

# Improving Service Delivery of Meteorological Products to Economic Sectors of Chile



WMO Secretary-General Michel Jarraud (second from left) looks on as HM Queen Sofia of Spain (centre) speaks at the opening ceremony of the WMO International Conference on Secure and Sustainable Living: Social & Economic Benefits of Weather, Climate and Water Services. Madrid, Spain, 19 March 2007. Approximately 450 participants from 115 countries attended.



Source: Google Maps

## **Background**

The WMO International Conference on “Secure and Sustainable Living: Social and Economic Benefits of Weather, Climate and Water services” took place in Madrid, Spain from 19-22 March 2007. The Conference endorsed the Madrid Action Plan (MAP), with the overall objective of achieving, within five years, significant recognition and value to society of weather, climate and water information and services in response to the critical challenges presented by rapid urbanization, economic globalization, environmental degradation, natural hazards, and the increasing threats from a changing climate.

Society, particularly developing countries and least developed countries are not currently deriving all the benefits that can be derived from weather, climate and water services by NMHSs yet substantial investments have been made over time in the infrastructure and skills required to generate these services. Subsequently, the MAP laid emphasis on NMHSs to enhance their efforts to make potential users including their governments, aware of the range of products and services available and including potential new products and services, and demonstrate the benefits of their services and products in socio-economic benefits to society while incorporating Quality Management Systems (QMS) to ensure continued product and services improvement. There is great potential in benefits to be derived in socio-economic sectors resulting from the effective use of these services and products in decision-making. This shift by NMHSs to generate products that are defined by users suggests a renewed focus on the creation of innovative, well-crafted service delivery techniques that increase user engagement throughout the delivery process. In addition, quantified benefits in economic sectors resulting from the use of enhanced products and services and showcase the value and role of NMHSs in national economies.

**This case study describes the WMO Public Weather Services pilot project implemented in Chile’s DMC to generate user-defined products and services in select economic sectors and improve communication with users to demonstrate aspects of the WMO Strategy for Service Delivery. The study explores avenues of quantifying socio-economic benefits derived from the use of an improved and additional range of products and services to raise the visibility of Chile’s DMC to the government. The GFCS User Interface Programme mechanisms is demonstrated via a closed loop system of information flow from providers to users.**

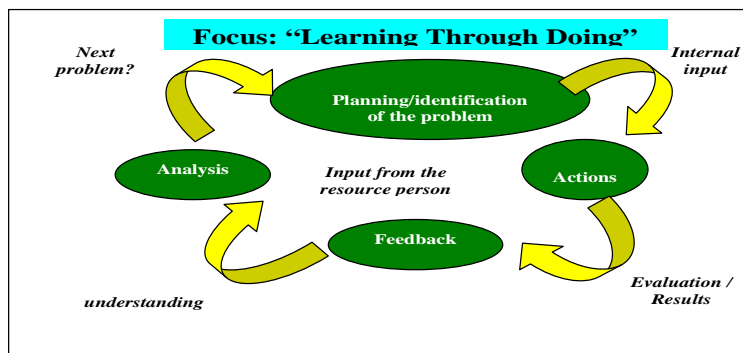
The Plan of Asuncion was crafted during the Directors' Meeting of the Iberoamerican Meteorological and Hydrological Services in Asuncion, Paraguay from 6 to 9 November, 2007. During this meeting, two pilot projects were initiated to build relations of the NMHSs of the region with key socio-economic sector users in select countries in accordance to the criteria established by the WMO Working Group on Socioeconomic Applications of Meteorological Services. During this time, Chile and Peru were selected to execute the "Learning Through Doing" pilot project and promote the products and services provided to users, as well as evaluate the socio-economic impact and contribution to the sustainable development of these countries. The pilot project in Chile was expected to develop innovative mechanisms to interact with users from selected economic sectors and facilitate service delivery of meteorological services and products specified by users and determine their benefits resulting from use that will reflect in the national economy and increase the visibility of Chile's DMC to its government.



Latin America and the Caribbean Heads of State Summit in Madrid adopts The Madrid Action Plan (MAP), May 2010.

### Project Methodology/Concept – “Learning Through Doing”

The methodology used in the pilot project was developed by a multidisciplinary team consisting of personnel from the Chile NMHS and external organizations under the supervision and support of WMO/AEMET consultants. The project was designed based on the “Learning through Doing” concept where the participant learns by a combination of actions and reflection. The approach consisted of a series of cycles of learning, each cycle comprising the following phases: planning, action, feedback and reflection. A cycle begins with a topic, which turns into the learning motivation. The next step is to analyze the situation and make assumptions based on the current situation. Next a plan is developed with all interested parties and based on these assumptions. The results of the actions are checked and the lessons learned identified. The following diagram illustrates the “Learning through Doing” approach:



Principal characteristics of this approach are:

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Learning by participation</li> <li>2. Reflection on the action to verify the validity of the basic assumptions</li> <li>3. Collaboration and participation of the diverse</li> </ol> | <ol style="list-style-type: none"> <li>4. Existence of an external agent to allow the creation of a learning environment.</li> <li>5. Capacity building by participants</li> </ol> |
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## The Project

**STEP 1 - Requirements for effective service delivery of weather, water and climate information to economic sectors and the use of the information to result in benefits were defined and involved local sector users**

The pilot project “Learning Through Doing” is an integral part of the follow-up actions arising from the MAP, and takes into account outcomes of the regional capacity-building workshops held in various parts of the developing world which preceded it. The scope of the project comprises:

1. The application of a methodology to improve services to the public and to sector users of products and services by Chile’s DMC and include QMS mechanisms for continuous improvement.
2. The evaluation and quantification of socio-economic benefits derived from use of the services.

