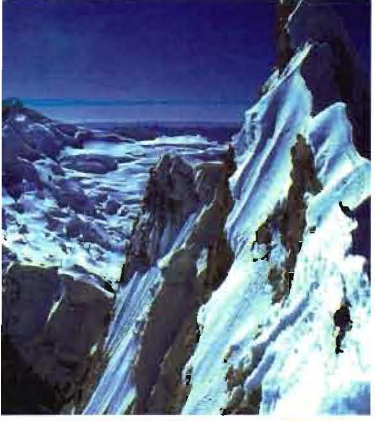
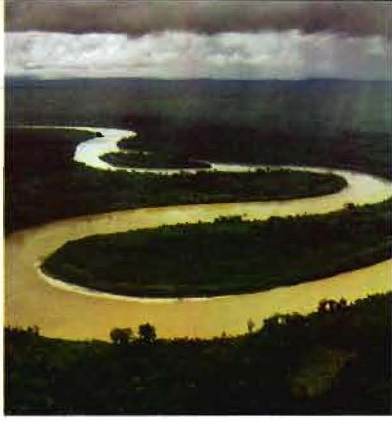
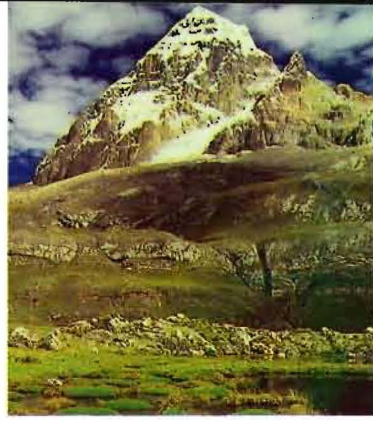
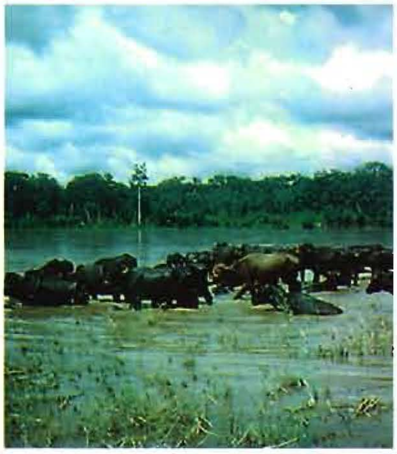
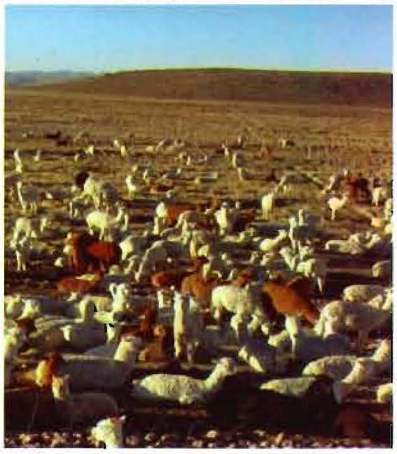




Climate Scenarios for Peru to 2030

SECOND NATIONAL COMMUNICATION ON CLIMATE CHANGE

EXECUTIVE SUMMARY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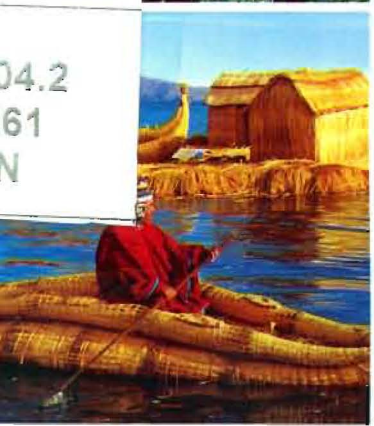
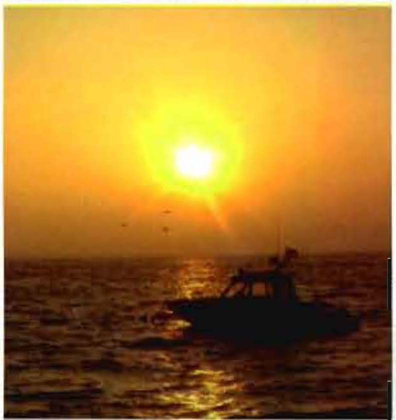
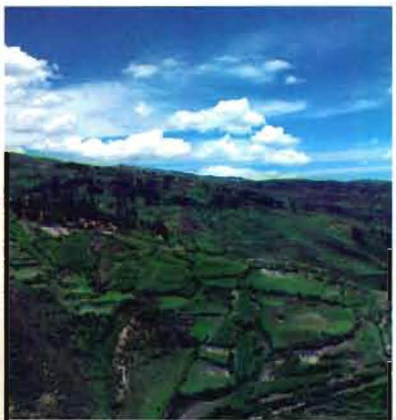
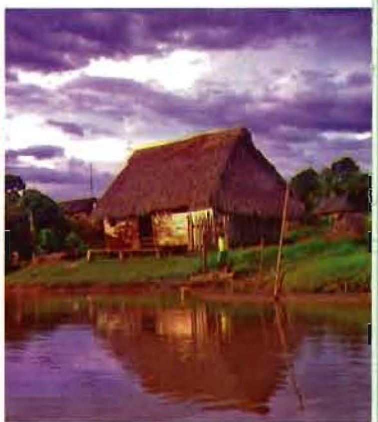

Executive Summary
CLIMATE SCENARIOS FOR PERU TO 2030

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EXECUTIVE SUMMARY

Climate Scenarios for Peru

TO 2030

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Background

In spite of the several regional impacts of global climate change occurring at present, there is still a considerable lack of knowledge about all these facts in Peru, since uncertainties associated with climate are due to the presence of the Andes Mountain Range; all this generates in our territory a diversity of climates and microclimates, that respond in different ways to global climate change.

The reserach that helps understand how the climate of our country critical areas, such as regions of high mountains and the Amazon, are lagerly limited by the scarcity of meteorological observations from long periods of time. However, there are some national efforts aimed at developing inter-institutional studies, such as the Program for Strengthening National Capacities for Managing Climate Change and Air Pollution (PROCLIM, 2005), and regional such as the Regional Andean Project for Adaptation to Climate Change (PRAA, 2007), carried out by the them National Council for the Environment (CONAM), currently the Ministry of Environment; these projects have allowed to generate useful information to determine current and future vulnerability in specific regions and together with it, to be able to establish adaptation measures in accordance to the local characteristics of the areas of study, as it is stated in IPCC AR4, in which it is recognized the importance of generating regional information.

