-9:00 of the first day of the conference (Tuesday, 16th October), and should be removed by Thursday 18th October by 18:00. (Note: posters that are not taken down by this time will be disposed of).

Poster abstracts by session and board number are listed sequentially in the [Abstract Book](#). A mapping of poster board locations and a listing of all posters by presenting authors can be found at the end of the ENSO2018 Conference Handbook and on the conference website, and will be also posted on-site in the poster room and on the conference website. Staff will be available at the registration and the poster area to help presenters locate their poster space. Double-side tape will be provided to attach posters to the poster boards.

7.2 Poster presenter guidelines

Poster Sessions: Tuesday – Thursday: (See times on section above)

1. Poster boards are 0.8 wide and 1.6m high (portrait orientation). The maximum size available for posters is 0.6m wide and 1.2m high.
2. Posters will be on display on the First Floor of the Conference Site at ESPOL Campus.
3. Posters will remain in exhibition during the whole conference. Please check the Conference Handbook or website for the exact date of your poster viewing session. Your poster number has the following format SS-NN, SS indicates the Session number, and NN indicates the poster number. Example: 01-01 means Session 1, poster number 1.
4. Double-side tape will be provided to attach posters to the board material, which is made of wood.
5. Please arrive at the poster area at the beginning of your daily session and stand by your poster for a suitable time. It is advisable to indicate with a note on the board when you will be available.

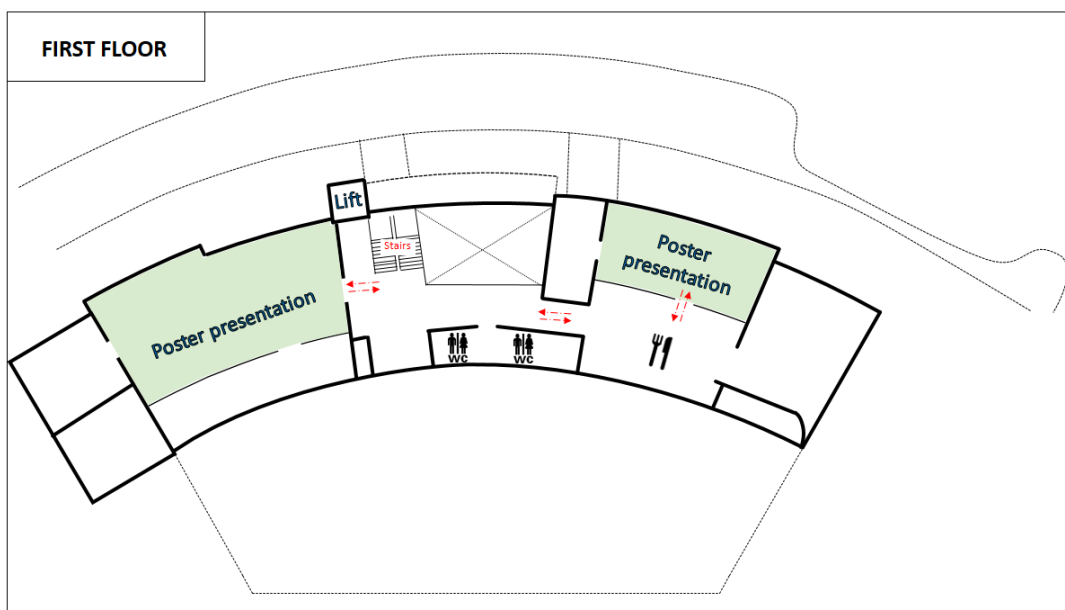
Pico presentations

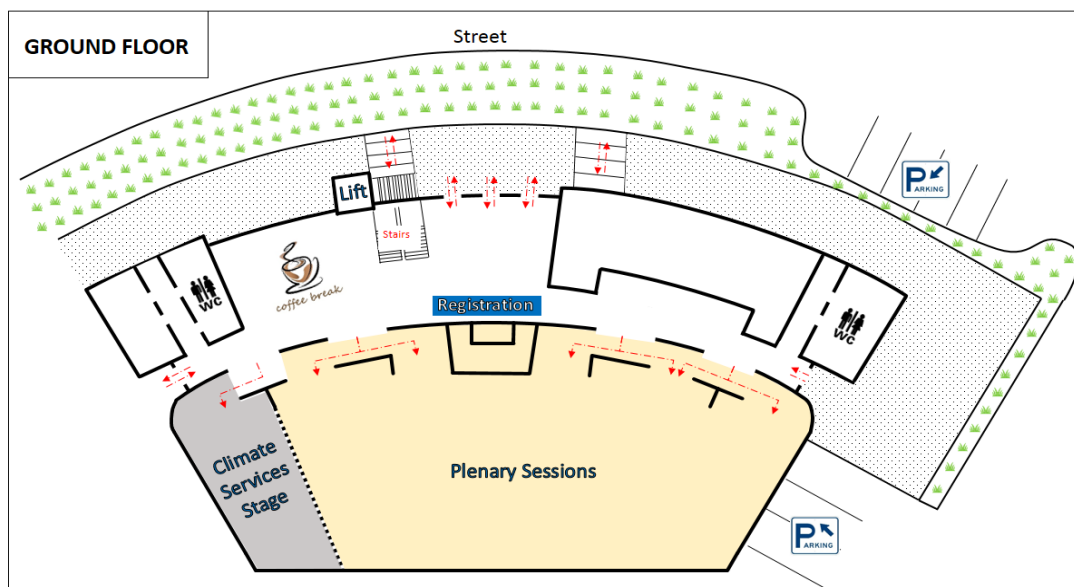
Poster presenters are invited to make a 2-minute presentation of their posters in the main conference room at selected time. Sign-up sheets will be posted outside the room. Participants interested in making such a presentation can sign up on a first-come, first-serve basis for any of the 6 poster sessions, (see the following table for the available time slots). A total of 10 presentations can be accommodated within each 20 min-long poster session. A laptop and projector will be provided but participants must load their own presentations beforehand. There will be a timekeeper.

Session	Tuesday, 16 October	Wednesday, 17 October	Thursday, 18 October
1	14:10-14:30		
2	17:40-18:00		
3		12:10-12:30	
4		17:40-18:00	
5			12:10-12:30
6			17:40-18:00

7.3 Poster Area Plans and Clusters

The poster area are located on the first floor of STEM building (two rooms, right-left). While the ground floor will be devoted for the Plenary Sessions (main room) and Climate Service Stage (right-room).