The following is a select list of Actions from MAP that have direct relevance to the mandate of the WMO PWSP and their corresponding GFCS principle implications:

<b>Action</b>	<b>GFCS Implications/ Principles</b>
<b>Action 3:</b> Embark on capacity-building endeavours through the creation of education and training opportunities for both users and providers of weather, climate and water information, to increase awareness of users to the opportunities afforded by weather, climate and water services and to assist the providers of these services to understand more fully user requirements.	Principle 2: The primary goal of the Framework will be to ensure greater availability of, access to, and use of climate services for all countries. Principle 8: The Framework will be built through user – provider partnerships that include all stakeholders.
<b>Action 4:</b> Foster increased recognition by governments and other stakeholders of the contribution that National Meteorological and Hydrological Services and their partners are making to secure and sustainable living.	Principle 5: Climate information is primarily an international public good provided by governments, which will have a central role in its management through the Framework.
<b>Action 7:</b> Facilitate and strengthen dialogue and collaboration between providers and users of weather, climate and water information and services through international, regional and national platforms and programmes, and through the development of appropriate tools and methods.	Principle 8: The Framework will be built through user – provider partnerships that include all stakeholders. Principle 2: The primary goal of the Framework will be to ensure greater availability of, access to, and use of climate services for all countries.
<b>Action 9:</b> Strengthen existing, and establish new, operating partnerships between users and providers of weather, climate and water services to share responsibility for effective delivery of services, and evaluate their performance.	Principle 8: The Framework will be built through user – provider partnerships that include all stakeholders. Principle 7: The role of the Framework will be to facilitate and strengthen, not to duplicate.
<b>Action 10:</b> Facilitate and strengthen the ability of NMHSs to effectively communicate weather services and products, through all forms of media, in such a manner as to maximize the benefits provided to society by the meteorological and hydrological community.	Principle 2: The primary goal of the Framework will be to ensure greater availability of, access to, and use of climate services for all countries.
<b>Action 11:</b> Encourage NMHSs and the social science research community to develop methodologies for quantifying the benefits of services provided by NMHSs in socio-economic sectors, in particular: <ul style="list-style-type: none"> <li>• Develop new economic assessment techniques including techniques of economic assessments for developing and least developed countries;</li> <li>• Develop WMO guidelines on operational use of economic assessment techniques.</li> <li>• Train national staff on the use and practical application of economic assessment of benefits of services provided</li> <li>• Demonstrate economic benefits to governments and donors to attract investments for infrastructure and service delivery of NMHSs.</li> </ul>	Principle 1: All countries will benefit, but priority shall go to building the capacity of climate-vulnerable developing countries.

## Project Team for management /oversight



Group photo of the Chile LTD project management team in front of the Directorate of Civil Aviation building.

Working teams were formed in the DMC and focal points established with participating organizations according to the table shown below:

<u>NAME</u>	<u>TASK/FUNCTION</u>
Director of DMC (The NMHS of Chile)	Final person responsible for the project
DMC General Coordinador	Person in charge of coordinating and controlling the activities and results of the project at DMC level.
WMO Consultants	Persons in charge of providing the methodology that will be used in the achievement of the project.
AEMET Assessor	To supervise and control the overall development of the project.
Marketing Person	To supervise the activities pursuing the development of the Marketing plan of the respective sub-projects in the DMC.
Business Coordinator	To coordinate the activities pursuing the development of the business Plan of the respective sub-projects in the DMC.
DMC Focal Point	Person in charge of executing the activities related to the assigned sub-project.
Sector Focal Point	To give and to support with information of the respective sector, the execution of the project.
Work Teams of the respective Subprojects.	To execute the activities programmed by the respective focal points.

## Project Scope

The pilot project was phased into three main phases: Planning, Implementation and Review phases with a description of activities, key deliverables and milestones in each phase. Project duration was two years, 2008 - 2010. The following list presents the expected outcomes of the project:

- Improved service delivery to benefit both target sectors and participating DMC;
- Enhanced capacity in the Chile DMC;
- Increased visibility of the the Chile DMC to the government.

**STEP 2 – Capabilities of Chile’s DMC to provide and deliver user-driven services and products were evaluated against the requirements and a baseline was established in terms of human resources, infrastructure, institutional and procedural capabilities,**  
**STEP 3 – Gaps were analyzed and steps outlined to meet the requirements for effective service delivery by Chile DMC to sector users**

### **The Planning Phase / Preparatory activities**

The planning phase commenced with the commitment on the part of the DMC to proceed with the pilot project with support from AEMET and WMO through the engagement of a consultant to oversee the critical areas of the project. The planning phase established and put in place the necessary elements for implementing the project. This phase developed the project document, determined the scope and duration (2008 -2010), and verified the procedure that would be the basis for its development. The consultant was responsible for the selection of economic sectors that would participate in the project. The following sectors presented their user needs:

- Andean Division of the Copper Corporation (CODELCO);
- Andean Water Company L.T.D.;
- Technical Salmon Institute;
- Agriculture Region VI;
- Department of Public Works; and,
- Faculty of Agronomy, University of Chile.

The following preparatory activities were carried out.

1. Selection of participating sectors: A meeting was held between staff of the Chile Weather Service and sector users from selected economic sectors that would participate in the project, in Santiago, Chile 4 – 5 June 2008. There were 40 participants representing different regions of the country. The objective of the meeting cum workshop was to identify problems that hinder service delivery of meteorological products and services to users. The meeting included a training course on “Evaluation Methods of Social and Economic Benefits of Hydrometeorological Information” to determine and quantify benefits. The following problems were identified:

- Inadequate understanding of user needs for information and services by providers;
- Lack of awareness by users of the available and potential services;
- Difficulty in integrating Weather, Climate and Water services into national development strategies and priorities;
- Lack of capacities and competencies in NMHSs to deliver services that meet user needs;
- Inadequate, weak or non-existent communication between NMHSs and users.

2. A training course on “Evaluation Methods of Social and Economic Benefits of Hydrometeorological Information” was held in Santiago, Chile, 2008 during the meeting under the leadership of a WMO consultant.

3. The set up of the WMO Moodle platform site to facilitate communications among the project participants and avail access to periodic progress reports and for exchange of information between consultants, coordinators and teams in terms of meetings, agendas, techniques and work plans detailing proposed activities and updated throughout the project development.

Activity 1: Involved the planning and organizing the first workshop of the project with the participation of the Chile DMC and representatives of a wide selection of user sectors, as identified by the PR of Chile. The consultant worked with the Chile DMC to identify and invite speakers to the workshop. The purpose of the workshop was to facilitate open dialogue between users and providers and the opportunity for user sectors to present their requirements for the type of information and services they needed and likewise for the Chile DMC to present its current capabilities and services and explain what can be realistically achieved. The workshop also identified target sectors that participated in the pilot project. **(April 2008)**



A mozaic of Chilean farm produce

Activity 2: Market surveys were conducted for each selected user sector to benchmark the NMHS brand to determine in a formal way, if the selected sectors are aware of and use the products and services by the NMHS. A Methodology for socioeconomic assessment of the benefits of meteorological services to these sectors was established and the baseline impact of the existing set of meteorological products and services clarified to identify gaps. The project used the experiences of countries which might have already started this initiative to explore how their experiences could be applied to Chile. **(May/June 2008)**

The following table summarizes the outcome of the workshop with select sectors and associated proposed sub-projects which determined the scope of the project:

<u>Sector</u>	<u>Project</u>	<u>Objetive</u>
Mountain Meteorology	Weather Forecasting System, for Complex Los Libertadores.	To establish an information System on conditions of the principal route that joins Chile and Argentina, to avoid the risks of the persons' transit and load and to facilitate the works of clearing of route reducing times of closing of the Step.
Meteorology for agents of road networks	Weather forecasting system, for agents of (concessionary) private road networks.	To have information about critical precipitation, events of fog and of freezing, to manage the safety of road users and maintenance operations.
Meteorology for primary productive sectors	Weather forecast system for the agriculture, across the Regional Centers of Information Agrometeorological (CRIA)  Weather forecasting system for the Industry of the Salmon and handmade fishing in the regions X and XI.	To have information about meteorological parameters of relevancy to the farmers of the country, with specific level for product and for region. To have information about critical meteorological parameters, which affect the productivity of the salmon and the management of operations. The information is also relevant to small-scale individual fishers.
Meteorology for Other Sectors	Information system and rainfall forecast, for Andean Waters S.A.	To be provided with information on excessive rainfall, for the maintenance of the sewerage and drainage systems.

**Activity 3:** The Chile DMC engaged the selected target sectors in dialogue in a systematic manner, to identify and establish an in-depth inventory of the user requirements for each sector and Chile's DMC capability to meet the requirements, thus identifying the gaps between user requirements and the DMC's existing capability. **(June 2008)**. The following are results of the market survey conducted via questionnaires for the selected sectors:

Sector(s):	Question(s):	Analysis of Answer(s):
Agrometeorology	Do you think that if you had access to meteorological information applied to agriculture, you would be able to better anticipate the adverse weather events and that this would help you improve the quality and quantity of the production in the agricultural and fishing sectors?	97.2% of the samples considered that access to agrometeorological information by the agricultural community, would enable them to better anticipate adverse weather events and hence to improve the quality and quantity of their production. Whereas 2.8% thought that it would help them anticipate adverse weather events only moderately.
Los Libertadores Border Crossing	<p>When you plan a journey, to what extent do you consider the effects of meteorological conditions (prevailing weather) on the Los Libertadores?:</p> <p>a) They are very important and they determine whether I take the trip;</p> <p>b) They are important but not determinant;</p> <p>c) I do not consider them in my planning;</p> <p>d) I travel without worrying about the weather conditions; or,</p> <p>e) If the conditions are bad I do not travel.</p>	<p>71% of the people questioned considered the meteorological information to be very important in planning the journey, and also that this information determined the decision to travel across Los Libertadores.</p> <p>15% considered the meteorological information to be very important to plan the trip, but the information did not determine the decision to take or not to take the journey, which meant that besides the weather information, other decisive factors were considered.</p> <p>About 14% did not consider the meteorological information to plan the trip and simply traveled without worrying about the weather.</p> <p>No one responded to option "e".</p>
Salmon Industry	<p>Do the products that the DMC provides satisfy your expectations from a Meteorological Service?</p> <p>If your answer is "No", please specify the reason.</p>	It is important to have forecasts with a bigger spatial resolution, considering specific environmental variables, such as the sea conditions and solar radiation, which are not included in current forecasts issued by the DMC.

**Activity 4:** The results of the survey and dialogue were translated by the consultant into marketing and business plans for each participating sector and how DMC would deal with the target sectors to meet user requirements. The marketing plan established a new line of products derived from the analysis of the requests indicated by users. The following improvements needed at the DMC of Chile to close the gaps were outlined **(June 2008)**:

- (i) new and/or enhanced products;
- (ii) use of new technology in service delivery;
- (iii) improved effective communication skills and means;
- (iv) increased public education and outreach.

**STEP 4 – A strategic plan was developed to address the identified problems for effective service delivery. This was done during the workshop with Chile DMC and sector organizations.**

The following outcomes of the planning phase included three sub-projects with the following description for each subproject:

Sub-project 1: Weather Information System for the Salmon Industry

Representing 65% of fishing exports and providing employment to approximately 50,000 people, the objective was to implement a new line of meteorological products to satisfy the demand for specialized meteorological information, to efficiently support the operation and planning of activities developed by the Salmon Industry in Regions X and XI. It was envisioned the products and services would allow the user, to know the meteorological conditions for the day including precipitations and winds, with a projection of up to three days in order to mitigate meteorological risks

Sub-project 2: Weather Forecast System for the Los Libertadores

Two objectives for the sub-project: First to improve the image of the DMC among users and second, to support the operation of the control border office with timely and reliable meteorological information. A strategy for achieving these goals was a select distinctive line of accessible products and services.

Sub-project 3: Implementation of the Agrometeorological Centre for Region VIII.

Objective of the sub-project is to implement a new line of meteorological products designed to meet the demand of specialized meteorological information for the medium and large-scale agriculture of Region VIII. Products and services to be offered include two daily weather forecasts, agrometeorological alerts (frosts, forest fires) and seasonal agroclimate forecasts with three (3) months lead time for planning purposes. It was planned for the implementation of this new product line, to integrate the analysis centers of the DMC in Santiago and the Agrometeorological Information Center (CRIA) of Region VIII, to develop a joint methodology which will allow access to the products and services, in a timely and reliable manner.



The Paso Libertadores – The most important Andes pass to Chile

<sup>1</sup>The *Paso Internacional Los Libertadores*, is a [mountain pass](#) in the [Andes](#) mountains between [Argentina](#) and [Chile](#). It is the main transport route out of the Chilean capital city [Santiago](#) into [Mendoza](#) city in Argentina and so carries quite heavy traffic. From the Argentine side the route to the pass is a slow, gentle incline until entering a tunnel at around 3,500 m (11,483 ft) through the mountains. On the Chilean side the slope has a far higher grade, and the road descends down a long series of [switchbacks](#) to make the descent. Opened in 1980, the tunnel is 3,080 m (10,105 ft) long, at an elevation of 3,175 m (10,417 ft), and serves as an important land crossing between Chile and Argentina. At the middle of the tunnel is the eastern terminus of [Chile Route 60](#) and the western terminus of [National Route 7 \(Argentina\)](#). The path can be closed during winter because of heavy snow blocking both ends and the threat of [rockfall](#). The market for meteorological products and services is comprised of three principal users: Public services that operate in the Complex, tourists and both freight and passenger transportation companies.