The Ministry of Environment, within the framework of the Second National Communication to the UNFCCC, a Project supported by the United Nations Development Program – UNDP, has given SENAMHI the task of execution of the study "Generation of Climate Scenarios in Peru" which describes two important aspects of the national climate: first, the characteristics of current climate and its climate trends in the last 40 years, and the second part; consisting of future projections to 2030, based on the global climate scenarios, using dynamical and statistical downscaling methodologies for the A2 emission scenarios (high rate emissions).

The evaluated variables are extreme temperatures and precipitation in this study. It is important to point out that each step of the regional climate scenarios study considers an element of uncertainty; both in the part of the historical analysis, because of the limited knowledge on current climate variability, and in the methods used to generate future projections at regional level. However, the obtained results are based on standard methodologies recognized by the IPCC, that allow to improve our knowledge on the current and future climate variability in the country and to give advise on the most adequate policies for the adaptation to face climate change at national level, contributing to the Millennium Development Objectives.

Peru: a multiple-climate and megadiverse country

From the 32 existing climates in the world, Peru has 27; according to the Climate Classification of Thornwaite (SENAMHI, 1988), it is also considered as one of the twelve mega-diverse countries in the world, according to the Cancun Statement (2002) recognized by the United Nations Environment Program (UNEP).

All these recognitions are mainly due to the fact that Peru has a particularly complex geography from which its most outstanding features are the elevations of the Andes Mountain Range and the Pacific Ocean currents, that determine the different climates and landscapes in the desert coastal region, the puna or high Andean plateau and the tropical jungle in the Amazon Basin, all of them converging in a territory with a great variety of natural resources.

Peru is considered as the twentieth largest country in the world and the third one in South America. Peru is geographically located in the central western part of South America just underneath the Equatorial line; it has a total area of 1 285 215,6 km2. To the north it is bordered by Ecuador and Colombia, to the east by Brazil, to the southeast by Bolivia, to the south it is bordered by Chile and to the west by the Pacific Ocean. It is also important to mention that according to our Constitution, the maritime domain of Peru extends 200 miles off shore.

On this matter, the Peruvian sea is heterogeneous due to the confluence of two ocean currents of different characteristics: the Peruvian Current of Humboldt Current of cold waters flowing northward, that determines a temperate desert climate in the coast instead of tropical; and the warm El Niño Current, that permanently influences the northern coast of the country and eventually flows further south.

It is worth mentioning that these currents determine up to four sea zones off the Peruvian coast: a) The cold sea of the Peruvian Current, down to the central part of Chile, of relatively low temperatures, b) The tropical sea of warm temperatures, c) the ocean zone east of the Peruvian Current, of warm temperatures, d) the transition zone, between the cold sea and the tropical sea, where the cold and warm waters mix together off the coasts of Piura and Lambayeque.

Concerning the presence of the great Andes Mountains, which locates along the country; it determines the geographical heterogeneity of Peru and it is expressed in: a) three large continental masses: the coast, between the sea and the Andes Mountains; the Andean region or Sierra, as a mountain mass; and the Amazon region, east of the Andes Mountains, b) three main hydrographic regions: the Pacific, the Atlantic and the Titicaca, c) Also the different zones in the Mountain region: the low plateau, north of the Porculla depression; the center and southern Puna; and the High Plateau, in the surroundings of the Titicaca Lake.

How is our current climate?

Characteristics of our climate

From the perspective of multiannual variation of extreme temperatures and precipitation, the highest temperatures occur in the northern coast and the lower jungle. The lowest temperatures are registered in the highland zones, mainly in the High Andean Plateau.

Concerning precipitation, the central and southern coast show very scarce precipitation or none; in the mountain region, rainfall is moderate and in the northern and southern jungle there is heavy rainfall. Variation of multiannual average precipitation ranges from 1 to 50 mm in the coast, except for the Northern region that shows values between 50 to 200 mm; in the mountain region between 50 to 1000 mm, while in the jungle values vary between 1000 to 3000 mm. (See maps 01, 02 and 03 in Appendix).

Multiple-quarterly precipitation for the months December-February and March-May are the rainiest periods at national level. The period March-May show accumulated rainfalls that significantly diminish in all the territory in relation to the previous quarter, except for the northern jungle, where precipitations remain the same. Also the driest period corresponds to the June-August quarter, where the accumulated rainfall for the coast is lower than 5 mm; in the mountain region it reaches 100 mm and in the jungle, 900 mm. Between September and November, rainfall slightly increases in the mountain and jungle region with respect to the previous quarter.

All the variations that the Peruvian climate shows from one year to another, known as interannual variability, are mostly determined by the occurrence of El Niño /Southern Oscillation (ENSO) and the extreme events associated with it and that cause great economical loss because of their impacts.

Precipitation and extreme temperatures trends

In Peru, total annual precipitation shows some stressed increases (positive trends); from 1965 to 2006; for the coast and northern mountain region values reach between 30 and 40% over their averages; while from the 1960's decade up to the end of the last century in the northern jungle values shows some decreases (negative trends) by 20 to 30% below their average, statistically significant. The temporal analysis in the last 40 years indicates that large scale circulation mechanisms modulate precipitation mainly at decadal periods or even longer for these regions. In the case of the interannual variability, the ENSO events are responsible for this trend, but its incidence is minimal, and is restricted to the most intense events. Conversely, the central and southern jungle show a very similar interannual variability, but with opposite trends, where the ENSO events seem to be the dynamical source that modulates these regions with high intensity.

Linear trends of annual and seasonal mean maximum temperature show a prevailing of positive values (increase) in all our territory with values of +0,2 °C/decade in average, and in general these are statistically significant in the highlands of the southern part of Peru. The most intense ENSO events modulate its interannual behavior generating positive anomalies of different intensities all over the country.

Also, the annual and seasonal trends of average minimum temperatures are mostly positive with values between 0,1 - 0.2 °C/ decade, except for several stations located north of the Titicaca Lake. Similarly, temporal variations show that the increase or decrease of this variable occur gradually throughout the period of the present analysis and it is quite clear that these temperatures are modulated by larger oscillations than just interannual and with more intensity than the one observed in the maximum temperatures. The temporal distribution of minimum temperature shows that this depends on the ENSO phenomenon phases, which alters interannual variability, depending on its intensity. In average, mean minimum temperatures trends slightly increased in a lower rate than maximum temperatures did.

These observed trends are within the range estimated by IPCC AR4 for the whole planet, between the years 1981 and 2005 (0,18 °C/decade).

It has also been analyzed that these trends in temperatures show very particular regional values; possibly besides the anthropogenic influence, maybe some other influences exists, such as heat islands due to city development and the alteration of soil properties, deforestation, etc.

Are extreme events increasing?

