

RESEARCH CENTERS OF EXCELLENCE IN PRIORITY AREAS (FONDAP)

FINAL EVALUATION REPORT

This form is intended to facilitate your work as a referee and standardize the evaluation reports. Each topic should be evaluated with concepts ranging from “Excellent” to “Does Not Qualify”. Please indicate your qualification for each criterion in a scale between **0 to 5 points (half points are also allowed)**. Each qualification must be properly supported with relevant comments.

Grading scale:

0 = Does Not Qualify	The proposal fails to meet/address the criterion under analysis or cannot be evaluated due to missing or incomplete information.
1 = Poor	The proposal does not properly meet/address the aspects of the criterion or there are serious inherent deficiencies.
2 = Fair	The proposal broadly meets/addresses the aspects of the criterion, but there are important deficiencies.
3 = Good	The proposal properly meets/addresses the aspects of the criterion, although some improvements are required.
4 = Very Good	The proposal meets/addresses the aspects of the criterion very well, although some improvements are still possible.
5 = Outstanding	The proposal successfully meets/addresses all the aspects of the criterion. Any shortcomings are minor.

If the Center report does not contain information on the given topic, please indicate so in your evaluation.

Your final overall comments and recommendations are an important part of the review process.

I. PROJECT INFORMATION

CENTER'S NAME:

Center for Climate and Resilience Research

DIRECTOR:

Rene Garreaud Salazar

II. EVALUATION PANEL

REFEREE NAME	ORGANIZATION/ INSTITUTION	E - MAIL	SIGNATURE
REVIEWER 1	- - - - -	- - - - -	- - - - -

III. CENTER ACHIEVEMENTS

1. Scientific achievements and their impacts to local, national and international community.

i. Comments

The Center for Climate and Resilience Research (CR2) has made significant scientific contributions in the field of climate science and resilience research. Their research initiatives, collaboration efforts, modeling capabilities, policy impact, and educational outreach showcase their technical prowess and commitment to advancing our understanding of climate dynamics and building resilience in the face of environmental challenges. The center has played an increasingly visible role in shaping our understanding of climate dynamics and building resilience and is now an internationally recognized innovator in climate and resilience research.

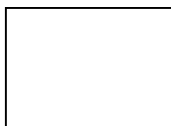
A unique aspect of the Center is the number of cutting-edge research initiatives. This clearly highlights their role in expanding the boundaries of climate science. The Center's research encompasses a wide range of disciplines, including atmospheric science, hydrology, ecology, and social sciences. This integrated approach to studying of climate change's impact on ecosystems and biodiversity has yielded important insights into the intricate relationships and vulnerabilities within these complex systems. From studying the impact of climate change on ecosystems and biodiversity to exploring the role of oceans in modulating global climate patterns, understanding the causes and impacts of the unprecedented megadrought conditions in central Chile, identifying the social and environmental factors that impact air quality and harmful algal blooms, the Center's research efforts have yielded valuable contributions to both local policy makers as well as the national and international scientific community. The scope of the Center's research and its multidisciplinary approach are truly impressive and ensure a comprehensive understanding of climate-related phenomena. The Center's utilization of advanced climate models play a crucial role in predicting and understanding climate patterns and trends, aiding policymakers, and helping society make informed decisions. The Center's state-of-the-art modeling techniques, coupled with observational data, enable accurate projections of future climate scenarios. These projections are critical for policymakers and stakeholders to develop effective mitigation and adaptation strategies, as they provide a solid foundation for evidence-based decision-making. Such projections are vital for effective planning and adaptation strategies, providing valuable insights into the potential impacts of climate change on various sectors, including agriculture, water resources, and human settlements.

In addition, the Center's focus on resilience research highlights its commitment to addressing the practical implications of climate change. By investigating the vulnerabilities and adaptive capacities of different systems, including natural, social, and economic, the Center actively contributes to building resilience at various levels. Moreover, the center's efforts to translate scientific knowledge into actionable policy recommendations have garnered widespread recognition. The Center's close collaboration with policymakers ensures that research findings directly influence policy decisions, fostering a more sustainable and climate-resilient future

ii. Evaluation



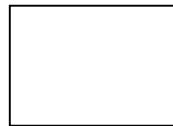
Outstanding



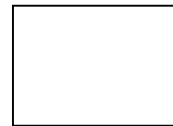
Very Good



Good



Regular



Poor



Not Qualify

2. **Educational achievements and impact.** Please pay attention to integration of research and educational activities in training advanced human resources, and participation in **PhD Programs.**

i. Comments

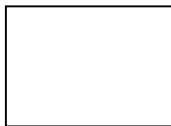
The Center has made remarkable advances in education, particularly through its masters and PhD programs. These programs have played a crucial role in nurturing the next generation of climate scientists by equipping them with the skills, knowledge, and experience necessary to address the complex challenges posed by climate change. The graduate programs uphold a rigorous academic standard, ensuring the development of highly skilled and competent researchers. Importantly, the programs prepare students for the emerging areas of research by embracing an interdisciplinary approach that combines atmospheric science, hydrology, ecology, and social sciences. This integrative approach enables students to explore the multifaceted dimensions of climate change and resilience, fostering a more holistic understanding of the subject matter.