7.4 ECS Poster Competition

Early career scientists and students attending the ENSO2018 Conference and presenting posters are eligible to be considered for outstanding poster awards. A distinguished committee of senior and early career scientists will review and identify outstanding posters given by students and early career scientists. Best posters will be announced during the closing session of the conference on the 18th of October.

Contest general guidelines:

- The first author of the poster should be registered as a student or ECS (if in doubt, check your registration) and be the poster presenter at the ENSO2018 Conference;
- The presenter has to indicate that s/he wishes to participate in the competition by attaching a sticker to her/his poster; these stickers will be available in the poster room;
- The presenter must be next to her/his poster during the judging period which will be indicated in the poster room;
- The poster must be formatted according to the poster guidelines;
- The presentation by the ECS must be original and based on recent research results;
- The Award will go to the poster presenter (who must be the first author and an ECS or student).

Contest criteria:

The posters will be reviewed based on the following criteria:

- Scientific merit and novelty
- Originality of work
- Aesthetics of display
- Clarity of the poster
- Oral presentation of the poster and responses to questions

8. Climate Services Stage

Date: 16 – 18 October 2018

Time: 12h30 – 13h30

The CLIMATE SERVICES stage is a special venue where selected ENSO Conference participants will share their practical experiences about climate services related topic, project or initiatives. Its aim is to widen the array of topics that are discussed at the Conference beyond those that are presented in the main specialized sessions.

Objectives:

To review existing and successful multi-sectoral experiences (national, regional, and international) of the use of climate services for the different sectors. Particular attention will be paid to the extent to which experiences demonstrate a significant level of user ownership, of direct or associative financial and political/institutional commitment, and of complementarity in synergy with similar initiatives.

Schedule:

The CLIMATE SERVICES stage will be presented all the days of the Conference between 12h30-13h30 in a special location in the exhibition room. The sessions will be:

- I Global and Regional Climate services: good practices and remaining challenges.
- II National Climate services: good practices and remaining challenges.
- III Climate services and stakeholder engagement: from scientists to decision makers and Authorities

Day 1. Tuesday 16 October 12h30-13h30

Theme: Global and Regional Climate services: good practices and remaining challenges.

Facilitator: Juan José Nieto (CIIFEN)

Invited Panelists:

- Michelle L'heureux (USA - Climate Prediction Center, NOAA)
- Rodney Martinez (International Research Center on El Niño CIIFEN)
- Eleftheria Exarchou (Spain, Barcelona Supercomputing Center)

Day 2. Wednesday 17 October (12h30-13h30)

Theme: National Climate services: good practices and remaining challenges..

Facilitator: Mercy Borbor-Cordova (ESPOL)

Invited Panelists:

- Juan Bazo (Peru - Red Cross Red Crescent Climate Centre, Climate Services for Humanitarian Response)
- Carolina Rueda (Colombia - Meterological Service of the Air Force)
- Eric Alfaro (Costa Rica - University of Costa Rica)
- Desislava Petroslava (Spain - Barcelona Institute for Global Health) (TBC)

Day 3. Thursday, 18 October (12h30-13h30)

Theme: Climate services and stakeholder engagement: from scientists to decision makers and practitioners.

Facilitator: Jonathan Cedeño (ESPOL)
Invited Panelists:

- María del Pilar Cornejo, (Ecuador - ESPOL & Centro Internacional del Pacifico para la Reducción de Riesgos de Desastres).
- Palmira Cuéllar (Mexico - UNAM) (TBC)
- Shadananan Nair Krishnapillai, (India - Centre for Earth Research and Environment Management). (TBC)
- Boris Dewitte (France - LEGOS/CNRS) (TBC)

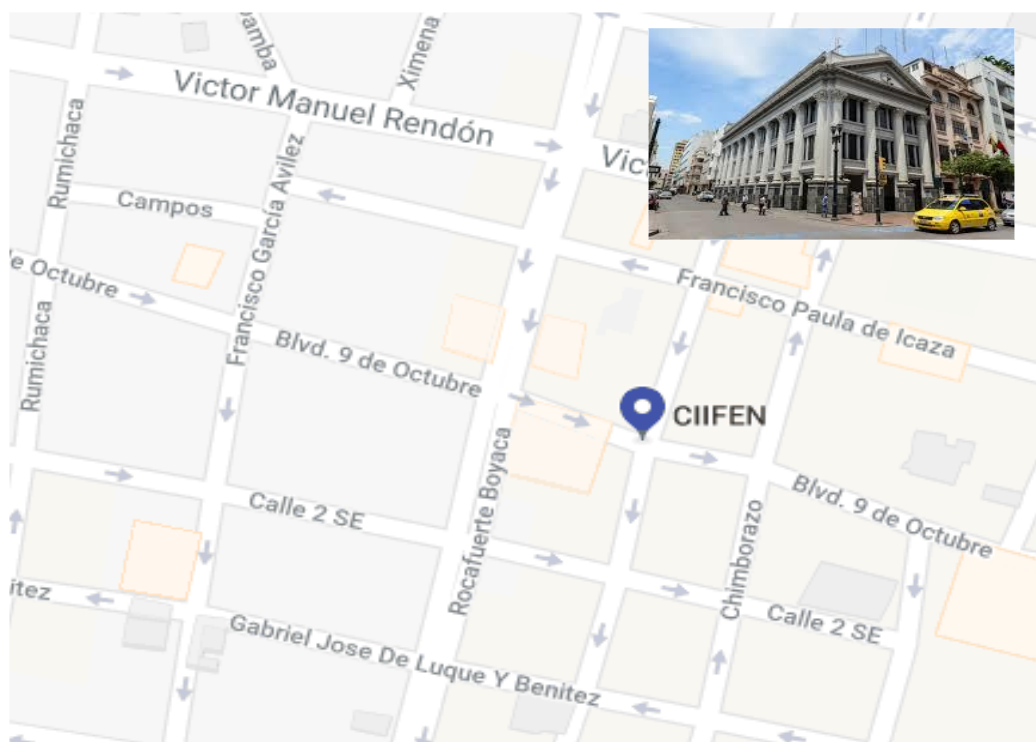
9. TRANSPORTATION

9.1 Transportation from Hotels to ESPOL

Shuttle from and to ENSO Conference venue to be hold at ESPOL campus will be organized by CIIFEN and ESPOL during the days of the conference.