Among the characteristics of the extreme precipitation indices, it is worth mentioning that the trend of the Simple Daily Intensity Index (SDII) of precipitation in the central mountain region is the most homogeneous one with respect to northern and southern mountain region. It shows a decreasing trend between 0,1 - 0,2 mm/day in the western central mountain region and zones of the department of San Martin, while in Puno and northern mountain region (Piura). It shows an increasing trend of 0,1 mm/day

The SDII precipitation index is influenced by the local prevailing geographical characteristics, as it can be observed in the distribution that occurs west of the northern jungle (San Martin). Similarly, the maximum precipitation index (Rx1day), registered in one day, shows that the northern and central mountain regions follow the observed patterns in the total precipitation trends.

On the other hand, the index that indicates the amount of accumulated precipitation in five (RX5Day), shows that the central mountain region is the one that through the years is becoming less prone to the occurrence of floods and landslides. On the contrary, parts of the southern mountain region, including the highlands of Arequipa and the Central western Puno region, as well as the entire northern mountain region, have the potential to become risky regions prone to this type of hydroclimatic events, because they show an increase in the number of extremely rainy days.

It is observed that the Consecutive dry days index (CDD) trends does not show a direction with regional coherent characteristics, to the contrary, it shows local patterns or small regions where some scattered places show some significant positive values as in the western-central mountain region with 2 to 3 days/year.

In addition, the rainy period index trend shows prevalence of positive values over our territory, besides it shows some regions with coherent trends, as it is the case of the northern mountain region; while in the rest of the territory a non statistically significant increase in the number of rainy days; would indicate the occurrence of days with more and more accumulated amounts of daily precipitation ; but with a mean intensity quite scattered over the whole country, because in some places the intensity of rainfall decreased and in others increased, possibly due to the orographic configuration of the region.

Climate extremes in temperatures show a decrease of cold days and an increase of warm days in most of the stations used in the present study, except for the northern jungle, where this trend is just the opposite. The most outstanding characteristics of the trend in the number of days with meteorological frost days index (FD) and cold nights (TN10p), is the presence of negative values (decrease of days with frost) in the highlands of Arequipa, with values ranging between 0,4 -0,8 days/year, while in the adjacent zones to the Titicaca Lake, the trend is positive (increase in days with frost).

This pattern indicates that the higher regions are gradually warming up, which represents a problem for the highland regions, because it will accelerate the glacier melting process. At first, this phenomenon will cause an increase in the river discharge and then a drastic decrease that will affect agriculture and water resources for human consumption in most regions of Peru, where the ice caps are the main sources of water. On the other hand, the warm nights index (TN90p) show an increase with significant values in the southern mountain region, between 0,2 to 0,6 days/year; but, without bipolarity characteristics observed in the adjacent zones to the Titicaca Lake and the highlands of Arequipa. Apparently, the values of minimum temperature are affected by the thermal effect of the Titicaca Lake. On this matter, this aspect needs to be studied more deeply at regional level, where the long-term and interannual variability of the lake's temperature should be taken into consideration.

From 1965-2006 droughts at national level during the period of study, do not show any trend, it was determined that the most intense droughts appeared in the positive phase of the ENSO (1982-83, 1991-92). The jungle region is the zone that shows a higher occurrence frequency of moderate and severe droughts as well as the Southern mountain region.

In conclusion:

- Precipitation shows some increases in the coastal and northern mountain regions and a decrease in the northern jungle, without any major patterns in the rest of the territory.
- Maximum and minimum temperatures have increased up to 0,2 °C/decade in almost all the country.
- The dry periods (CDD) are increasing more in intensity than the humid periods (CWD) at national level.
- The intensity in the precipitations is increasing in the coastal and northern mountain regions; while it is decreasing in the central mountain region. The southern mountain region shows moderate variations.
- Moderate and intense rainfall frequencies have increased in the coastal and northern mountain regions, while it has decreased in the central mountain region.
- In general, the number of cold days has a pronounced trend to decrease, while the warm days are increasing in the last 40 years. Concerning cold nights, they are decreasing as the warm nights increases.
- Local or regional factors modulate spatial distribution of extreme indicators, showing some discrepancies in many zones.
- Droughts show no trend, either increase or decrease in the number of these events, as time goes by, The Southern jungle region as well as the southern mountain region have showed the highest frequency of moderate and severe.

Global models simulate our climate?

Six Global Climate Models (GCM) have been analyzed with two emission scenarios of greenhouse gases, defined in the Special Report on Emission Scenarios (SRES) of the IPCC (2007) these are the emission scenarios A2 scenario high level increase of CO_2 and the B2 scenario of low CO_2 increase. The change in the emissions of greenhouse gases, from energetic sources and/or the industry for the year 2030, show a consistent increase of 25 to 90% with respect to the year 2000, while for the year 2100 from 90% up to 250% (IPCC 2007).

The GCMs used by IPCC and analyzed in the present study, are listed in the following table (see information in SENAMHI, 2005):

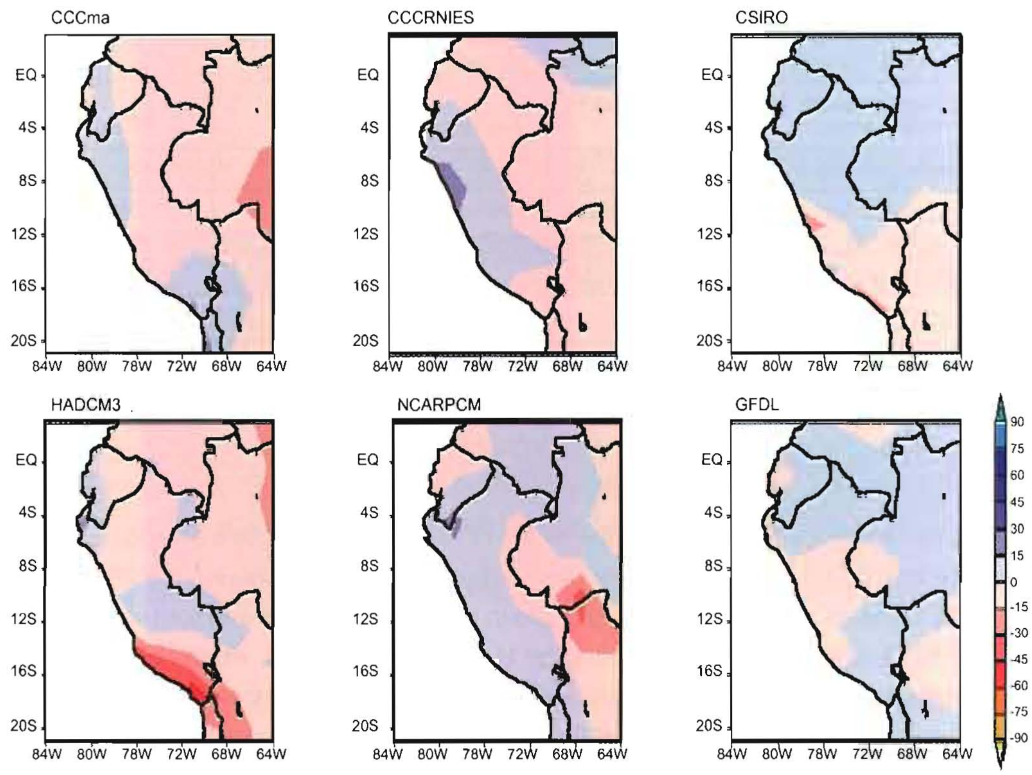
Center	Country	Acronym	Model
Max Planck Institute für Meteorology	Germany	MPIfM	ECHAM5/OPYC3
Hadley Centre for Climate Prediction and Research	England	HCCPR	HADCM3
Australia's Commonwealth Scientific and Industrial Research Organization	Australia	CSIRO	CSIRO-Mk2
National Centre for Atmospheric Research	USA	NCAR	NCAR-PCM
Canadian Center for Climate Modeling and Analysis	Canadá	CCCma	CGCM2
Center for Climate System Research (CCSR) - National Institute for Environmental Studies (NIES)	Japan/USA	CCSR/ NIES	CCSR/NIES AGCM + CCSR OGCM
Geophysical Fluid Dynamics Laboratory	USA	GFDL	R30