Since 2015, the Center has completed the training of 37 students with another 90 students in progress (127 in total). The majority of these students are either masters or doctorate. The Center has also trained another 26 postdoctoral fellows. These are very impressive numbers, particularly for the number of postdoctoral fellows, which I am happy to see since I believe investment in early career scientists is equally as important as for graduate students. This is an impressive investment that will provide the scientific foundation for the future that is capable of addressing the inevitable climate challenges that Chile and the world will face.

ii. Evaluation



Outstanding



Very Good



Good



Regular



Poor



Not Qualify

3. National and international collaboration achievements. Pay attention to activities that contributed to national and international networking

i. Comments

The Center has made significant strides in fostering scientific collaborations, both within Chile and abroad. These collaborations have been instrumental in advancing knowledge, sharing resources, and addressing specific climate-related themes. The center's commitment to formal partnerships and spontaneous collaborations has strengthened its research capacity and enhanced the impact of its work.

The collaboration with renowned international institutions and researchers exemplifies the dedication to fostering global scientific cooperation. The interdisciplinary nature of their research is clearly evident in their publications. Of 518 ISI publications, 77 involve researchers from multiple interdisciplinary research lines. For non-ISI publications, the ratio is even higher and is more than 30% (47 of 162). The center actively engages in collaborative projects and exchanges with organizations across disciplines, facilitating the exchange of knowledge, data, and expertise. These collaborations have facilitated a broader perspective on climate change, enabling cross-disciplinary insights and a more holistic understanding of their research findings. The Center's participation in collaborative, interdisciplinary projects demonstrates their commitment to transcending institutional boundaries and addressing climate challenges collectively.

The Center has established formal collaborations with renowned research centers, both in Chile and abroad. Notable among these is the Memorandum of Understanding (MOU) signed with the Scripps Institution of Oceanography, University of California San Diego. This collaboration has facilitated the exchange of expertise, data, and research resources, leading to a deeper understanding of oceanographic processes and their interaction with climate change. Additionally, the joint operation of the Andean Snow Observatory with IANIGLA-Argentina has allowed for comprehensive monitoring and analysis of snow cover and water resources in the Andean region, contributing to improved climate change modeling and water management strategies.

The center has also collaborated with CAPES and CRHIAM in Chile to address the economic aspects of climate change. This collaboration has brought together experts from diverse fields to examine the economic impacts of climate change, contributing to a more comprehensive understanding of the complex interactions between climate and socio-economic systems. These spontaneous collaborations have enriched the research portfolio and fostered innovative solutions to address the multifaceted challenges posed by climate change. The Center's engagement in integrative themes, such as Harmful Algal Blooms and Climate Change, has involved a broad network of researchers from universities, external institutions, and national agencies. By bringing together experts in the field, including colleagues from the Instituto de Fomento Pesquero (IFOP), the Center has contributed to the study of harmful algal blooms and their relationship with climate change. This collaborative effort has generated valuable insights into the ecological and societal impacts of harmful algal blooms, enhancing our understanding of the complex interactions between climate and marine ecosystems.

Another significant achievement is the recent establishment of CEODOS-Chile, a consortium of excellence research centers dedicated to oceanographic investigation along the Chilean coast. Through this collaborative platform, which includes (CR)2, IDEAL, COPAS, CIEP, and others, researchers have joined forces to study oceanographic processes and their connection to climate change. This consortium

represents a concerted effort to pool resources, share expertise, and tackle complex research questions, promoting synergy and advancing knowledge in the field of oceanography.

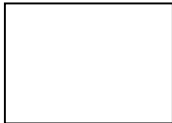
ii. Evaluation



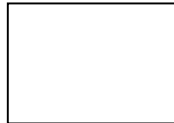
Outstanding



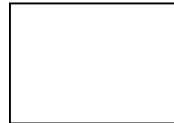
Very Good



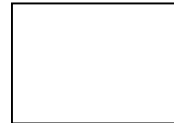
Good



Regular



Poor



Not Qualify

4. Outreach Achievements. Pay special attention to those activities that tied the Center with the **external community** such as elementary or high schools, institutions, companies, among others.

i. Comments

The Center has demonstrated a significant commitment to outreach activities, targeting a wide range of stakeholders, including professionals in state agencies, private organizations, high-level policymakers, and undergraduate and graduate students in universities. With a dedicated communication team and active involvement from researchers, the Center has undertaken a systematic and comprehensive approach to engage with these audiences and contribute to the dissemination of climate change knowledge.

Outreach efforts have prioritized engaging professionals in state agencies and private organizations, recognizing their crucial role in implementing effective climate change adaptation and mitigation strategies. By targeting these stakeholders, the Center provides necessary scientific information and expertise to help them make informed decisions and take proactive measures. Additionally, high-level policymakers are also a focus, as their decisions can have significant implications for climate-related policies and actions. The proactive approach to engaging policy makers should greatly help to shape effective climate governance frameworks. The involvement of nearly all researchers in outreach activities showcases the strong commitment of the Center's administration and scientists to effectively communicate research findings to the broader public. By providing materials, participating in media interviews, and co-organizing events and forums the scientists help to ensure that scientific knowledge is effectively and accurately translated and disseminated to different target audiences which further enhances the impact of the governments investment in the Center.