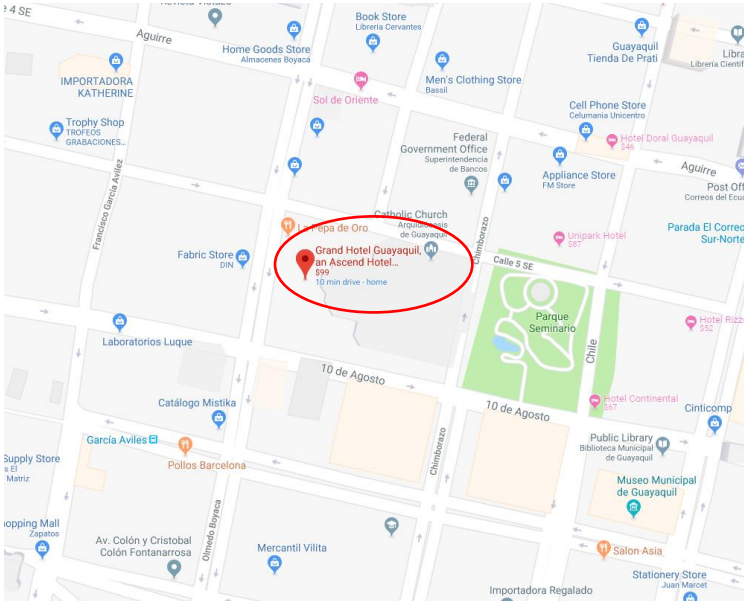
For the downtown hotels, the meeting point will be at CIIFEN's headquarters located in Escobedo 1204 and 9 de Octubre avenue (see map below) which is near (walking distance) of most of the suggested downtown hotels for the conference. Buses serving downtown area will depart from CIIFEN every day at 07h30 and will return at the same stop at 18h00.

For the north hotels, the bus will pass by each hotel at 07h00 (Sheraton, Plaza del Sol, Av. Joaquin Orrantia González) and 07h30 (Radisson, Ciudadela Kennedy, Av. Gral. Francisco Boloña 503a and calle Jorge Insua Hindro.), and return at the same stop at 18h00 (Sheraton, Radisson).

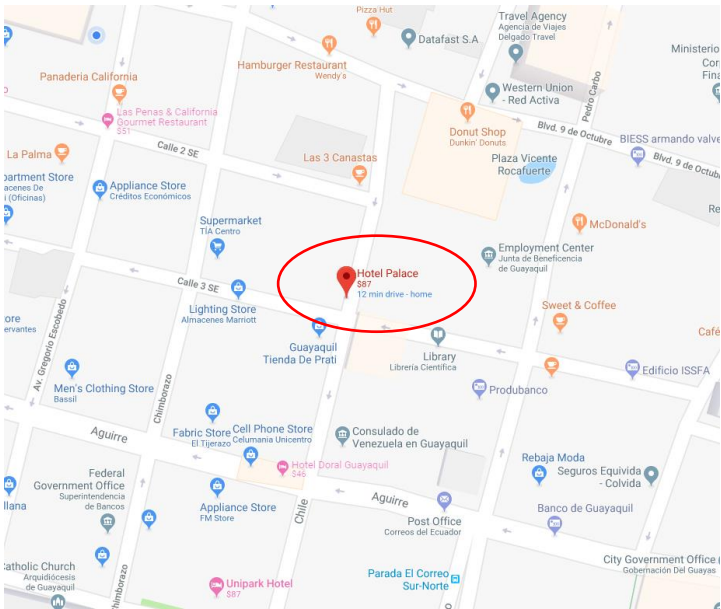


CIIFEN Headquarters

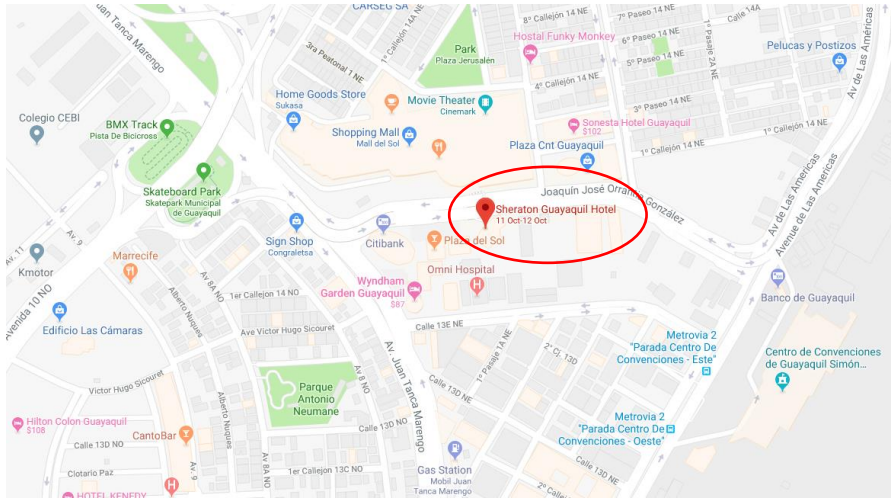
10. ACCOMMODATION



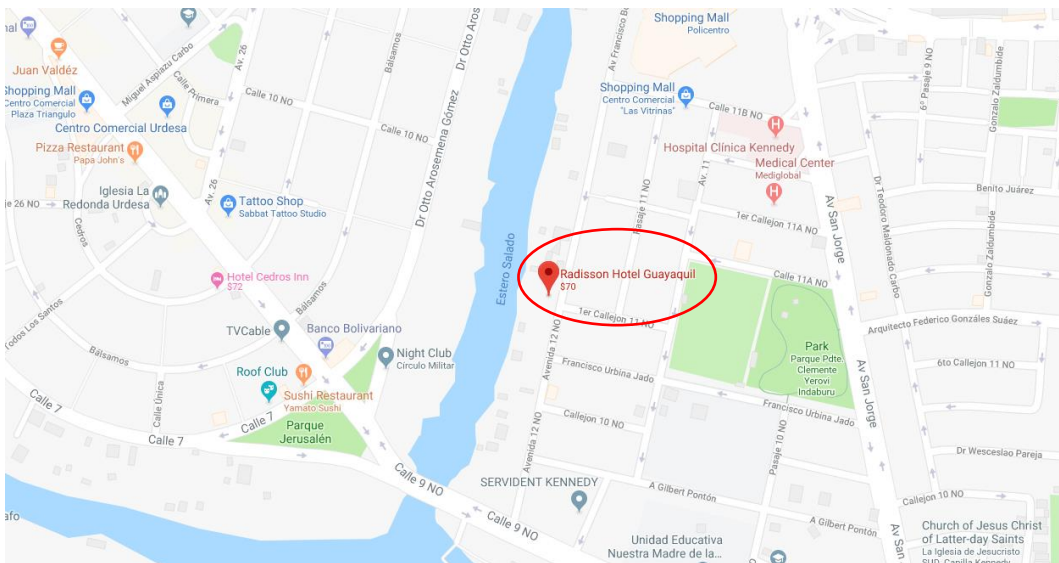
A: Grand Hotel Guayaquil (downtown)