All analyzed models show a dry bias in the Andean and Amazon region of Peru, and particularly drier in the Andean Region (90%).

For South America, from the six models, the NCAR-PCM and the GFDL show a negative bias (dry) in most part of the region; however, they show a moist bias or rainier bias in the western coast (70%). While the HadCM3 registers a low dry bias in the Amazon region and southern mountain region (15-30%). Similar results were found by Marengo et al. (2007), when he evaluated the global models for South America between 1961 and 1990, showing that the CSR/NIES, HadCM3 and CSIRO patterns registered a better skill in the representation of rainfall over Peru, because it showed less differences in precipitation, between -1 to 1 mm/day.

Concerning Peru, projections for maximum temperatures in the five global models analyzed in this study indicate, in average, positive anomalies that are, warming. According to these models it is expected an average increase in maximum temperature of up to 1 °C to 2030, and up to 2 °C by the end of 2050, in both scenarios. Concerning minimum temperatures, the average increase is similar to that of maximum temperatures. The high variability showed by the HadCM3 model decreases. The CSIRO model is the one that shows larger fluctuations, with a deviation towards cooling in both scenarios. None of the models simulate high temperatures detected during the El Niño years, except for the HADCM3 model, that with certain skill simulated the El Niño 1982/83, but only in the B2 scenario.

Concerning precipitation, at national level, all the models show different distributions in the country. Only for the northern coast, all the models agree, showing an increase of up to 15% in this area, situation that is associated with the increase of sea surface temperature (SST). Similar results were found by Marengo, 2007, with more intensity for the period 2041 to 2100. Concerning the mountain and jungle regions, the models do not show an agreement, there are a lot of differences. Only two models, out of six show increases of up to 15% with shortage prevalence, that reach up to 45% over the western slope of the southern mountain region (HADCM3 model). For the jungle region, three out of six models show an increases of up to 15%.



Variation in percentage (%) of annual precipitations simulated by the CCCma, CCSR/NIES, CSIRO, HADCM3 models and NCAR-PCM, for 2030 decade in relation to climatology from 1961-1990.

How would future climate be in Peru under a high emission scenario (A2)?

Although GCMs allow us to make projections as how climate will be in the future, it is also true that due to their low resolution (normally between 300 and 500 Km), they do not allow us to know the changes in the climate of areas such as: the coast, high mountain regions, intra-Andean, basins, etc. Being dynamical regionalization or dynamical downscaling an alternative to simulate in a low scale grid, the effects in the coastline, bodies of water and surface coverage in the local climate can be identified.

Dynamical downscaling is a technique in which a regional pattern takes the values from a coarse grid "mother" model (boundary conditions and initialization from a GCM) and it solves the atmosphere and ocean equations related to the GCM; but in a smaller grid, that is, with a better spatial resolution than the one of the matrix grid. Also, the regional model uses other surface variables such as topography, type of soil, etc.

In the present study, the dynamical downscaling was made using the RAMS regional model, which was forced by the NCAR global model, because it was the one that better performed the simulation of intense rainfall in the northern coast of Peru, associated to the warm phase of the ENSO, a climate event that modulates climate interannual variability in our country.

Regarding extreme temperatures

Annual projection to 2030 for maximum temperature is 1,6 °C with respect to its current climatology almost all over the country:

Seasonally speaking, maximum temperature in the coastal region to 2020 and 2030 would show more intense positive variations in the winter period (JJA) and spring (SON), with values from +1,2 to +2,0 °C and from +1,2 to +1,6 °C, respectively, mainly in the top northern coast. The most important variations in the mountain region would occur in the autumn (MAM) and winter (JJA) seasons of up to +1,6 ºC mainly in the south eastern mountain region in autumn, and in the north eastern mountain region and central eastern mountain region during winter.

In the High Plateau region, variations would not be so significant, except in autumn with values of up to +1,2 ºC. In the jungle region, the most intense variations would occur during spring (SON), mainly in the northern jungle, with values of up to 2,4 ºC. In the other seasons, variations will show values of up to +1,6 ºC. In the southern jungle, the periods with larger variations would occur in the winter and spring with values of up to +1,16 ºC.. In the central jungle variations are very pronounced, except for the low central jungle during summer (DJF) with values of up to +1,2 ºC.

To 2030, minimum air temperatures, close to surface, would increase in the country with respect to current climate, between 0,4 and 1,4 °C, mainly in the coastal and northern jungle areas (Piura, Chiclayo and east of Iquitos), central zone (Cerro de Pasco, Huancayo, Huancavelica) and part of the south Andean sector (Ayacucho, Abancay).

It is projected that to 2030, in the jungle region, the area of minimum temperature from 22 -24 ºC would cover a larger spatial extension. In the coast, the area from 20-22 °C would show a reduction with respect to 2020. To 2020, in the High Andean Plateau's 2020 temperature would increase 2 ºC .

At seasonal level, the largest changes to 2030, in minimum temperatures are projected to occur in autumn and winter, with substantial increases of up to 2°C with respect to current climate, mainly in Chiclayo, Chimbote and northwest of Iquitos. While in spring, these changes would reach 1,2 °C (Piura, Chiclayo, northeast of San Martín and east of Iquitos) and in summer up to 1,6 °C (top northern coast, northeast of Moyobamba, central mountain region, Cusco, northeast of Abancay and south of Ayacucho.

Also, there would be a pronounced trend in the increase of warm days at national level, being the most intense in the southern mountain region of the territory. With respect to warm nights, there is not a pattern, but a regionalized behaviour; where in most part of the coast there would be a decrease, while in the mountain region it would tend to increase. This would be consistent with the projections of positive changes in minimum temperature to 2030 and with the current increasing trend of warm nights, mainly in the southern mountain region.