The Center has produced over 300 policy briefs and analyses, demonstrating their dedication to providing timely and relevant information on climate change issues. These documents complement the National Reports, provide contingency scientific issues and aim to contribute to climate change adaptation and mitigation efforts in Chile. The availability of these resources on the website has attracted significant attention, with over 300,000 visits and an average of more than 3,000 visits per brief/analysis. This indicates a strong interest from stakeholders and the general public in accessing scientific information to inform decision-making. The success of the Center's outreach efforts is further evidenced by their innovative products, such as "Climate capsules." These capsules analyze scientific concepts present in public discourse, effectively bridging the gap between scientific research and the general public's understanding of climate change. Additionally, the development of "Constitutional bulletins" contributes to the ongoing constituent process, addressing climate change issues and providing valuable insights for policymakers involved in shaping the constitution. The Center's increasing presence in media and social networks reflects their proactive approach to disseminating scientific information. With over 400 annual press appearances, it has ensured that their research findings reach a wide audience and contribute to public discourse on climate change. The exponential growth in media and social network presence indicates a growing recognition of the Center's expertise and their role in informing the public about climate-related issues.

ii. Evaluation

	4				
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Outstanding

Very Good

Good

Regular

Poor

Not Qualify

5. Contribution to **public policies**. Pay special attention to the impact of the FONDAP Center in terms of contribution to public policies and other targeted groups, if applied.

i. Comments

This is included in my assessment above to number 4

ii. Evaluation

5

Outstanding

Very Good

Good

Regular

Poor

Not Qualify



IV. OTHER RELEVANT ASPECTS

If the Center report does not contain information on **other relevant aspects**, please indicate so in your evaluation.

i. Comments

No comments.



V. CENTER PROJECTIONS

Please comment about the **center projections** after the 10 - year of funding. If the Center report does not contain information on the Center projections, please indicate so in your evaluation.

i. Comments

The Center has made tremendous progress of the past decade. The investments made in the Center will undoubtedly result in the protection of lives, property and ecosystems within Chile. The rate of climate change and the challenges it presents for the future will only become greater in the coming decade and the Center is uniquely qualified to help policy makers plan and adapt to the inevitable changes that they will face. Continued investment in the Center will pay of many times over.

VI. INSTITUTIONAL COMMITMENTS

Please comment about the facilities that were available to the Center, the commitment of the administration of the leading and partner institutions to the Center, and the commitment of the partner institutions to achieve the Center goals.

i. Comments

All institutions met their financial contributions on time and according to the agreements.

ii. Evaluation

5

Outstanding


Very Good

Good

Regular

Poor

Not Qualify



VII. ADVISORY COMMITTEE

Please comment about the commitment of the **advisory committee**, and its contribution to the Center development.

i. Comments

This is difficult to evaluate. They committee members are certainly distinguished with appropriate backgrounds to serve on the advisory committee. They are diverse and cover the relevant disciplines that the Center is focused on. They seem to have made useful contributions to the Center's development and direction, but its difficult to assess how involved they have been or what contributions they have made to the Center.



ii. Evaluation

Outstanding

Very Good

Good

Regular

Poor

Not Qualify



VIII. FINAL OVERALL COMMENTS AND RECOMMENDATIONS

Please provide a final overall and recommendations for the Center. Include here aspects that were not covered in the previous sections, which you consider significant for the Center.

i. Comments

The Center has made significant achievements in advancing interdisciplinary climate science, fostering scientific collaborations, and engaging in outreach activities. The Center has emerged as a leading institution in addressing climate change and its impacts in Chile. Continued investment in the Center is essential for the benefit of the people of Chile. By supporting ongoing research efforts, the Center will continue to generate crucial knowledge about climate change impacts specific to Chile's unique geographical and socio-economic context. This knowledge will inform evidence-based policies and adaptation strategies, ensuring the country's preparedness for climate-related challenges. Their outreach activities will continue to play a vital role in enhancing public understanding of climate change, empowering communities, and fostering dialogue among stakeholders. Such investment will not only strengthen Chile's resilience to climate change but also bring substantial socio-economic benefits. The center's research findings and policy contributions will guide sustainable development practices, support the growth of climate-resilient industries, and promote the efficient use of natural resources. Furthermore, continued investment will attract and retain top-tier researchers, fostering scientific talent and creating opportunities for collaboration with local and international partners.



ii. Evaluation

5

Outstanding

Very Good

Good

Regular

Poor

Not Qualify

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Your final overall comments and recommendations are an important part of the review process.


I. PROJECT INFORMATION

CENTER'S NAME: CENTER FOR CLIMATE AND RESILIENCE RESEARCH (CR)2

DIRECTOR: PROFESSOR RENE GARRAEUD SALAZAR

II. EVALUATION PANEL

REFEREE NAME	ORGANIZATION/ INSTITUTION	E - MAIL	SIGNATURE
REVIEWER 2	- - - - -	- - - - -	- - - - -

III. CENTER ACHIEVEMENTS

1. Scientific achievements and their impacts to local, national and international community.

i. Comments

One of the CR2's (Center for Climate and Resilience Research, or Center hereafter) original goals was to *"deepen our understanding of the climate system, processes, and impacts throughout Chile [that are] confronting its socio-ecological complexities"*. This complements the two additional goals of strengthening the community of natural and social scientists and Chile's climate and resilience science.