B: Hotel Palace (downtown)



C: Sheraton Hotel Guayaquil (North)



D: Radisson Hotel Guayaquil (North)

DOWNTOWN HOTELS

a. Grand Hotel Guayaquil

Tel: +5934 (2) 32-9690

Add: Boyacá y Clemente Ballén

Email: ventas@grandhotelguayaquil.com

b. Hotel Palace

Tel: +5934 (2) 32-1080

Add: Chile y Luque

Email: reservas@hotelpalaceguayaquil.com.ec

(See map below) walking distance from hotels to CIIFEN headquarters

NORTH HOTELS

c. Sheraton Hotel Guayaquil

Tel: +593 4 370 7070

Address: Plaza del Sol, Av. Joaquin Orrantia González

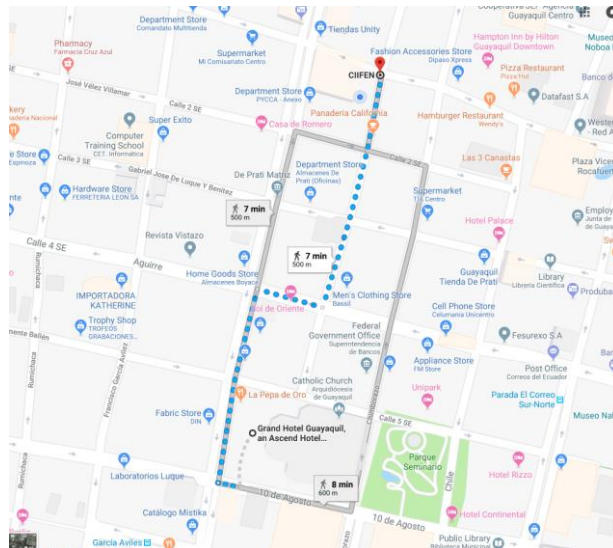
Email: fernanda.grijalva@sheratonguayaquil.com

d. Radisson Hotel Guayaquil

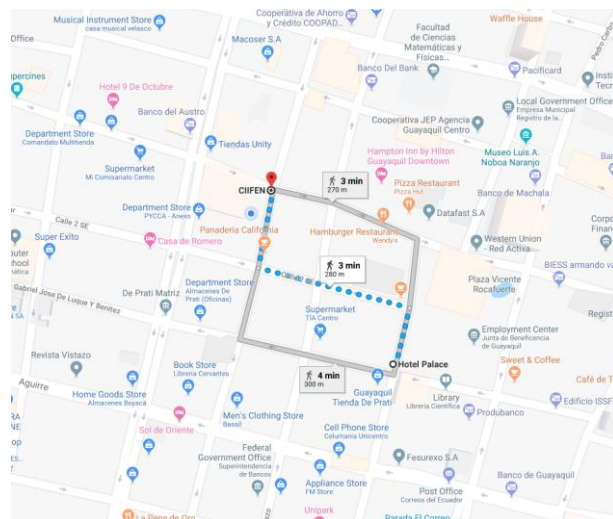
Tel: +593 4 600 8080

Address: Ciudadela Kennedy, Av. Gral. Francisco Boloña 503a and calle Jorge Insua Hindro

Email: maria.grijalva@ghlhoteles.com



From Grand Hotel Guayaquil to CIIFEN



From Palace Hotel to CIIFEN

USEFUL INFORMATION

10.1 General Information on Guayaquil

Official name: Santiago de Guayaquil

Patron Saint Festivities of Santiago de Guayaquil: July 25

Independence: October 9th, 1820

Extension: 345 square kilometers

Geography

The geography of Guayaquil is characterized by its coastal position in the northwest part of South America, in the coastal region of Ecuador, between the Guayas River and the Salado Estuary. Because of its proximity to the ocean and its port condition, the city is the one with the largest population in Ecuador.

Location

Guayaquil is located in the northwest part of South America; with few elevations and far away from the Andes mountain range. These elevations are formed by hills that cross the city and later join the mountain range called "Chongon-Colonche", which is located to the west. The river network of Guayas surround the city by the east and the Salado Estuary surrounds it by the west. This is why, the city has an easy access to the ocean through the Gulf of Guayaquil.

Altitude. 4 masl.

Weather. Guayaquil can be visited in any time of the year, since the city does not have extreme temperatures. Has two seasons: winter (from January to May) and summer (from June to December). During winter season, the city is hot during the day and a little cooler at nights. In the summer Guayaquil has a cool weather during day and night.

Population. Is the main city of the country with an approximate population of 2'500 000 inhabitants. The last census (2010) determined that 2'350 915 people live in Guayaquil.

Gentilic. Guayaquileño or guayaquileña.

Time zone. GMT -5.

Language

The official language is Spanish, however, in some touristic places like hotels and classy restaurants, tourists can speak in several languages. English is the most common non-native language.

Currency. American Dollar

Postal code. EC0901

Type of government

Autonomous. The government is elected by democratic vote that elects a Mayor and Cantonal Council.

Political-Administrative distribution

The Guayaquil canton has 16 urban parishes and 5 rural.

Attire

Even in winter time (rainy season) the city is very sunny; is the ideal time to visit the beaches. During winter days is recommended to wear fresh and light clothes, and comfortable shoes. For those sunny days tourists can wear caps or hats, and also sunblock. It is suggested to bring an umbrella. For summer time, the clothes are similar for the day, however, for the nights tourist may need a sweater.

Voltage

110 volts

10.2 Getting around

Santa Ana hill

Santa Ana Hill is the place where Guayaquil was born back in the XVI century, between the decades of 1540 and 1550, when Spanish Diego de Urbina was resettling the city at the foot of the Cerrito Verde or Cerrito de la Culata, which, alongside the Carmen Hill formed an image similar to a saddle, for that the city was called "The saddle city".

Tells the story that a Spanish treasure hunter by the name of Nino de Lecumberri, invoked the Saint Ana when he was facing death. When he survived, in gratitude, he placed a cross at the top of the hill, with the name of "Santa Ana" (Saint Ana) printed on it. Since then, the inhabitants started calling the place with the name that before was called "Loninchao" by the original aborigines.