Regarding rainfall

For years 2020 and 2030 there is no evidence of large changes in the spatial distribution of rainfall, and they are associated to its climatology. Annual precipitations to 2030 show shortages mostly in the mountain region, between -10 and -20% and in the northern and central jungle (high jungle) of -10%. The most important increases would occur in the northern coast and southern jungle between +10% and +20%.

At seasonal level, there would be some irregularities in the behaviour or rainfall, being shortages more significant during summer in most part of the country, while in autumn, rainfall would register values over normal. In the winter and spring, with respect to spatial distribution, there would be some increases and shortages alternating during these seasons between -30 and + 20% above their averages.

In the case of maximum precipitation to 2030, there would be a decreasing trend in most part of the country and only in certain locations there would be an increase in reference to its current values.

In conclusion:

- Precipitation at national level would show some increases and decreases ranging between +10% and -10% over or below their averages; which won't be very significant for 2030 decade.

- In the coastal and northern mountain region, part of the central mountain region and southern jungle, there would be no increases of more than 20% and decreases of more than 20% in the northern jungle and part of the central and southern mountain region.

- Estimated extreme rainfall would possibly show a decrease in the next 30 years in most part of the Peruvian territory.

- In general, there would be an increase in maximum temperature of up to 1,6 °C in average, (0,53 °C/decade), and of up to 1,4 ºC for minimum temperature (0,47 °C/decade).

- The largest increases would occur in the coast and northern mountain, northern jungle and in the central and southern mountain regions of the country.

What should we do next?

- Generate climate information, based on network of climate stations with large records, using the current stations and incrementing their number in places with a low density in observations. The improvement in our understanding on the mechanisms and processes that determine climate in our country depend on this information.

- When considering limitations on the availability of historical information, and knowing that there are uncertainties inherent to the process of evaluation of our current climate and projections of the future climate at a regional scale, the results of the present study should be considered as an approximation, emphasizing the identified trends more than the absolute values, which would indicate the direction that precipitation and extreme temperatures would take in the next decades, and based on these trends evaluate vulnerability to climate change and take preventive measures when facing the intensification of climate extremes, as they are projected in the present technical paper.

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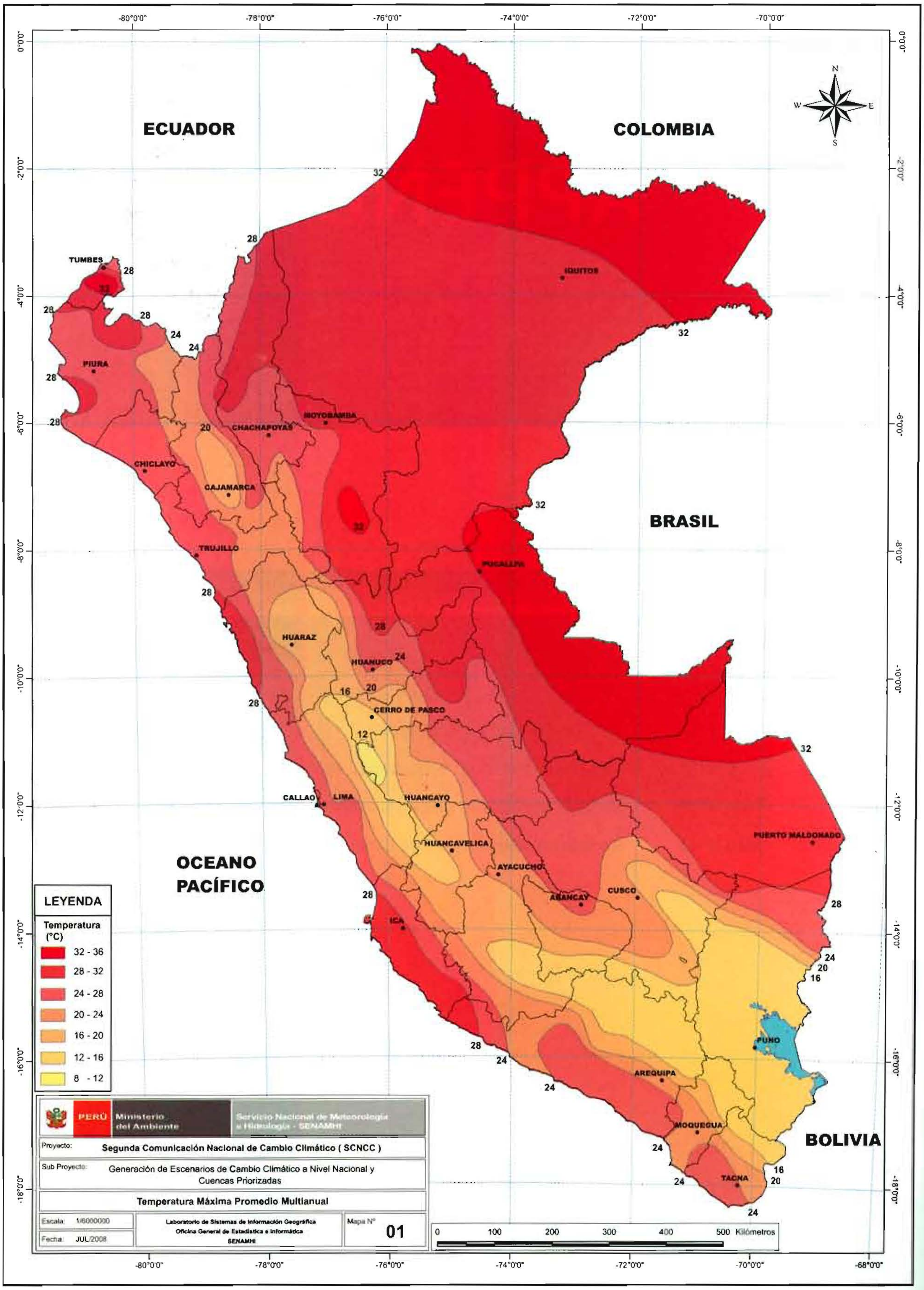
APPENDIX