The research undertaken by CR2's researchers has significantly advanced the knowledge of the climate of the region, its variability and how this is changing including the nature, frequency and intensity of some of the extreme events that affect Chile's society and economy. The Final Report provides numerous examples of research that has deepened our understanding of those key processes and drivers that affect the climate of Chile and the adjacent coastal regions and ocean. Some examples that are of significance for Chile's communities, economy, and ecosystems, and for the scientific community within Chile, South America and beyond, include (noting that the report describes many more):

- a) Published analyses of the recent, unprecedented Central Chile megadrought - the occurrence of such megadroughts in the longer-term climate record; the causal factors that combine natural variability processes (such as ENSO) and trends in rainfall, warming, snowmelt and river flow caused by anthropogenic climate change; what these results mean for future hydroclimates and drought risk; and the socio-economic impacts of the drought. Related to this, a significant output is the published reconstruction of gridded annual soil moisture for South America. This will be key to diagnosing the frequency, intensity and timing of droughts in the past, and what this means for future risk.
- b) Research showing that a new fire regime has been established in Chile because of anthropogenic climate change (affecting rainfall patterns, temperatures and evaporative demand) along with the influence of human activities that increase fire ignition, modify land use and land management practices and the effects on ecosystems of invasive species.
- c) Published research diagnosing important extreme weather and climate events such as sudden stratospheric warming and atmospheric rivers that have significant impacts in the region. For example rare summertime atmospheric rivers have the potential for damaging impacts on the supply of drinking water for Chile's capital city.
- d) Published analyses diagnosing the processes contributing to observed warming trends in near surface air temperatures over land, and cooling in sea surface temperatures in the coastal regions and their consistency with regional climate projections. As well as advancing understanding and building confidence in projections of future climate, this research underpins assessments of the effect on biogeochemical cycling, and thence harmful algal blooms and productivity of these coastal ecosystems. Of note, related to this, is the delivery of a long time series (more than two decades) of greenhouse gas (GHG) observations from Station 18 off Concepcion, along with additional oceanographic databases on GHG, all of which are publicly available .
- e) A detailed spatiotemporal description of the glacier and ecosystem evolution in north-western Patagonia and its links to variations in atmospheric CO₂ via the interplay between atmospheric and oceanic circulation. This contributes to our understanding of processes that link the cryosphere, atmosphere and ocean components of the global climate system.

- f) Analysis of observed trends, and projections of future trends in air quality and its impacts on human health.
- g) Research that explores what is a suitable framework for understanding urban resilience in the context of climate variability and change; develops an integrated analytical framework to support analysis of urban resilience; and the development of resilience indices for settlements across Chile.
- h) The important connections between biophysical processes and changes and human and social factors and impacts; what this means for governance and climate adaptation measures.


Whilst it was not easy to fully assess the quality and impact (locally, nationally and internationally) of these publications, as there are almost 500 papers in the last five years alone (nb it would have been helpful for the Final Report to include a hyperlinked bibliography of all cited papers to facilitate such an assessment feasible). Furthermore, beyond citations, impact is something that can take much longer to assess. Nonetheless, my assessment is that the quality of the publications delivered by the Center is high based on the following evidence:

- The statistics presented demonstrate the significant number of peer-reviewed research publications delivered by the Center over its 10-year lifetime. While there was perhaps a small drop-off in the final year, the cumulative metrics for years 6 - 10 of the Center exceed the targets on all counts except for the “Number of ISI publications at the top 10% of impact for the Center’s primary disciplines” metric, which fell away somewhat in the final few years.
- To achieve a cumulative total of 490 published ISI research papers in the last 5 years (i.e. 98 per year) is very impressive (this equates to around 2 papers per year per researcher and postdoc) - especially as this included the years of disruption due to COVID-19.
- That 115 of these publications were in the top 10%, and that many published in the internationally peer-reviewed literature, is equally significant. The citations of these ISI papers also exceeded the targeted number.

Given this evidence, summarized above and detailed comprehensively in the Final Report, I rank the Center’s performance on scientific achievements and their impacts as surpassing the “Very Good” criterion and is close to the “Outstanding” criterion.

ii. Evaluation

√	√ 4.8				
Outstanding	Very Good	Good	Regular	Poor	Not Qualify



2. Educational achievements and impact. Please pay attention to integration of research and educational activities in training advanced human resources, and participation in PhD Programs.

i. Comments

Building capacity, skills and strengthening the human capital in natural and social sciences has been an enduring and priority goal of the Center, featuring in three of its establishment and mid-term goals. The close integration between research and educational activities is also a priority and a strength - given that research and scientific excellence is at the core of CR2 and so education and training can draw from this and the high-quality researchers (many of whom are Professors) who comprise the Center's staff.

239 students participated in CR2 over the last five years (2018 - 2022); just over half were postgraduates with a majority undertaking masters degrees. This seems to be a healthy mix of undergraduate, Masters and Doctoral students - especially as there is active involvement across all levels in the Center's research. It means that the educational experience of all, especially undergraduate students, is enriched by their exposure to research *and* its applications to real world outcomes. From 2013 there have been 62 completed Masters (with 36 in progress); 15 completed PhDs (21 in progress); and 62 completed (41 in progress) Undergraduate degrees. A total of 26 postdoctoral students were part of the Center from 2018-2022 with over half (14) being women. This cohort of postdoctoral researchers has been important in advancing the Center's research. Combined, this is clear demonstration that CR2 contributes significantly to training new scientists, and that the skills and knowledge being taught benefit from the close integration of teaching, research, outreach and policy engagement and the content that fuses both physical climate science, natural sciences, social science including those disciplines linked to resilience.