<sup>1</sup> From Wikipedia, the free encyclopedia. [www.wikipedia.org](http://www.wikipedia.org)



## Implementation Phase

**STEP 5 – National Ownership was secured through the Chile DMC but there is no evidence of budget proposals at the national level.**

**STEP 6 – Both national (Chile DMC) and external support (WMO and Spain) was provided.**

The project had commenced with the commitment by the Chile DMC to proceed with the pilot project and with support from AEMET and WMO through the engagement of a consultant to oversee the critical areas of the project. A kick-off meeting for the implementation phase was held at the DMC Headquarters, Santiago, Chile, 20-21 October 2008. Work for this phase was developed by a multidisciplinary team comprising personnel of the Chile DMC, the WMO consultants and Spain's AEMET. The work comprised the development of products and services that met the sector users' specifications, as well as development of marketing and business plans for each participating sector. This team was responsible for the development and implementation of methodologies that would improve the capacities of the Chile DMC to enhance its service delivery to sector users and the general public, as well as build capacity of the Chile DMC staff in socio-economic evaluation skills and techniques at demonstrating the socio-economic benefits of Chile's DMC products and services to the government.

Three sectors were selected and an implementation plan was developed for the sub-projects information systems that would be operational for the chosen sectors. The design and development of services and products were based on user specifications on the type of products and services they found most useful in their decision making.

**STEP 7 - The plan was implemented with appropriate oversight established by the multidisciplinary team**

### The implementation Plan

The implementation plan initiated the operational stage of the project and the elaborate layout of the different products and services established in the business Plan. The implementation plan was envisioned to accomplish the following:

- To design and implement in the DMC, the operational methodology for elaborating the products and services as specified by the select sector users, including the development of the computational tools, for running and visualization of the products.
- To include on the corporate Web page of the DMC, during the development of the pilot project, a sub-page dedicated to the pilot project WMO-DMC-AEMET, where the new line of products and developed services were posted and availed speedy access by sector users.
- To train the technical and professional personnel of the DMC, who will prepare the products and services, as well as, to teach the users to optimize the use of the new line of products, along with an evaluation of the socio-economic benefits derived from use.



A salmon fish farm in Puerto Montt, Chile.

The control of the developed products was achieved using a Product Form (accessible in the WMO platform Moodle), where the characteristics of every system developed and associated improvement records were registered for access. The following is an example of such a product form:

<b>DMC-AEMET-WMO Pilot Project</b>	<b>PRODUCT FORM</b>		
	<b>Start:</b>	<b>State:</b>	<b>Upgrade date:</b>
<b>NAME OF THE PRODUCT:</b>	<i>Meteorological Information System (MIS), for Agrometeorology, Region VIII</i>		
<b>USER(S):</b>	<ul style="list-style-type: none"> <li>• Small and medium scale farmers in the region;</li> <li>• Large producers in the agricultural and forestry areas in the region;</li> <li>• Regional authorities of the Department of Agriculture (SEREMI); and,</li> <li>• CONAF, FDF, FUCOA, INDAP, INIA and ODEPA.</li> </ul>		
<b>SERVICES RESPONSIBLE FOR THE PRODUCTS:</b>	Chilean Weather Service (DMC), National Analysis Center (CNA) and Agrometeorology Office		
<b>DESCRIPTION OF THE PRODUCT(S):</b>	<p>The information System for Agrometeorology, is an integrated meteorological product, on the DMC Webpage (DMC-AEMET-WMO Pilot Project) and includes the following sub-products:</p> <ol style="list-style-type: none"> <li>1. Weather forecast for the agriculture, by geographical areas (two daily forecasts);</li> <li>2. Meteorological warnings and alerts for agriculture (accessible also from cell phone with Internet capability);</li> <li>3. Dekadal bulletins for the region: Agrometeorological bulletin and degree days bulletin;</li> <li>4. 3-Month regional forecast of degree days;</li> <li>5. 72-hour forecast maps for precipitation, maximum temperature, minimum temperature and wind speed and direction;</li> <li>6. Synoptic Information (current and predicted satellite image); and,</li> <li>7. Requests (via e-mail).</li> </ol>		
<b>SCOPE OF THE PRODUCT:</b>	This product includes seven homogeneous geographical areas of Region VIII. The agrometeorological forecasts are updated twice daily. Warnings and alerts are updated regularly.		

<b>ASSOCIATED DOCUMENTS:</b>	(DMC-AEMET-WMO) Pilot Project Marketing and Business Plan.
<b>TECHNICAL REQUISITES:</b>	<p>The technical requirements are:</p> <ul style="list-style-type: none"> <li>• Meteorological and Agrometeorological information, validated by the CNA and the Office of Agricultural Meteorology of the DMC;</li> <li>• Should be published using a clear and understandable language for the user;</li> <li>• Must be regularly updated and accessible to the user; and,</li> <li>• Must be evaluated and subjected to continuous improvement.</li> </ul>
<b>REQUISITES OF ACCESSIBILITY:</b>	Permanently accessible by Internet for the users ( <a href="http://www.meteochile.gob.cl">www.meteochile.gob.cl</a> ).
<b>VERIFICATION POINTS:</b>	<ul style="list-style-type: none"> <li>• Verification of reliability and timeliness of information periodically done by the CNA and the Office of Agricultural Meteorology;</li> <li>• Review of the customer satisfaction surveys; and,</li> <li>• Review of the indicator.</li> </ul>
<b>PERIOD:</b>	During the DMC-AEMET-WMO "Learning Through Doing" Pilot Project.
<b>DELIVERING CONDITIONS:</b>	Free access to the product by the user.
<b>REMARKS:</b>	Products are submitted to a continuous improvement process.
<b>INDICATOR:</b>	N° of monthly visits to the Agrometeorology menu, of the DMC-AEMET-WMO Project webpage.
<b>IMPROVEMENTS DONE:</b>	<ol style="list-style-type: none"> <li>1. Warnings and alerts can be accessed from cell phones with Internet capability. (<a href="http://www.meteochile.gob.cl/sim/movil">www.meteochile.gob.cl/sim/movil</a>) (20 April 2010);</li> <li>2. An online survey form (20 May 2010) is included in the Agrometeorology menu;</li> <li>3. Three-month climate predictions are updated monthly (7 June 2010);</li> <li>4. Climate Bulletins for temperature and for each station of the region (5 July 2010);</li> <li>5. General Information about population and principal agricultural activities is included for some counties of Region VIII (12 July 2010);</li> <li>6. Capacity to print products contained in menu is included (12 July 2010); and,</li> <li>7. The "Meteogram" menu is included, which provides information on meteorological parameters for the counties (15 July 2010).</li> </ol>

The outcome of the marketing survey and corresponding analysis of the requests by target user sectors resulted in the development of additional line of new products as shown in the table below:

A summary of the developed products are indicated in the following Table:

<b>Total Developed Products</b>	<b>Sector <u>Los Libertadores</u></b>	<b>Sector Agrometeorology of VIII Region</b>	<b>Sector <u>Industry of Salmon</u></b>
22	4	9	9

**Activity 5:** The business plan was implemented. The improved and/or new line of products and services were applied to the identified areas and the outcome of the business plan monitored systematically and set up jointly by the consultant and Chile DMC. **(July 2008-December 2009)**

### Socio-economic benefits Workshop

A workshop study was conducted to identify/develop methodologies for evaluating and quantifying socio-economic benefits of hydrometeorological services by the Chile NMHS. **(June 2 & 3)**. The main goal of the workshop was to provide a forum for promoting interdisciplinary assessment of socio-economic benefits of meteorological and hydrological services involving service providers and users. The following topics/thematic areas were presented during the workshop:

1. Methodologies of measurement of socioeconomic benefits of the Meteorological Services; J. Ducci
2. Case study: Evaluation of the System of Early Alert of ENOS for Mexico; J.Ducci
3. Case study: Economic evaluation of the Rainfall Network in Chile; J.Ducci
4. Economic General Scope of Service of the Meteorological Services; S. Quiroga
5. Economic impacts of the Climate change on the Agriculture in Europe; S. Quiroga
6. Case study: Evaluation of the Restoration of the Integrated Meteorological System/ Charpentier.

### Achieved Results

Result 1: Introduction of a Weather Information System within the operational and functional structure of the DMC. Through this process, different work areas and equipment were integrated within the DMC in order to give continuity to the development and dissemination of products that met user requirements. This resulted in enhanced capacity in infrastructure and process areas of Chile DMC and the users.

Result 2: The construction of a Web page of the pilot project, in the corporate Web page of the DMC which was updated daily. The web page was accessible to the users of the information and allowed the reporting of critical feedback of the behavior of users by the number of times users accessed it.

Result 3: The establishment and critical work of the multidisciplinary team in charge of optimizing the level of satisfaction of the sector users. Products incorporated in the respective information systems were submitted for continuous improvement, through the multidisciplinary team who facilitated information flow from providers to user sectors, as well as analyzed feedback information from sector-users for continuous improvement of the products. This resulted in quality management systems (QMS) incorporated in the operational processes of Chile DMC.

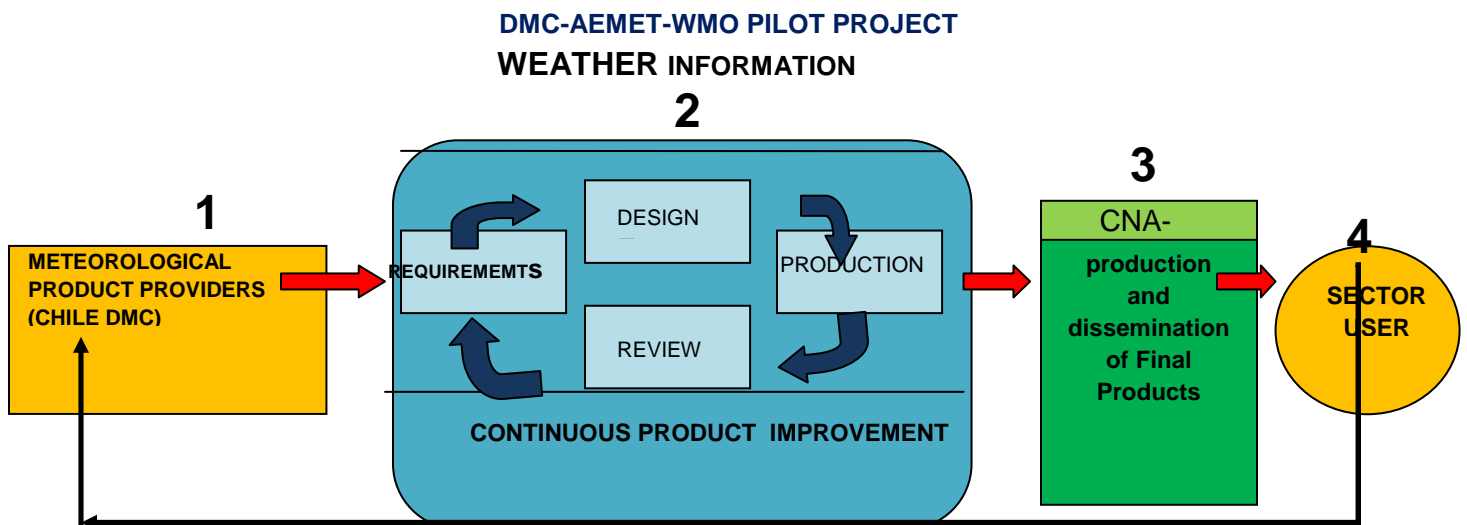


Diagram showing the process for the implementation of the products and services included in the Weather Information System of the DMC-AEMET-WMO Pilot Project. The GFCS User Interface Programme mechanism is demonstrated via a closed-loop information flow from providers to users with feedback information for product improvement.

## Continuous Improvement

A team in charge of continuous improvement was formed to improve presentation formats, optimize the communication system for alerts, and included more detailed recommendations as received suggestions. The team was essential in integrating feedback and evaluation and/or new information in the products for continuous improvement. This team comprised professionals and technical staff of different specialties belonging to the DMC. The main function was to apply procedures of continuous improvement, based on the interaction with the users. A Form was used to solicit feedback information from users.