The staircases to the top of the hill, are one of the favorite tourist destinations because it has symbolic places of the culture of Guayaquil, besides entertainment places.

It starts at the foot of the hill and end at the top. It is formed by 444 numbered stairs in which the tourists can find squares, roundabouts, museums, a chapel, a lighthouse, art galleries, craft shops, Internet coffee places, bars and restaurants.

Las Peñas neighborhood

With more than 400 years old, Las Peñas was the first neighborhood of Guayaquil, which took its name from the cliffs and limestone rocks that formed the Hill back then when the Spanish settled in the XV century. In 1982 the neighborhood was declared Cultural Heritage of Ecuador and between 2002 and 2008, the place was restored and regenerated by the Municipality of Guayaquil. This neighborhood, born in Colonial times, was destroyed in several occasions by the fires that assailed the city. The fact that the neighborhood was rebuilt in times of the Republic alienated its colonial style.

Distinguish personalities from the spheres of politics, business and culture lived in the neighborhood, among them, eleven Presidents of the country like Carlos Arroyo del Rio, Francisco Robles, Jose Luis Tamayo, Carlos Julio Arosemena Tola, Alfredo Baquerizo Moreno and Eloy Alfaro; writers like Enrique Gil Gilbert; historians like Rafael Pino Roca; artists like Manuel Rendon Seminario and Alfredo Espinoza Tamayo; the educator Rita Lecumberry and the musician Antonio Neumane, author of the lyrics of the National Anthem. It is also said that the revolutionary Che Guevara lived there for a while, giving free pediatric assistance to the inhabitants of the place; that the neighborhood was visited by American writer Ernest Hemingway and Chilean poet Nefali Reyes, better known as Pablo Neruda.

Santa Ana port

Is a touristic building complex of 4 hectares formed by several office buildings, commercial shops, apartments, squares, museums and a pier that borders the Guayas river. Its construction began in January 2005 and the first stage was inaugurated on April 15, 2007. It cost more than 20 million dollars that were funded by the Municipality and private corporations.

The work, whose original layouts were designed by the American firm of architects DDG, similar to Cocowalk in Miami, was built right in the place where the city was born. The old National Brewery, the dairy company Indulac and the rice company Modelo used to be settled in the same exact location. The area is connected to Las Peñas Neighborhood through the Numa Pompilio Llona Street. It is surrounded by a natural landscape since is located in front of the Guayas River; it has a modern architecture with a building constructed in the same place where the silos of the National Brewery used to be located, which maintains its original design. There is the Pilsener Square in which several artistic events take place and also the museums that pay tribute to Julio Jaramillo, the Beer industry and, Barcelona Sporting Club and Club Sport Emelec.

Civic square

It was inaugurated in 1999, as part of the process of urban regeneration that created an area of approximately 25 thousand square meters formed by broadleaved green areas with monuments of great historic importance. One of its main architectonic attractions is a great portion of its area (approximately 10 thousand square meters) that was reclaimed from the river by a reinforced concrete base, on a pilot foundation, which approaches the city to its quite river.

The Civic Square comprises famous monuments like the Rotunda Hemicycle to Bolivar and San Martin, the Moorish Tower (public clock), the President's Walkway (monuments to former presidents from Guayaquil) and also peculiar sculptures like the Wild Boar. It's the home of two traditional Clubs: the Naval Club and the Yacht Club that have been incorporated to the project respecting their access and private requirements. The Square also has four sculptures that evoke popular culture and represent the four elements of nature (earth, air, fire and water), two of them transformed into viewpoints, which provide the visitor a privileged view of the city and its surroundings. There is also an esplanade with a series of water fountains that create an exceptional environment at night.

Historic Park

History: the Central Bank of Ecuador built it in 1997 on the banks of the Guayas River as a theme park of 8 hectares with educational, cultural, environmental, recreational and tourist purposes. It is aimed to exhibit the history and culture of the old province of Guayaquil that emerged at the end of the colonial times and the beginning of the republican life of the country between the XIX and XX centuries, which occupied almost all of the Ecuadorian coast including the existing provinces of Los Rios, El Oro and part of Manabi.

The site also recreates the architecture, traditions and the urban and rural life of the Guayaquil of those times, mixed with a beautiful natural park full of a diverse vegetation that form different natural and wildlife areas with their respective flora and fauna. Its history dates back to the beginnings of 1980 when the director of the Anthropologic Museum of the Central Bank of Ecuador, Olaf Holm, was notified of the demolition of four buildings of great historic value, so he suggested that instead of demolishing them, a tourist-cultural project be developed to reflect the architecture of the city. Therefore, the buildings were dismantled and storage in the bank until the construction of the project.

The Special Projects Unit of the Central Bank that inaugurated the work on June 15, 1997 carried out the project. It was developed by stages, including the different areas of the park. On October of 1999, the Wildlife area was opened; on November 2000, the Traditions area; on November 2002, the Urban Architectonic area and the Pier 1900; on July 2005, the Julian Coronel House; on June 2006, the chapel of the Corazon de Jesus Hospice; on October 2000, the Territorial Bank and the Lavayen Paredes House.

The Public Company of Natural Parks and Public Spaces took over the administration on June 14, 2012, maintaining the same initial purposes.

Attractions: the visitors can get a taste of the geopolitical context of the old days; since the park recreates different habitats in which the people of the old province of Guayaquil used to develop their activities, such as the woods, the countryside and the city, which is closely related to the so called "Golden Age" of the main port of Ecuador, whose principal activity was the commercialization of cocoa.

The visitor can appreciate the history of Guayaquil in three defined areas:

1) Wildlife Area: it comprises approximately four hectares and recreates the natural habitat of more than 50 species between birds, mammals and other animals that turned the woods into their natural habitat, some of which are in danger of extinction.

2) Urban Architectonic Area: the space recreates the wealthy times of Guayaquil of the first decades of the XX century, when the city enjoyed an economic boom thanks to the growth and exportation of cocoa, which brought prosperity to the city and the surrounding farms.

3) Traditional Area: the space of two hectares is a place of reminiscence in which the visitor can learn about the history of urban Guayaquil, besides the observation of the rural life of our countryside.