From the data presented on all metrics, CR2 exceeded its performance indicators over the last five years, with the exception of the completion of Masters theses (which fell below the target for 2-3 years but exceed the target in 2022). This includes the completion of two Summer Schools 2021 and 2022, when none were planned. The number of completed PhD theses exceed the indicator by 30% (13 vs 10) over the five-year period and the average number of Postdoctoral students in each of the last five years was 2.5 times the indicator (11 vs 4). These are impressive results that, combined with the evidence provided above, further demonstrates the Center is fulfilling its goal of strengthening the emerging community of natural and social scientists in Earth System Science in Chile.

The Report also demonstrates that the Center has taken its education and training goals beyond the Center's undergraduate and postgraduate cohorts, an example is the delivery of two Diploma courses between 2018 and 2022 that provided critical capacity building to over 100 students through the annual Diploma in Climate Change and Low Carbon Development, and the broader practitioner community with 84 municipal officials undertaking the Diploma on Climate Action and Municipal Management in 2021. The Center has also delivered several Workshops and activities aimed at building practitioners' knowledge and expertise, for example the Municipal Risk Diagnosis Workshop delivered to over 200 public servants in the use of the Climate Risk Atlas (ARCLim).

These examples, along with others described in the Final Report, further demonstrate the quality and success of the Center's educational achievements. My evaluation score reflects this, i.e. the Center's performance on educational achievements and impacts easily meets the "Very Good" criterion and is very close to the "Outstanding" criterion.



ii. Evaluation

Outstanding

Very Good

Good

Regular

Poor

Not Qualify

3. National and international collaboration achievements. Pay attention to activities that contributed to national and international networking.

i. Comments

It seems that the Center develops and strengthens alliances and collaborations for the following purposes: i) to strengthen its research quality and impact; ii) to sustain important observing infrastructure, modelling and datasets; iii) to build capacity in Chile and South America; and iv) to engage with the broader community of practitioners, decision-makers and politicians. These collaborations and alliances are both regional and international and can be leveraged for a national benefit within Chile.

The Final Report highlights 7 national, and 10 international, collaboration networks (more are listed in Annex 9.5) showing that the Center has been both energetic and effective in building these national and global networks and alliances, although the Final Report does not clarify whether all these were initiated by the Center. The impact and benefit from these collaborations are not really addressed, including from the leverage as mentioned above. However it does seem obvious that there is considerable benefit to the broader research community. Furthermore, it is likely that these would probably not have flourished if not for the focus and resources that CR2 has brought to the climate and resilience research “ecosystem” in Chile and the broader region.

It is evident that these networks and collaborations are critically important for advancing climate and resilience research within the region and globally because climate and Earth system science - from observations, analysis and modelling - cannot be done by a single institution or nation. Collaborations are vital and it's clear that the Center has been instrumental in building and sustaining these. I would highlight the following examples of collaborations and networks to underscore this point:

- The creation of a consortium (CEODOS-Chile) of excellence research centers ((CR)2, IDEAL, COPAS, CIEP et al) to focus on oceanographic research, and especially along the Chilean coast.
- The Andean Observatory and the Observatory for Atmospheric Rivers provide critical infrastructure and observing capability in scientific areas that are key for advancing our knowledge about the climate system and how it is changing. CR2 has enabled efficiencies by integrating multiple observations (e.g. integrating GAW into the Andean Observatory) and helped created research “critical mass”.
- The several centers (CAPES - IEB - ECOS), and the ENEAS programme, that seek to advance more transdisciplinary research that bridges physical, social and ecological sciences.
- CR2's involvement with WCRP's ANDEX is an international opportunity that will deliver important scientific outcomes, and whose success depends on the input and leadership from national research institutions like CR2 but will also strengthen the research profile and output of CR2.

The formal MOU with Scripps is a further example of an excellent partnership that will benefit CR2 researchers. Similarly CR2's success in being part of the international project team who have secured funding from Horizon 2020 for the "Air Quality: Worldwide Analysis and Forecasting of Atmospheric Composition for Health (AQ-WATCH)" is an example of the excellent standing of CR2 and its involvement in an activity that will deliver significant outcomes for air quality and health.

My score also reflects that all performance indicators relevant to collaborations have been exceeded - significantly so in the case of the number of joint projects with international and national institutions or research centers, and the number of international Workshops or Meetings held in Chile, organized by the Center (achieved 27 in the last five years, compared to just 5 expected).



ii. Evaluation

Outstanding

Very Good

Good

Regular

Poor

Not Qualify

4. Outreach Achievements. Pay special attention to those activities that tied the Center with the external community such as elementary or high schools, institutions, companies, among others.

i. Comments

The diversity, quality and quantity of outreach products, articles and platforms developed and delivered by CR2 is an outstanding and successful achievement. Measuring the impact of this is much harder, however there are some clear signals that the impact is significant - for example, these outreach products have collectively attracted over 300k visits to the CR2 website and there is an exponential increase in engagement via traditional and social media. Moreover, the Center has been successful in its goal of establishing CR2 and its researchers as a reliable source of information on climate change related issues, as illustrated by “climate change” being the most popular topic in the press over the last five years. The Report provides many similar examples.