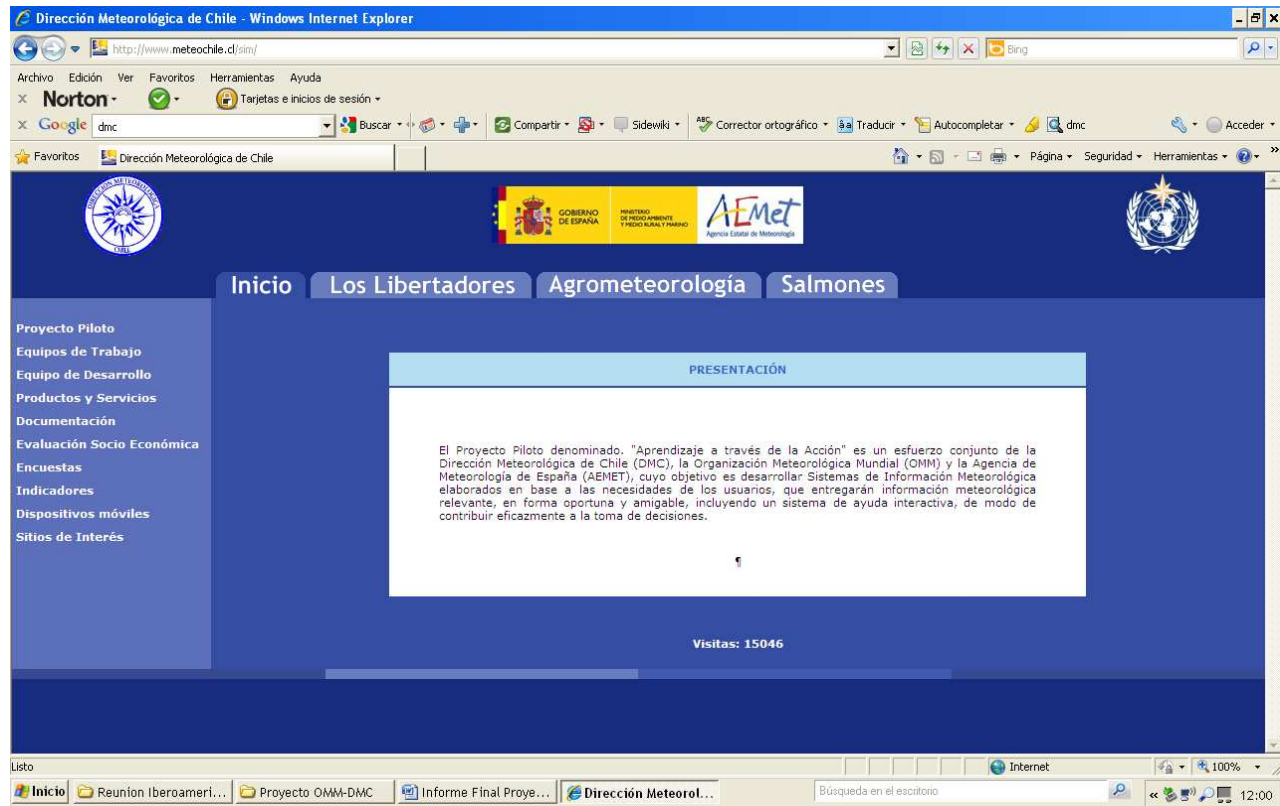


Subsistence farming in Chile



Organic large scale farm in Chile

Below is a page image of the web page showing the three logos of the Chile DMC, Spain's AEMET, and WMO with a drop-down tab menu for each of the three selected sectors (Los Libertadores, Agrometeorología, and Salmones):



The screenshot shows a web browser window displaying the website of the Dirección Meteorológica de Chile. The browser's address bar shows the URL <http://www.meteochile.cl/sim/>. The website features a dark blue header with the logos of the Dirección Meteorológica de Chile, the Gobierno de España, the Ministerio de Medio Ambiente y Medio Rural y Marino, and AEMET (Agencia Estatal de Meteorología). Below the logos is a navigation menu with tabs for "Inicio", "Los Libertadores", "Agrometeorología", and "Salmones". The main content area is titled "PRESENTACIÓN" and contains the following text:

El Proyecto Piloto denominado, "Aprendizaje a través de la Acción" es un esfuerzo conjunto de la Dirección Meteorológica de Chile (DMC), la Organización Meteorológica Mundial (OMM) y la Agencia de Meteorología de España (AEMET), cuyo objetivo es desarrollar Sistemas de Información Meteorológica elaborados en base a las necesidades de los usuarios, que entregarán información meteorológica relevante, en forma oportuna y amigable, incluyendo un sistema de ayuda interactiva, de modo de contribuir eficazmente a la toma de decisiones.

Visitas: 15046

## Review and Evaluation Phase

**STEP 8 - Reviews and evaluations were conducted iteratively and the process was used for continuous improvement of service delivery by Chile DMC to sector users.**

The review and evaluation phases involved the analysis of the impact resulting from the development of the pilot project, both in the executing organization, the Chilean Weather Service (DMC), and in the internal and external users.

For the development of this phase, information from indicators, analysis by the coordinators and user surveys was used. Three areas were evaluated as follows:

### **Evaluation of the operational aspects.** *Performance Indicator – Number of visits by sector users.*

An evaluation was conducted of the products which were most visited within every menu. The results showed that among the different products for every sector, those related to weather forecasting were the most visited. The following graph shows statistics of access by sector users seeking meteorological information:



The graph shows on average there were about 1,120 visits per month, and 15,200 visits during the entire period. Larger number of visits occurred during the autumn and winter months being in April the largest one. These numbers demonstrate the importance of monitoring the number of regular users visiting the website. This can be interpreted as a confirmation of the usefulness of the available information. The results of an online survey by users carried out concludes as follows:

- The interrogated persons confirmed that the information was very useful;
- 100 % of the interrogated persons indicated that they visit the website very frequently; and
- The interrogated persons agreed that the information could be interpreted easily and was usable.

### **Evaluation of the socio-economic benefits.**

A methodology was developed by the consultants that would evaluate of the socio-economic benefits in all three select sectors. The methodology was applied, with adjustments in accordance with the availability of information contributed by the users.

Sector 1: The Los Libertadores - Performance Indicator – amount of money saved

The information system for the Los Libertadores was evaluated for a one-day closure situation. The closing of the route takes place in Guadia Vieja (km 178), where there is a police control unit. The responsibility of the administrator of the Los Libertadores pass is the closure of the border pass, for two main reasons:

1. Meteorological extremes related to blizzards and snowfalls. There are currently no records of these events available, nor have critical levels been established for operational purpose;
2. Uncertainties related to frontal systems forecasts, to allow for about two hours of good weather, which is the estimated time that it takes to cross from Guardia Vieja (1,600 Metres Above Sea Level (M.A.S.L)) to the same altitude in the Argentine sector.

The danger of avalanches occurs during thunderstorms and, sometimes, on the following day, and is a threat for the whole linear length of the G20 international highway. From the beginning of a thunderstorm, efforts are made so that vehicles circulate safely, do not park on the highway in places where shelter does not exist, and where life might be at risk without the necessary equipment.

Therefore, an accurate forecast would reduce border closures in two scenarios:

First scenario would allow for a reduction in the preparation time for snow operations; and second scenario would reduce the overall number of closed days due to erroneous forecasts. Considering that one day of closure was quantified in dollars (November 2010), it was then possible to quantify the economic benefits emanating from correct/accurate weather information:

For the 2009 year, there were 13 days of closure due to snow, which were all forecast. For 8 days the forecasts were correct and in accordance with the indication by the Direction of Vialidad; but for 5 days the closures were due to wrong forecasts. During the 2010 year, there were 10 days of closing, of which 8 were due to snowfall certainty and only 2 days due to erroneous forecast. This demonstrated a better experience in the mountain forecast by the Service and a greater credibility in the forecast by the Provincial Government. It can be concluded that of those 5 days of erroneous snowfalls forecast in 2009, hence reduced to only 2 days for the 2010 year. In other words, there was a reduction in the erroneous closure of the Los Liberators border by three days, which equates to USD \$ 7,232,484.