10.3 Medical services

The nearest hospital (Downtown): Clinica Sotomayor

Address: Loja No. 700 and Escobedo. Phone: (04) 256 0300

Website: <https://www.hospitalvernaza.med.ec/clinica-sotomayor>

The nearest hospital (North): Clinica Kennedy

Address: Av. del Periodista and Callejón 11-A, N.O. Phone: (04) 228 9666

Website: <http://www.hospikennedy.med.ec/sedes/hck-kennedy/>

10.4 Insurance and liability

The conference registration fee does not include provisions for insuring participants against injury, sickness, theft, or property damage. Participants are advised to obtain whatever insurance they consider necessary.

10.5 Dining info

a. Dining options at the Palace Hotel (information taken from hotel webpage)

PALACE RESTAURANT

Located at the lower floor next to the lobby, offers fresh and authentic ecuadorian and international cuisine in a comfortable and cozy environment, with indoor seating overlooking the commercial street of the city centre.

Breakfast: Monday to Friday: 6:30 AM - 10:00 AM;

Saturday, Sunday & Public Holidays: 7:00 AM - 11:00 AM

LUNCH & DINNER

Lunch: 12:00 PM - 3:00 PM

Dinner: 6:00 PM - 10:30 PM

Reservations: +593 4 321080

b. Dining options at the Grand Hotel Guayaquil (information taken from hotel webpage)

COMPLIMENTARY BREAKFAST

LUNCH & DINNER

Opened 24/7 the restaurant La Pepa de Oro offers excellent buffet choices.

Breakfast: Monday to Friday: 6:00 AM - 10:00 AM; Saturday,

Sunday & Public Holidays: 6:00 AM - 10:30 AM

Lunch: 12:00 AM - 3:30 PM

Dinner: 24 Hours

Reservations: +86 532 8612 0656

c. Dining options at the Sheraton Hotel Guayaquil

COOK'S RESTAURANT

This is the ideal destination for any occasion between family or colleagues. Discover the best view and comfort that will transform your stay into the best personalized service experience that will make you feel at home.

COMPLIMENTARY BREAKFAST

Breakfast: Monday to Sunday: 6:30 AM - 10:00 AM BUFFET

LUNCH & DINNER

Lunch: Monday to Friday 12:00 AM - 3:30 PM BUFFET
Saturday 12:00 AM - 3:30 PM MENU
Sunday 12:00 AM - 3:30 PM BRUNCH

Dinner: Monday to Sunday 19:00 PM - 22:30 PM MENU

Reservations: +593 4 370 7070 ext 150

d. Dining options at the Radisson Hotel Guayaquil

Try our Guayaquil restaurant's seaside-inspired cuisine

Savor flavors of Guayaquil without leaving the Radisson. Our Mangle Restaurant serves local and Pacific seafood in a setting inspired by the seaside landscape surrounding the hotel. Enjoy a breakfast buffet, a lunch buffet or a delicious dinner, and then head to The Roots Lounge Bar to sip on flavorful cocktails. Are you an early riser? From 5 to 6:30 a.m., you can snag items from our continental breakfast at the front desk station before heading off for meetings or a day trip to Playas. With 24-hour room service, you can indulge in a late-night dinner in the privacy of your room.

Mangle Restaurant

A la Carte Service. Monday to Sunday 10:30 a.m. – 10:30 p.m.

Life Music: Thursdays 6:30 – 8:30 p.m. and Saturdays 8:30 – 10:30 p.m.

Mangle Restaurant hours

Breakfast: 6:30-10:30 a.m.

Lunch: Noon-3 p.m.

Dinner: 6:30-10:30 p.m.

The Roots Lounge Bar hours

9 a.m.-10:30 p.m.

e. Lunch availability during the Conference

A lunch service will be available at Engineering Dining Room (10 minutes walking from the venue). This service is self-paid, with a cost of USD 5. The menu is as follow:

Tuesday 16th October:

Broad bean soup. Lassagna. Mixed salad. Blackberry juice. Desert: Jello.

Wednesday 17th October:

Chicken soup. Lentil stew with rice and chicken/beef. Cold salad. Orange juice. Desert: Carrot cake.

Thursday 18th October:

Fish soup (sancocho). Chicken in passion fruit (maracuyá) sauce. Rice with corn. Fresh salad. Grapefruit juice. Desert: Flan.

10.6 Useful numbers

Police: 101

Fire: 102-112

Emergency calls: 911

Local telephone number: 593 4 2514770

CIIFEN Secretariat cell number: 593 9 2578460 (Evelyn Ortiz)

10.7 Social event

The social event will take place in the reception area of the STEM building. Includes the presentation of "Ballet Folklórico" group from Faculty of Social and Humanistic Sciences of ESPOL, with typical dances from the Littoral and the Highlands.





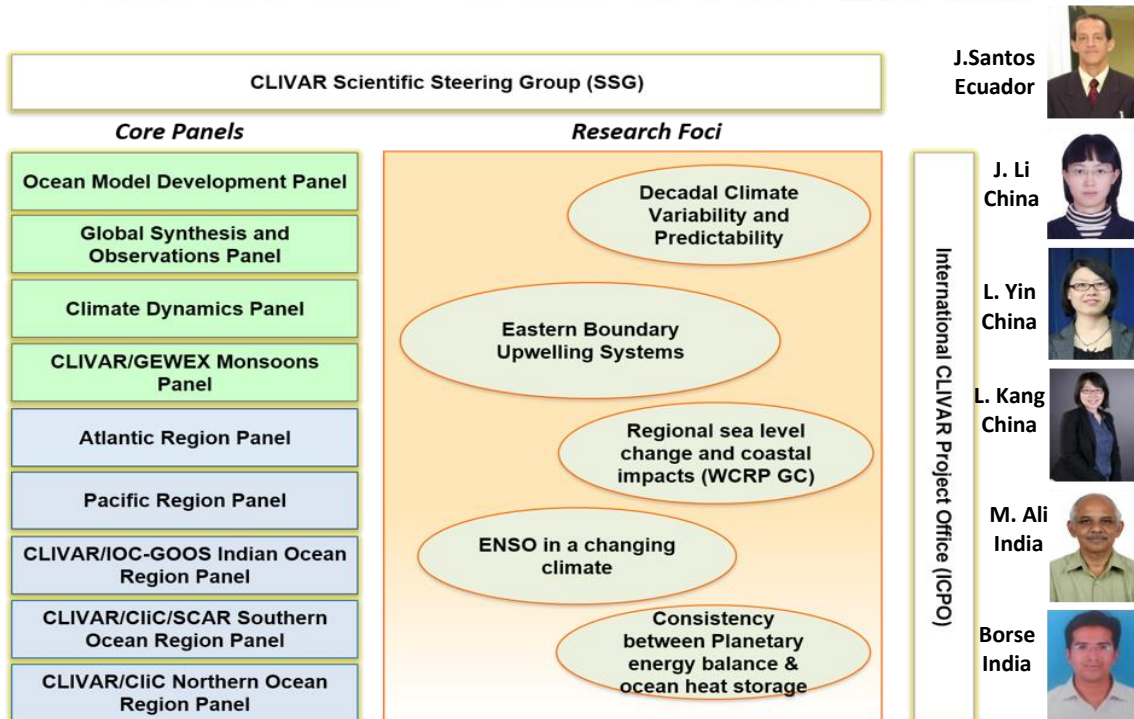
CLIVAR: contributing to the knowledge of the world's climate and ocean