The Center is to be congratulated on this achievement, which reflects the significant effort and commitment the Center dedicates to outreach, aiming for an audience of multiple stakeholders and the public with a focus on **state agencies, private organizations, high-level policy makers and university students**. It also reflects the wisdom of the Center’s approach, i.e. resourcing a dedicated team of communication professionals who engage with and involve all CR2 researchers, and their multi-pronged outreach strategy that encompasses: i) Media publications, ii) Outreach platforms (websites and social media); iii) Outreach products (namely their Policy briefs, Analyses, Climate capsules and Constitutional bulletins along with Infographics, Brochures explaining recent scientific papers, Videos and Radio programs, plus engaging stories for the (much) younger generation); and iv) Outreach activities such as side events linked to CP and IPCC Assessment Reports, Seminars and Webinars etc.

The statistics and metrics provide strong evidence of the achievements, with all performance indicators being significantly exceeded - some by a factor of 10. The list of products and activities provided in the Final Report is equally impressive and illustrates the diversity of products delivered, reflecting their audience of state agencies, the private sector institutions, along with schools and universities. I also thought the range of topics covered in the outreach products was impressive in their relevance and utility to the audience.

Another initiative, included under the Research delivery section of the Report, is the creation of the Chilean Atlas of Climate Risk (ARClim) - a web-based platform with nation-wide, municipal-level information on climate hazard, exposure and vulnerability. This valuable resource also fostered strong collaboration within CR2 and with 27 research groups in Chile and underpinned 12 Climate Services developed by the Center. The potential impact and relevance of this is very high. That said, I would have liked to know more about the science of the regional climate projections that underpins this web-based platform.

I rank the Center’s performance on Outreach, and its achievements, as meeting the Outstanding criterion.

ii. Evaluation

✓ 5					
Outstanding	Very Good	Good	Regular	Poor	Not Qualify

5. Contribution to public policies. Pay special attention to the impact of the FONDAP Center in terms of contribution to public policies and other targeted groups, if applied.

i. Comments

It's typically quite challenging for research and educationally focused centers of excellence to demonstrate real impact in the public policy domain; with many pointing to the involvement of their researchers in the IPCC's regular assessment reports, the UNFCCC COP, and global agreements like the 2015 Paris Agreement or 1987 Montreal protocol, as evidence. Given this, I have always been impressed that a pillar of CR2's outreach, engagement and impact strategy has been their determination to foster skills and expertise in interdisciplinary research that includes all the dimensions of climate "resilience", and to build effective bridges with those stakeholders involved in making critical decisions - including policymakers.

This is reflected in the establishment goal to "*(iii) contribute to the definition of climate change adaptation and mitigation measures for building societal resilience in collaboration with stakeholders*", and their post mid-term goal to "*(vi) contribute to our country's goals of achieving low-carbon, sustainable development consistent with the Paris Agreement*" Establishing a new Research Line on Governance and the Science-Policy Interface (GovSPI), after their mid-term review, enabled a focus on this important element of the Center's strategy. As a result, CR2 has informed and contributed to the management and public policies in the fields of climate change mitigation and adaptation, underpinned by a robust and credible research basis.

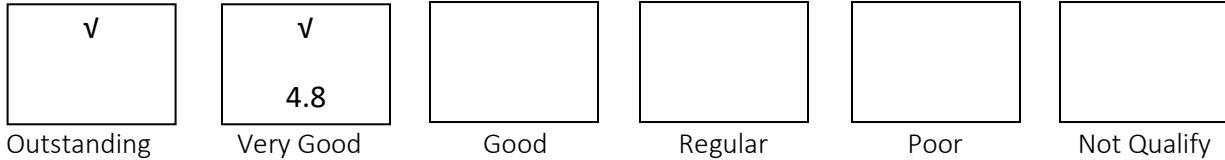
There is ample evidence to substantiate CR2's claim that they have "*... made substantial contributions to public policy in areas of climate-related hazard, mitigation, adaptation and resilience*" including:

1. The creation of the Climate Change Law Observatory, signed into law in 2022 *and* the inclusion of the recommendations made in CR2's most recent National Report (on climate governance of the elements) into the Constitutional Convention regarding "*fair climate action, the recognition of the climate and ecological crisis, and the duty of the state to develop mitigation and adaptation policies*".
2. Examples where CR2 have provided scientific based information and advice:
 - a) To the Ministry of Environment on the important role of black carbon mitigation in the update of Chile's NDCs (nationally determined contribution). CR2 evaluated the impact of mitigating long-lived greenhouse gases in terms of their potential to reduce black carbon.
 - b) Maisa Rojas, now Chile's Minister for the Environment and former CR2 Director, led the Chilean Science Committee on Climate Change, an advisory body on climate change to the Ministry of Science, Technology, Knowledge and Innovation to ensure that the national scientific community in Chile was connected to COP25.
 - c) To the Ministry of National Defense, on an update to the National Policy for the Use of the Coastal Zone. CR2's was asked to assist with developing the methodology for this update, whose scope included climate change and disaster reduction, among others.
 - d) To the Ministry of Science, knowledge, Technology and Innovation, and the Ministry of Agriculture, including their National Forestry Corporation on opportunities for a more formalized collaborative approach to managing changing fire regimes.
3. CR2 has supported development of public policies relating to climate and environmental risks through its Atlas of Climate Risks for Chile (ARClim). Mandated by the Ministry of Environment and jointly developed with the Universidad Católica de Chile's Global Change Center, this atlas provides information and analyses of climate impacts and risks, exposure and sensitivity of different sectors.
4. CR2 research has enabled better management of air quality through delivering detailed and comprehensive inventories for emissions from the residential, mining, energy and industrial sectors both nationally and for the broader South American region.