Year 2009-2010			
Forecasts	2009	2010	Difference
Certain	8	8	
Forecasts	5	2	3
Days Closed	13	10	
<b>Total value costs avoided</b>			<b>US\$ 7,232,484</b>

Sector 2: The Agrometeorology Sector / Region VIII. Performance Indicator/ Value of crop loss by frost

In the planning phase of the economic evaluation, information related to the damages and/or losses caused by meteorological phenomena which took place during the previous periods (i.e., years 2007-2008) was collected. This was done in order to establish a basis for comparison with fewer losses which could happen with improved forecasting. In the implementation phase, a user was identified to provide

firsthand information with regards to the information used and the loss reduction due to meteorological phenomena. On this occasion, Córpora Company S.A. was the partner/user selected.

The compiled information was studied and several types of meteorological phenomena which affect agriculture were identified, and amongst them, frost was chosen for this particular study. This was due to the fact that some mitigation action could be taken for such a phenomenon. All relevant details were also identified such as: square meters planted, production/yield per hectare and prices. The mitigation method against frost by farmers was identified as smoke used for an average of 12 hours for the implementation of the procedure.

The impact of the 2007, when there were no special forecasts for frosts for the region was compared to the yields with frost forecasts applied to farming decision-making and it was concluded that frost affected the performance of the plantations. Of the sample of selected products, a different impact factor was used for each type of cultivation, and it was estimated, in accordance with the indication by Regional Secretariat of Minister of Agriculture of the Bio-Bio Region and of the Center of Agriculture and Environment of the University of Chile (AGRIMET), that the correct mitigation for frosts, as a result of a good forecast, reduces the impact of frost by 50%.

The following Table indicates the cultivation of the sample and the evaluation of the minor loss as a result of the measurements of mitigation, considering an opportune and quality forecast.

<b>Products</b>	<b>N°hectares</b>	<b>Yield per hectares quintals/hectare (qq/ha)</b>	<b>Price</b>	<b>% of hectares affected</b>	<b>Production without frosts (Millions of CH \$)</b>	<b>Losses due to frosts without forecast (Millions CH \$)</b>	<b>Losses with frosts mitigation with forecast (Millions CH \$)</b>
Wheat	72,000	51	11,500	14,40%	42,228	6,080	3,040
Oats	23,000	45	8,500	13,50%	8,797	1,187	594
Corn	9,600	125	10,200	6%	12,240	734	367
Rice	4,200	36	18,475	6%	2,793	167	84
Beans	3,400	14	38,167	0,80%	1,816	14	7,2
Lentils	800	7,5	50,000	0,70%	300	2,1	1
Beet	14,000	94	27,560	13,30%	36,268	4,823	2,412
Chicory	3,000	54	38,000	11,00%	6,156	677	339
Tobacco	364	3,250	1,233	5%	1,458	73	36
Lupin	1,500	30	5,300	40%	238	95,4	47,7
Vineyard	15,613	8,500	6,667	18%	884,780	159,2	79,630
<b>Total US \$</b>				11,70%	997,078	173,117	<b>86,558</b>
<b>Total US \$</b>							<b>173</b>

#### Evaluation of the Information System for the Salmon Industry

Methodology of Evaluation involved the determination of the value of the closure of the port for the Pilot Client (INTESAL) for the salmon industry. Previous loss to the Salmon Industry estimated by INTESAL for 2007 was 180,400 tons. Considering that INTESAL had a 9.2% participation of the market, it was envisioned that the losses were equivalent to 16,597 Tons. Considering that a ton of salmon was valued



at US\$ 4,000, according to SurySur.net Website on 15 November 2010. The 2007 loss for INTESAL was estimated at US\$ 66,387,200. The developed Meteorological Information System dedicated to the salmon industry (SIMETSAL) which allowed 24-hour monitoring of meteorological conditions for decision-making by the salmon industry users since weather and climate information affects different stages of production.

To determine the economic value of the meteorological information provided by the DMC, the methodology used consisted of determining the number of occasions that Port authorities opened the ports as requested by INTESAL, which was based on the information provided by DMC. The information covered two out of 16 seaports, Melinka and Quellón. According to the information provided by the Marine Government of Port Montt in 2007, there were 185 cases of closures involving the 16 Salmon Industry ports, impacting the Industry for a total loss of US \$ 358,850.

Determination of the value in savings opening of the closed seaport

According to what was indicated by the Lieutenant commander in charge of the marine operations of the harbor master's office in Puerto Montt, the authorizations of opening the closed seaports can be indicated due to the fact that the port only authorized operations for some hours. However, records were not always kept on requests of opening of seaport since often the communication with the harbor master's office was by cell phone and not logged. Hence this lack of information has not allowed the determination of the savings accrued as a result of the concept of decrease of closing seaport days in 2010.

Determination of savings (or decreased loss) by management of seaport opening.

Despite the absence of information with regard to the management of opening of seaports, an approximation of savings due to seaport openings was made by determining the correlation of the 16 seaports for salmon with the 2 seaports where meteorological information was provided by the DMC; hence it was inferred that from the 185 closures corresponding to 16 ports, 23 of these would correspond to 2 ports with meteorological information available for opening. A simple calculation demonstrated that if the total number of the closings had been managed, the total of minor losses, according to the above model, would be around US \$ 8,298,400.

## **Benefits resulting from the Project**

### Benefits for the Meteorological Service of Chile

The following are the benefits to the Chile DMC:

Benefit 1: Enhanced capacity of the DMC and increased visibility of the DMC to showcase economic value of its services to the Chile government. This involved the incorporation of the Meteorological Information Systems concept within the functional structure, which will replicate the methodology used in the Pilot Project, in other important economic sectors of the country, and resulting improving the visibility and development capacity of the DMC;

Benefit 2 Improved service delivery in the Chile DMC. The development of a user interface via multidisciplinary working teams which facilitated information flow in a closed-loop system with feedback mechanisms for continuous improvement of products. Multidisciplinary working teams interacted directly with sector users and facilitated the development of innovative responses to user requests by incorporating continuous improvement;

Benefit 3: User-driven services and products. Increasing the quantity and quality of meteorological products and services, focusing on the real needs of the users;

Benefit 4: Enhanced capacity at the Chile DMC. Improving the skills of the professional and technical staff of the DMC, to design and implement continuous improvement of products and services and incorporating QMS in the process;

Benefit 5: Development of Methodologies to quantify socio-economic benefits of meteorological services and products. Training in socio-economic evaluation methods, to quantify the benefits that the DMC contributes to economic sectors to showcase the role of NMHS to national development.