N° of Map	Name of Map
Map N° 1	Multiannual average maximum temperature (ºC)
Map N° 2	Multiannual average minimum temperature (ºC)
Map N° 3	Total multiannual precipitation (mm)
Map Nº 11	Variation of maximum temperature to 2030
Map Nº 27	Variation of minimum temperature to 2030
Map Nº 43	Variation in percentage of precipitation to 2030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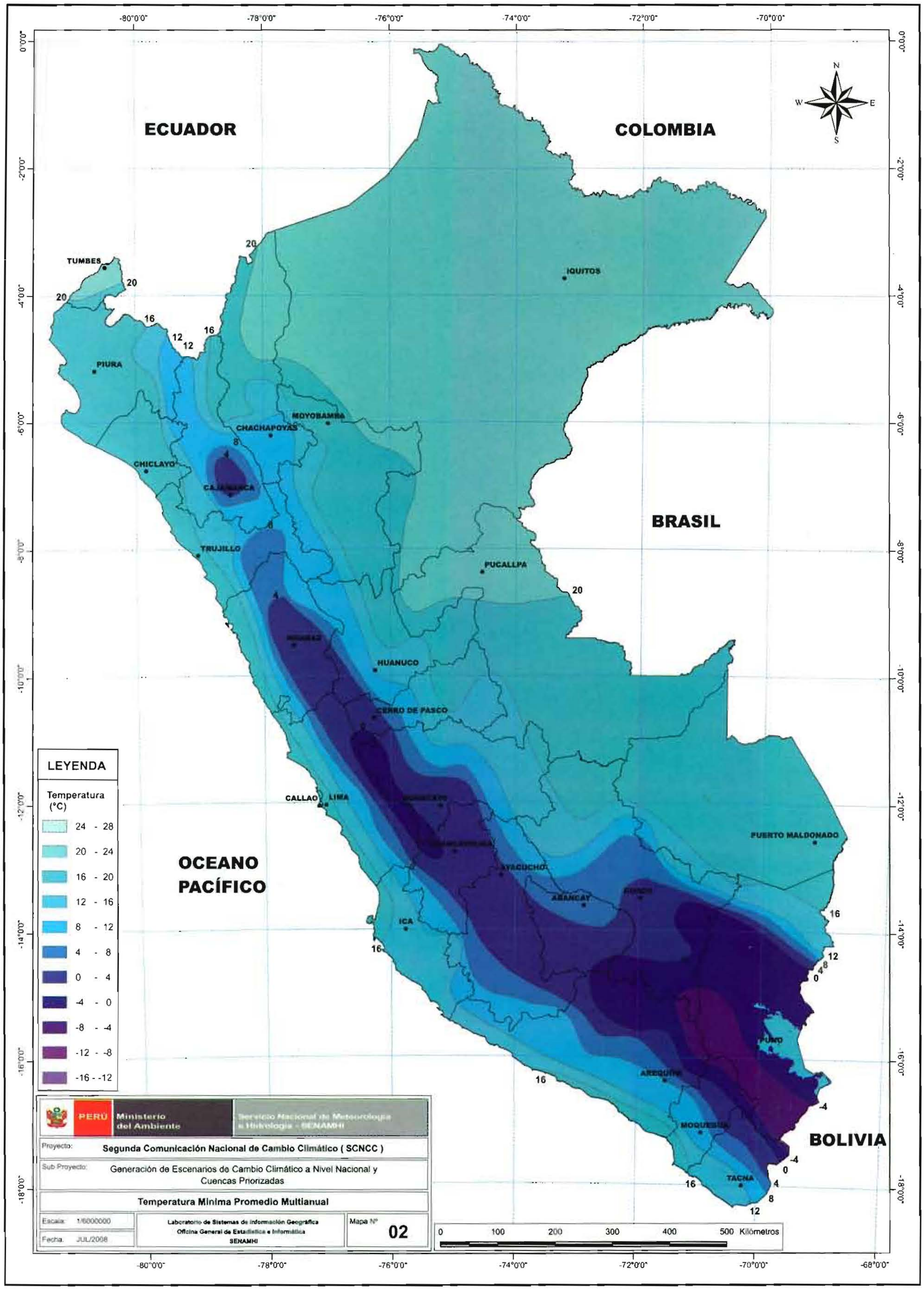
BOLIVIA
OCEANO PACÍFICO
TUMBES
PIURA
CHICLAYO
CAJAMARCA
CHACHAPOYAS
MOYOBAMBA
IQUITOS
TRUJILLO
PUCALLPA
HUARAZ
HUANUCO
CERRO DE PASCO
CALLAO
LIMA
HUANCAYO
HUANCAVELICA
AYACUCHO
ABANCAY
CUSCO
PUERTO MALDONADO
ICA
PUNO
AREQUIPA
MOQUEGUA
TACNA
LEYENDA
Temperatura (°C)
32 - 36
28 - 32
24 - 28
20 - 24
16 - 20
12 - 16
8 - 12
PERÚ
Ministerio del Ambiente
Servicio Nacional de Meteorología e Hidrología - SENAMHI
Proyecto: Segunda Comunicación Nacional de Cambio Climático (SCNCC)
Sub Proyecto: Generación de Escenarios de Cambio Climático a Nivel Nacional y Cuencas Priorizadas
Temperatura Máxima Promedio Multianual
Escala: 1/6000000
Fecha: JUL/2008
Laboratorio de Sistemas de Información Geográfica
Oficina General de Estadística e Informática
SENAMHI
Mapa N° 01
0 100 200 300 400 500 Kilómetros