- 5. CR2 researchers have played active roles in public consultations regarding the regulation of pollutant emission reduction activities and Chile’s long-term climate strategy; and as Co-chairs of the group establishing the scientific evidence for the design of Chile’s NDCs, clarifying the role of the ocean, forest and peatlands in carbon sequestration, and presented to COP25 in 2019.

For these reasons, I have ranked the Center’s contributions to public policy outcomes as easily meeting the “Very Good” criterion and close to the “Outstanding” criterion.

ii. Evaluation





IV. OTHER RELEVANT ASPECTS

If the Center report does not contain information on other relevant aspects, please indicate so in your evaluation.

i. Comments

There are no other relevant aspects that align with the above guidance, but I did want to comment positively on the achievements of the Center in promoting interdisciplinary and transdisciplinary research - consistent with the title of the Center and their strategic goals.

The statistics presented in Annex 9.1 provide clear evidence of collaboration between the Research Lines; over 85% of ISI and non-ISI publications were coauthored across three Research Lines. Furthermore, most of the Integrative Questions involve researchers from across all Research Lines.

V. CENTER PROJECTIONS

Please comment about the center projections after the 10 - year of funding. If the Center report does not contain information on the Center projections, please indicate so in your evaluation.

i. Comments

The final report eloquently describes the “value proposition” for a center such as CR2, given the impact that climate and environmental change will have on Chile’s society, ecosystems, industries and economy. They argue that there is a clearly demonstrated ongoing need for a center whose focus continues to be on managing the risks and opportunities of a variable and changing climate, with a clear focus on interdisciplinarity and effective science-to-policy dialogues and outcomes.

These arguments are both compelling and well-based. I strongly endorse the following statement from the Final Report: *“Over the last decade, the dedicated and talented effort of our researchers, support staff and students made possible that (CR)2 became a well-recognized national leader and international reference in climate and resilience research ...*

Based on interdisciplinary research, (CR)2 has informed and contributed to the management and public policies in the fields of climate change mitigation and adaptation and reached out to the general public. Nonetheless, many questions need to be revisited and new questions have arisen, especially on changes of climate-driven extreme environmental events (e.g., mega fires, HABs, coastal extremes among others), as well as governance and social response to these events.

Given the scientific success of (CR)2 in its first decade, the human/technical capacity built within and around the center and the complex, grand challenges that our country faces (climate wise at least!), it is quite reasonable that the center should continue in the next decade. No less important is the high esteem that our center has gained in the academia, political and social sphere in Chile along with increasing international recognition.”

Accordingly, since 2022 a CR2 committee has been developing a future plan for a new center, in dialogue and consultation with all members of CR2 and their stakeholder community. No details of this plan and its projections were provided, except the statement above and the view that there is a clear *“need for a research center devoted to study the specifics of the climate/earth system in Chile (and beyond) and to inform public policy on adaptation and mitigation measures for building societal resilience, it seeks to maintain most of our research group during the next decade.”* While a new Center would retain several of the CR2’s core pillars, emerging and relevant topics have been identified along with new geographical areas, and novel tools, methods and collaborations were committed.

As already noted, these views are strongly endorsed.

Finally, I would point to some of the challenges that the Center identifies: firstly that although there is ongoing uncertainty regarding the continuity of FONDAP funding for large and enduring Centers of Excellence, CR2 stands ready and is dedicated to bridging as much of their research and capability as possible. This is a very positive and constructive approach. The challenges associated with observations and modelling infrastructures are noted and accordingly I strongly endorse their plan to access an Earth System modelling capability through international institutions. I would encourage them to engage with international research programs like the WCRP, as well as leveraging their own well-established collaborations, to access this capability. This would bring significant national benefit.

VI. INSTITUTIONAL COMMITMENTS

Please comment about the facilities that were available to the Center, the commitment of the administration of the leading and partner institutions to the Center, and the commitment of the partner institutions to achieve the Center goals.

i. Comments

The Final Report clearly states that all the leading and partner institutions fulfilled their financial commitments in a timely manner. I saw no evidence that would indicate that the leading and partner institutions failed in any way to support the financial, administrative, research, educational and outreach goals of the Center.

These institutional commitments include the Geophysics Department within the Facultad de Ciencias Físicas y Matemáticas (FCFM) at the University of Chile, where all three of CR2's Directors have been employed and which provides technical support for the Center's instrumentation and field work, as well as High Performance Computing, for the research of the Center. Other CR2 researcher staff are employed in other Faculties within the University of Chile, and partner Universities - the Universidad Austral de Chile and Universidad de Concepción.