#### Benefits for the Users

Benefit 1: Direct access to Meteorological information Systems that met their needs and requests.

Benefit 2: Established user interface by the multidisciplinary working groups for the sectors facilitating dialogue and feedback information with the DMC, allowing product improvement and usefulness of the products and information.

Benefit 3: Increased services and products and information for sector decision-making.

Benefit 4: The development of specific expertise in meteorology for application in various sectors.

#### **Recommendations**

1. The pilot project is an excellent tool that has demonstrated improvement in service delivery and facilitated a process of improvement in the capacity of skills for meteorological service providers to engage with the users. The new and improved should be incorporated in the operations of the DMC for continuity and sustainability over time. A major recommendation was the implementation of a Public Weather Services Unit as soon as the project ended, to act as the interface between the meteorological service providers and sector users for the development and implementation of user specified products and services of high impact in different productive sectors.
2. Armed with the experience learned during the development of the Pilot Project, training for end-users is of the utmost importance and should be included in the operations of DMC.

#### **Post-project Period (November 2010 – June 2012)**

During this period, the analysis considers the results obtained and translated into the diffusion of products through the corporate website. The following outcomes were observed:

A. section, "Weather Information Systems", was established and incorporated into the corporate website of the Weather Service of Chile, where weather information and products developed during the pilot project were disseminated and updated. Updates on products and services improvement were based on user feedback from the participating sectors.

## **Product Improvements**

The following improvements were made in the products included in the information systems:

### 1. – The Los Libertadores:

An automatic weather station has been installed in the Complejo Los Libertadores, where real time reports of the main meteorological parameters are received. This improvement has allowed better products to be developed based on real-time data and posted /disseminated in a timely manner on the Weather Information Systems for access by sector users. Currently, software is being developed to display this information on the website in real time. Users will be able to plan their trips safely with advance information on weather conditions on the treacherous Paso Libertadores.

### 2. – Agrometeorology

The products developed in the pilot project for agrometeorological information system of the VIII region, was incorporated into the operations of the Agrometeorological unit of the DMC within the corporate site. The products have been extended to other agricultural regions of the country, using the methodology developed in the project.

### 3. - Forest Fire

Using the methodology learned in the pilot project, a new product line called "Weather Information System for Forest Fires DMC-CONAF" was developed jointly with the National Forestry Corporation CONAF, and is currently undergoing further validation of its products. The system is currently being validated and will avail access to users after the validation phase and distributed en masse in the Web page.

***NOTE: products are accessible using the username and password "conaf"***

### 4. - Salmon

A new product has been introduced in the meteorological information system for salmon, called "Climate forecast for the region Los Lagos." This product delivers a climate perspective up to three months ahead and is aimed primarily for planning activities. This product is based on the behavior of the "El Niño / La Niña", phenomena which has effects on water temperature and sector users have expressed interest in having this information.

## **Future Proposed Project and the Way Forward**

The Meteorological Office of Chile considers it necessary to continue the work accomplished during the pilot project, and a feasibility study is underway to determine the possibility of creating a special unit to develop integrated meteorological products, using the methodologies learned in the pilot project. In essence, the implementation of a Public Weather Services Unit to act as the interface between the meteorological service providers and sector users should be considered. This would also demonstrate the implementation of the GFCS User Interface Program which is a priority area of the WMO Strategic Plan for 16<sup>th</sup> Financial period. Despite the unavailability of required resources, The Meteorological office of Chile (DMC) is making efforts to achieve this in the near future and implement this project.

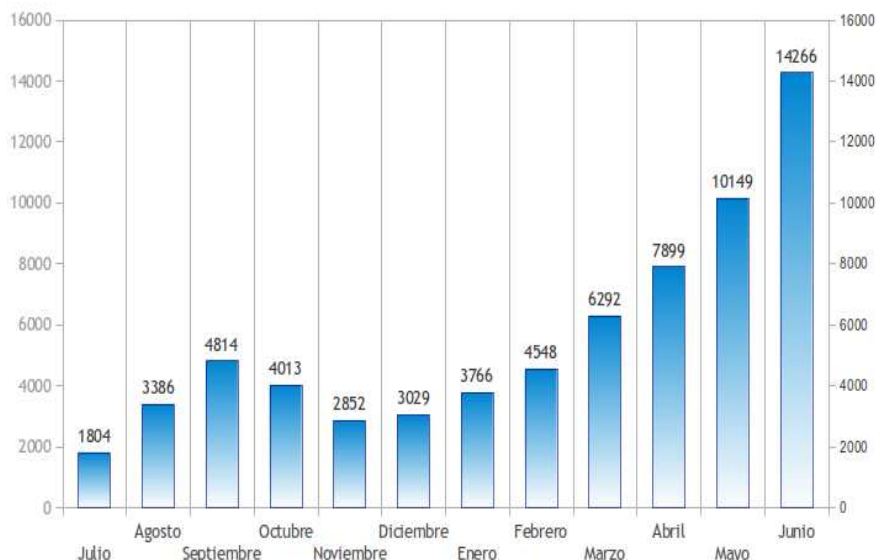
## **Conclusion**

One aspect that is relevant to highlight, relates to the growing number of users who regularly visit the Web page, where, the products are contained in the different sector information systems. The number of

users accessing the products has grown significantly when comparing the visits between 2010 and 2012 as shown in the table below:

Month	2010 Visits	2012 Visits
April	1,499	7,899
May	1,410	10,149
June	1,120	14,266

Contador de visitas últimos 12 meses



Sector users monthly visit counts (Nov 2010 – June 2012)

The above results show that products and services by the Chile DMC are being well received by users with increasing numbers of visits to the website by users. The results can be viewed as further evidence of the effectiveness of the pilot project and the improved service delivery to economic sector users where elements of the WMO Strategy for Service Delivery were demonstrated. DMC has the opportunity to showcase the role of its services to the national economy of Chile and cement national commitment of its services reflected in national development plans and/or Poverty Reduction Strategy Papers. The implementation of the proposed future project described above will contribute to the implementation of the GFCS User Interface Programme in the developing regions of the world.

### **Acknowledgment**

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Source: Adapted from the Pilot Project: "Learning Through Doing", Final Report by the Direction of Meteorology of Chile to WMO