ECUADOR
COLOMBIA
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BOLIVIA
OCEANO
PACÍFICO
TUMBES
PIURA
CHICLAYO
CAJAMARCA
CHACHAPOYAS
MOYOBAMBA
IQUITOS
TRUJILLO
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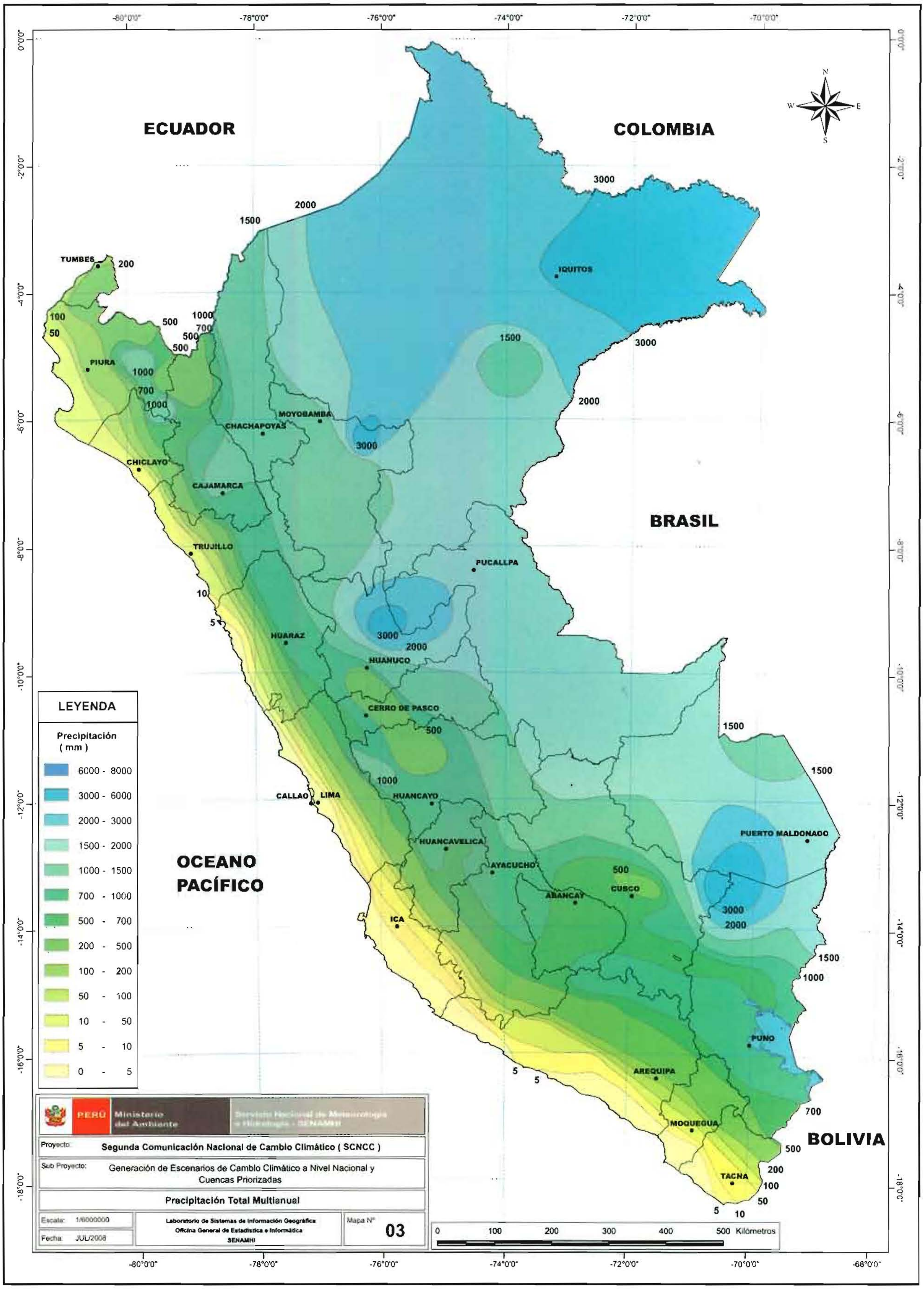
HUANUCO
CERRO DE PASCO
CALLAO
LIMA
AYACUCHO
ABANCAY
CUSCO
PUERTO MALDONADO
ICA
PUNO
AREQUIPA
MOQUEGUA
TACNA
LEYENDA
Temperatura (°C)
24 - 28
20 - 24
16 - 20
12 - 16
8 - 12
4 - 8
0 - 4
-4 - 0
-8 - -4
-12 - -8
-16 - -12
PERÚ
Ministerio del Ambiente
Proyecto: Segunda Comunicación Nacional de Cambio Climático (SCNCC)
Sub Proyecto: Generación de Escenarios de Cambio Climático a Nivel Nacional y Cuencas Priorizadas
Temperatura Minima Promedio Multianual
Escala: 1/6000000
Fecha: JUL/2008
Laboratorio de Sistemas de Información Geográfica
Oficina General de Estadística e Informática
SENAMHI
Mapa N° 02
0 100 200 300 400 500 Kilómetros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COLOMBIA
BRASIL
BOLIVIA
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PACÍFICO
TUMBES
PIURA
CHICLAYO
CAJAMARCA
CHACHAPOYAS
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IQUITOS
TRUJILLO
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HUARAZ
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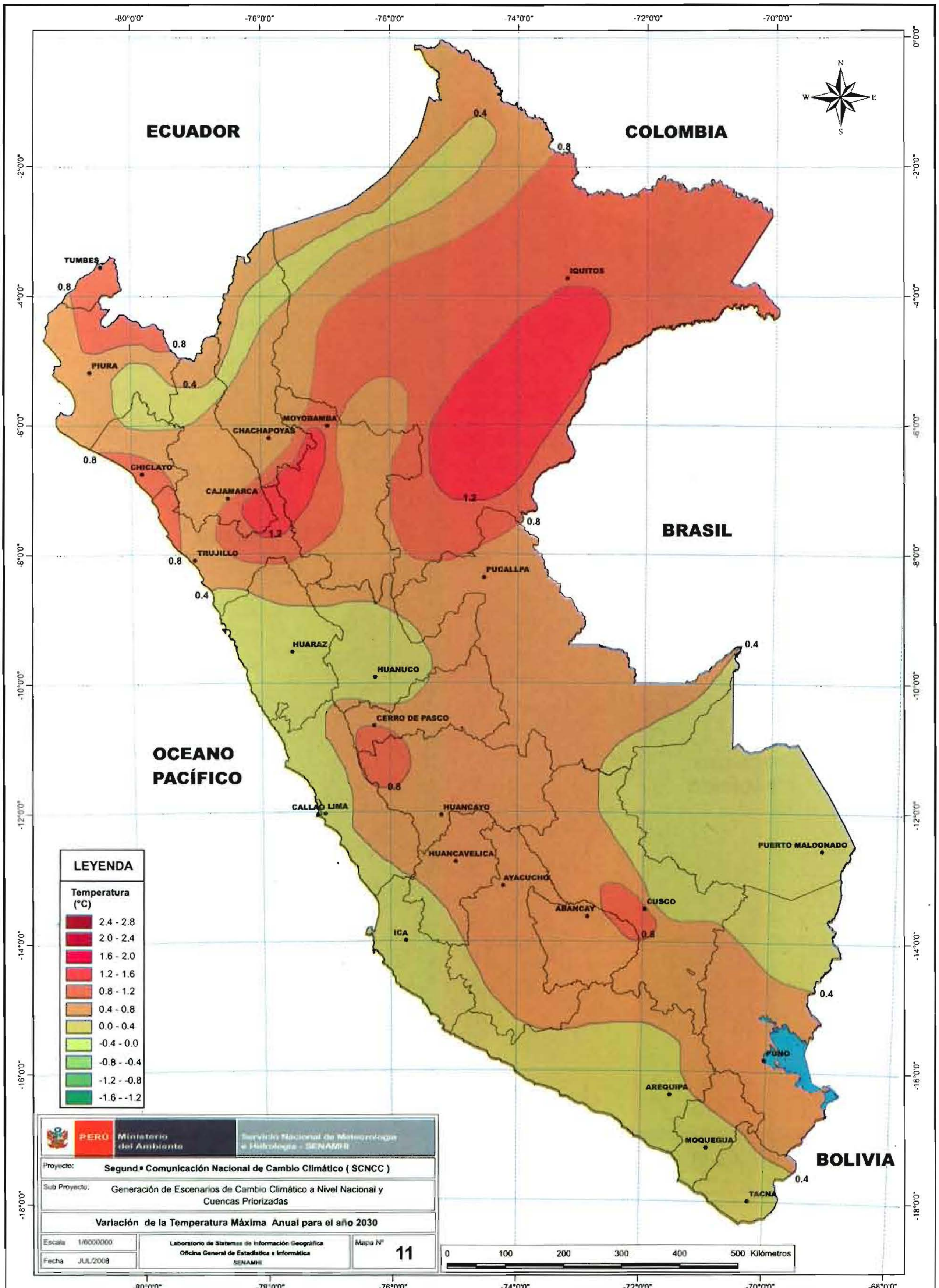
CERRO DE PASCO
CALLAO
LIMA
HUANCAYO
HUANCAVELICA
AYACUCHO
ABANCAY
CUSCO
PUERTO MALDONADO
ICA
PUNO
AREQUIPA
MOQUEGUA
TACNA
LEYENDA
Precipitación (mm)
6000 - 8000
3000 - 6000
2000 - 3000
1500 - 2000
1000 - 1500
700 - 1000
500 - 700
200 - 500
100 - 200
50 - 100
10 - 50
5 - 10
0 - 5
Proyecto: Segunda Comunicación Nacional de Cambio Climático (SCNCC)
Sub Proyecto: Generación de Escenarios de Cambio Climático a Nivel Nacional y Cuencas Priorizadas
Precipitación Total Multianual
Escala: 1/6000000
Fecha: JUL/2008
Laboratorio de Sistemas de Información Geográfica
Oficina General de Estadística e Informática
SENAMHI
Mapa N° 03
0 100 200 300 400 500 Kilómetros