It appears that all partner institutions have supported their staff and students, enabling them to work harmoniously in a productive collaboration that optimises the complementary research strengths.

ii. Evaluation

√	√ 4.8				
Outstanding	Very Good	Good	Regular	Poor	Not Qualify

VII. ADVISORY COMMITTEE

Please comment about the commitment of the advisory committee, and its contribution to the Center development.

i. Comments

The Center has been supported by two Advisory Committees - one national and one international - who have provided advice and evaluated the Annual Reports and Strategic plans (nb - it would have been helpful to have been provided the Terms of Reference, or mandates for these Committees).

The composition of these committees is balanced to ensure appropriate representation from the public and private sectors, and the academic community and civil society in the case of the national committee, and disciplinary expertise in the case of the international committee.

A positive feature of both committees is their stability, having been in place with their current membership since 2018, and the diverse expertise and experience they bring to their roles.

Given the success and achievements of CR2, both Committees appear to have been very effective in their provision of strategic advice and guidance. The Final Report does not identify any difficulties or problems associated with forming or implementing these Committees.

ii. Evaluation

<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Outstanding	Very Good	Good	Regular	Poor	Not Qualify

VIII. FINAL OVERALL COMMENTS AND RECOMMENDATIONS

Please provide a final overall and recommendations for the Center. Include here aspects that were not covered in the previous sections, which you consider significant for the Center.

i. Comments

My substantive comments on the five criteria/sections (Scientific achievements and impact; Educational achievements and impact; National and international collaboration achievements; Outreach achievements; and Public policy contributions) clearly demonstrate my very strong and positive assessment of the Center's performance and achievements - both over its lifetime and in the last five years. Quantifying this is the average score across these five criteria of 4.8, i.e. the Center's performance exceeds the criterion of "Very Good" (*meets/addresses the aspects of the criterion very well, although some improvements are still possible*) and is very close to the criterion of "Outstanding" (*successfully meets/addresses all the aspects of the criterion. Any shortcomings are minor*). Importantly this assessment is consistent across all criteria, and I did not identify any serious shortcomings across all the criteria / sections of assessment.

To reiterate and summarise: CR2 was established a decade ago with the original goals to: *i) deepen our understanding of the climate system, processes, and impacts throughout Chile confronting its socio-ecological complexities, ii) strengthen the emerging community of natural and social scientists in Earth System Science in Chile, and iii) contribute to the definition of climate change adaptation and mitigation measures for building societal resilience in collaboration with stakeholders*. After the 2018 mid-term evaluation, three further goals were added: *iv) developing climate and resilience science in Chile, v) strengthening CR2's role in the training of new scientists, and vi) contributing to Chile's goals of achieving low-carbon, sustainable development consistent with the Paris Agreement*.

CR2 has established, and adapted as needed, its structure, collaborations and partnerships and operating model to support these strategic goals. Its achievements and success have been enabled by the strong and enduring commitment from its foundational partners within the University of Chile and partner Universities in Chile (the Universidad Austral de Chile and Universidad de Concepción); and effectively supported by its two advisory committees.

Over its lifetime CR2 has achieved these goals, noting that some are more in the "developing" stage than the mature stage - for example the goal of defining climate change adaptation and mitigation measures for building societal resilience is a goal that cannot be achieved by a research center alone (as indicated by the wording of the goal) and is multi-decadal in its timespan. Importantly, it has brought a focus, significant resourcing and critical mass to Chile's Earth system, climate and resilience science. My assessment is that CR2 has indeed established itself as a well-recognized and credible national institution for climate and resilience research. The impacts of this are clear in terms of:

- a) Advancing the understanding of the climate system, especially in those aspects to which Chile's society, economy and environment are sensitive (e.g. fires, air pollution, algal blooms, droughts), and the key climate drivers and processes such as ENSO, atmospheric rivers, oceanic circulation etc), as detailed in Section 1.
- b) Facilitating science that addresses connections and interfaces e.g. between climate change drivers, air pollution and health in cities; between physical, natural and social sciences; and between science, policy and society.

- c) Training undergraduate and graduate students in climate and Earth System science and integrating them into the research and outreach activities of the Center.
- d) Significantly increasing the availability and quality of credible information regarding climate and Earth system change, and resilience, through outstanding outreach efforts to the community; private and public sector agencies; and universities.
- e) Significantly contributing to important national and global policies relating to climate change mitigation and adaptation.

The Center’s performance exceeds the criterion of “Very Good” (*meets/addresses the aspects of the criterion very well, although some improvements are still possible*) and is very close to the criterion of “Outstanding” (*successfully meets/addresses all the aspects of the criterion. Any shortcomings are minor*). Importantly this assessment is consistent across all criteria, and I did not identify any serious shortcomings across all the criteria / sections of assessment.

In conclusion, I congratulate the Center’s leadership team, including the current and past Directors, staff and students for this excellent achievement. In my assessment, if further funding is possible for a research Center with scope is similar to the CR2, then this would be endorsed.

ii. Evaluation

√	√ 4.8				
Outstanding	Very Good	Good	Regular	Poor	Not Qualify