International CLIVAR Project Office
 First Institute of Oceanography SOA
 Qingdao, China

Contact us: Jose Santos
 Executive Director ICPO
jose.santos@clivar.org

CLIVAR (Climate and Ocean: Variability, Predictability and Change) is one of four core projects of the World Climate Research Programme. CLIVAR's mission is to understand the dynamics, interaction, & predictability of the climate system with emphasis on ocean-atmosphere interactions. Thanks to CLIVAR's efforts, we now have unique observing, modelling and reanalysis capabilities that support research in ocean dynamics and variability for the benefit of society. The way CLIVAR works is by forming a network of scientists, at the moment we have 14 groups with a total of more than 230 renowned scientists from Africa, Australia, Asia, Europe and the Americas.

SSG Members: A. Bracco (USA), D. Stammer (Germany), K. AchutaRao (India), W. Cai (Australia), B. Dewitte (France), N. Bindoff (Australia), S. Griffies (USA), P. Braconnot (France), K. Takahashi (Peru), D. Chen (China)





The International Research Center on El Niño (CIIFEN) is an international non-profit organization established in January 2003 as a result of several resolutions adopted by the United Nations. It is supported by the World Meteorological Organization (WMO) as observer, the United Nations Office for Disaster Risk Reduction UNISDR and the Governments of Ecuador and Spain which are part of CIIFEN's International Board. Our mission is: "To implement actions to consolidate the science-policy interface and improve climate services to contribute on risk management and adaptation".

CIIFEN provides operational climate services to all Latin America. Our main products are:

1) El Niño/La Niña Bulletin for Latin America; 2) Seasonal forecast for South America; 3) Ocean analysis bulletin; 4) Oceanic and atmospheric conditions, evolution and outlooks; 5) Basic climate monitoring. These products are available in our web site: www.ciifen.org

We have a long track and vast experience organizing and running capacity building activities. Since 2003 more than 200 national and international workshops have been developed. They include a wide diversity of modalities, thematic areas and participants such as: technicians, indigenous communities, farmers, environmental managers, decision-makers, scientists, and university students.

CIIFEN has also executed more than 50 projects addressed to communities and most vulnerable regions.

In June 2015, CIIFEN was officially designated as *Regional Climate Center for Western South America (RCC-WSA)* by the World Meteorological Center (WMO) with the objective to strength the operational capacities of the Meteorological and Hydrological National Services. We strongly continue improving our climate services for the benefit of the regions.



CREA
CRECE
INNOVA
ESPOL



Established in 1958, Escuela Superior Politécnica del Litoral (ESPOL Polytechnic University) is a non-profit public higher education institution located in the urban setting of the large city of Guayaquil, Guayas. This institution has also branch campuses in the following location(s): Las Peñas, Santa Elena, Daule and San Pedro de Manglaralto. Officially accredited and/or recognized by the Consejo de Evaluación, Acreditación y Aseguramiento de la Calidad de la Educación Superior del Ecuador (Council of Evaluation, Accreditation and Quality Assurance in Higher Education of Ecuador), ESPOL is a large (uniRank enrollment range: 10,000-14,999 students) coeducational higher education institution. Escuela Superior Politécnica del Litoral offers courses and programs leading to officially recognized higher education degrees such as bachelor degrees, master degrees in several areas of study. This 60 years old higher-education institution has a selective admission policy based on entrance examinations. The admission rate range is 30-40% making this Ecuadorian higher education organization a very selective institution. International applicants are eligible to apply for enrollment.

ESPOL operates eight main faculties: natural sciences and mathematics; social and humanistic sciences; geosciences engineering; maritime engineering, biological science, oceanographic sciences and natural resources; electrical engineering and computing sciences; mechanical engineering and production sciences; life of sciences; and visual design and communication.

www.espol.edu.ec



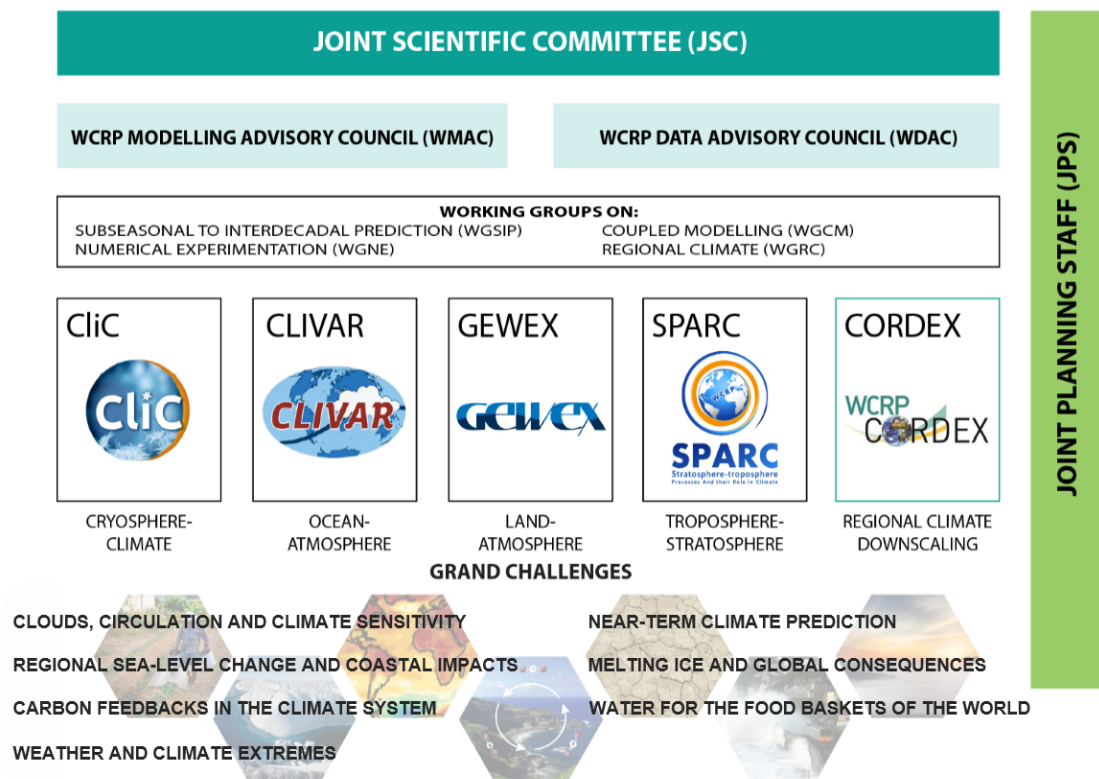


The WCRP mission is to facilitate analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit and value to society. The two overarching objectives of the WCRP are

- to determine the predictability of climate; and
- to determine the effect of human activities on climate

WCRP is organized as a network of core and co-sponsored projects, working groups and cross-cutting initiatives, which includes CLIVAR, the core project focused on ocean-climate linkages.

<http://www.wcrp-climate.org>



The World Climate Research Programme is sponsored by the World Meteorological Organization (WMO), the International Science Council (ISC) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO.



The First Institute of Oceanography (FIO), State Oceanic Administration (SOA), China, the predecessor of the Fourth Marine Research Institute of the Chinese Navy, was first established in 1958. In 1964, the Institute was re-organized and its governing body was shifted from the Navy Department to SOA. FIO is a comprehensive research institute, it is engaged in both basic and applied research in oceanography and marine related science and technology, supports the development of high-tech industries, advances marine science and technology, and provides technical support and research services in the areas of marine resources management, national marine protection, public service, marine economic development and marine safety.

The major research fields of FIO are on the regularities, distributions and variations of natural environmental elements in the maritime territory of China, the adjacent oceans and the polar region, such as marine resources development, environmental geology, the mechanism, establishment, and prevention of the marine disaster, the physiochemical and biological factors affecting marine ecosystems, remote sensing oceanography, marine information system management, appraisal, protection and governance of marine environment, development of marine high-tech, and comprehensive marine management.

<http://www.fio.org.cn/en/>



US Climate Variability and Predictability (CLIVAR) is a US federally-sponsored research program with a mission to foster understanding and prediction of climate variability and change on intraseasonal-to-centennial timescales, through observations and modeling with emphasis on the role of the ocean and its interaction with other elements of the Earth system, and to serve the climate community and society through the coordination and facilitation of research on outstanding climate questions. US CLIVAR provides US research and organizational contributions to the international CLIVAR Program.

The science goals of US CLIVAR are to:

- Understand the role of the oceans in observed climate variability on different timescales
- Understand the processes that contribute to climate variability and change in the past, present, and future
- Better quantify uncertainty in the observations, simulations, predictions, and projections of climate variability and change
- Improve the development and evaluation of climate simulations and predictions
- Collaborate with research and operational communities that develop and use climate information

For the past 20 years, US CLIVAR has addressed some of the most pressing research questions to observe, theorize, analyze, model, experiment, and synthesize our understanding of the climate system, particularly the great uncertainties related to the role of the ocean.

usclivar.org



The Climate Variability and Predictability (CVP) Program supports research that enhances our process-level understanding of the climate system through observation, modeling, analysis, and field studies. This vital knowledge is needed to improve climate models and predictions so that scientists and society can better anticipate the impacts of future climate variability and change. CVP maintains a portfolio of projects intended to answer the following questions:

- How can we better understand and anticipate the global and regional impacts of climate variability and change?
- What foundational knowledge do we need to improve climate models and predictions/projections - improving our ability to assess risk and inform decision-making?
- How can we close the predictability gap between weather models and climate models to inform seasonal and decadal predictions?

To achieve its mission, the CVP Program invests in NOAA mission-critical research, which is carried out at NOAA and other federal laboratories, NOAA Cooperative Institutes, and academic institutions. The Program also coordinates its sponsored projects with major national and international scientific bodies including the World Climate Research Programme (WCRP) - especially CLIVAR, US CLIVAR (Climate and Ocean Variability, Predictability and Change) and GEWEX (Global Energy and Water Cycle Exchanges) programs - and the U.S. Global Change Research program (USGCRP).

cpo.noaa.gov/Meet-the-Divisions/Earth-System-Science-and-Modeling/CVP



MAPP

Modeling, Analysis, Predictions, and Projections

The Modeling, Analysis, Predictions, and Projections (MAPP) Program's mission is to enhance the Nation's and NOAA's capability to understand, predict, and project variability and changes in Earth's climate system. MAPP's work directly impacts or provides foundational capability for improving understanding, assessing impacts for decision making, and improving NOAA products used in mitigation and adaptation. By supporting these goals, the MAPP program plays a crucial role in enabling the Nation to meet the societal challenges created by the impacts of climate variability, such as year-to-year changes in the occurrence of extremes or droughts, and longer term climate changes.

U.S. citizens and businesses face unprecedented challenges resulting from variations in the climate. Our growing National infrastructure is increasingly susceptible to both year-to-year and long-term changes in climate conditions. To prepare for and understand the nature of these changes, accurate and regional-scale computational modeling of the climate system is of the utmost importance. Climate and Earth system models and derived prediction systems have become central to almost every aspect of the global change research and applications apparatus.

NOAA is motivated by the challenges facing society to improve products and services through research. Ensuring that marine resources are sustainable; understanding coastal vulnerabilities and ensuring resiliency; monitoring, predicting, and understanding droughts; and preparing for extremes -- each of these critical aspects of our socioeconomic system are directly dependent upon our improved capability to model and predict aspects of the climate system. NOAA's MAPP Program sustains research that is critical to improving such a foundational capability.

cpo.noaa.gov/Meet-the-Divisions/Earth-System-Science-and-Modeling/MAPP



The French National Research Institute for Sustainable Development (IRD) is an internationally recognized multidisciplinary organization working in partnership with Mediterranean and inter-tropical countries. It is a French public establishment under the joint authority of the French Ministry of Higher Education and Research and the Ministry of Foreign Affairs and International Development.

Via its network and presence in fifty or so countries, it takes an original approach to research, expertise, training and knowledge-sharing, to the benefit of countries and regions that make science and innovation key drivers in their development.

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