ECUADOR
COLOMBIA
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BOLIVIA
OCEANO PACÍFICO
TUMBES
PIURA
CHICLAYO
CAJAMARCA
CHACHAPOYAS
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IQUITOS
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PUCALLPA
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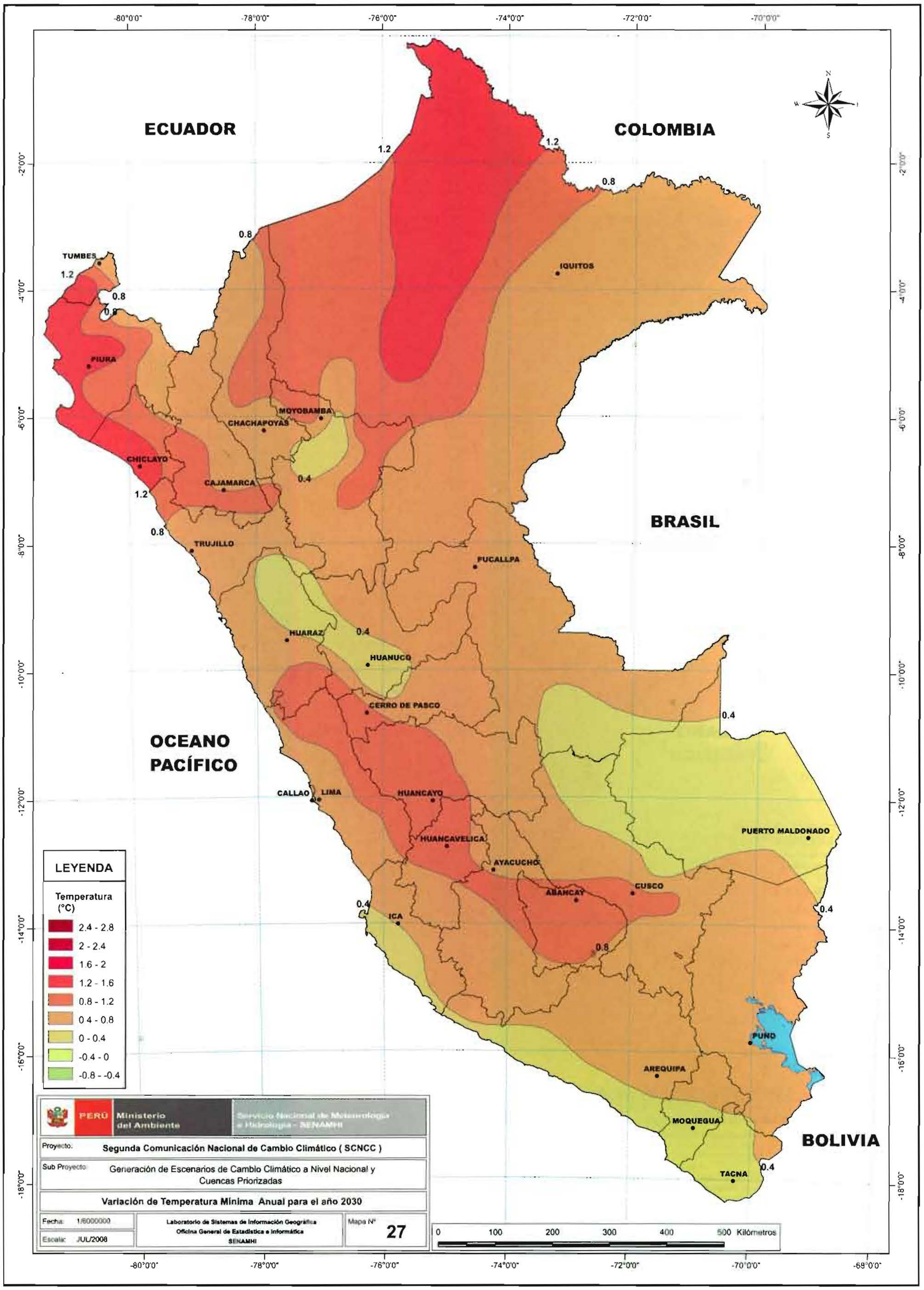
HUANUCO
CERRO DE PASCO
CALLAO
LIMA
HUANCAYO
HUANCAVELICA
AYACUCHO
ABANCAY
CUSCO
PUERTO MALDONADO
ICA
PUNO
AREQUIPA
MOQUEGUA
TACNA
LEYENDA
Temperatura (°C)
2.4 - 2.8
2.0 - 2.4
1.6 - 2.0
1.2 - 1.6
0.8 - 1.2
0.4 - 0.8
0.0 - 0.4
-0.4 - 0.0
-0.8 - -0.4
-1.2 - -0.8
-1.6 - -1.2
PERÚ Ministerio del Ambiente
Proyecto: Segunda Comunicación Nacional de Cambio Climático (SCNCC)
Sub Proyecto: Generación de Escenarios de Cambio Climático a Nivel Nacional y Cuencas Priorizadas
Variación de la Temperatura Máxima Anual para el año 2030
Escala 1/6000000
Fecha JUL/2008
Laboratorio de Sistemas de Información Geográfica
Oficina General de Estadística e Informática
SENAMHI
Mapa N° 11
0 100 200 300 400 500 Kilómetros


ECUADOR
COLOMBIA
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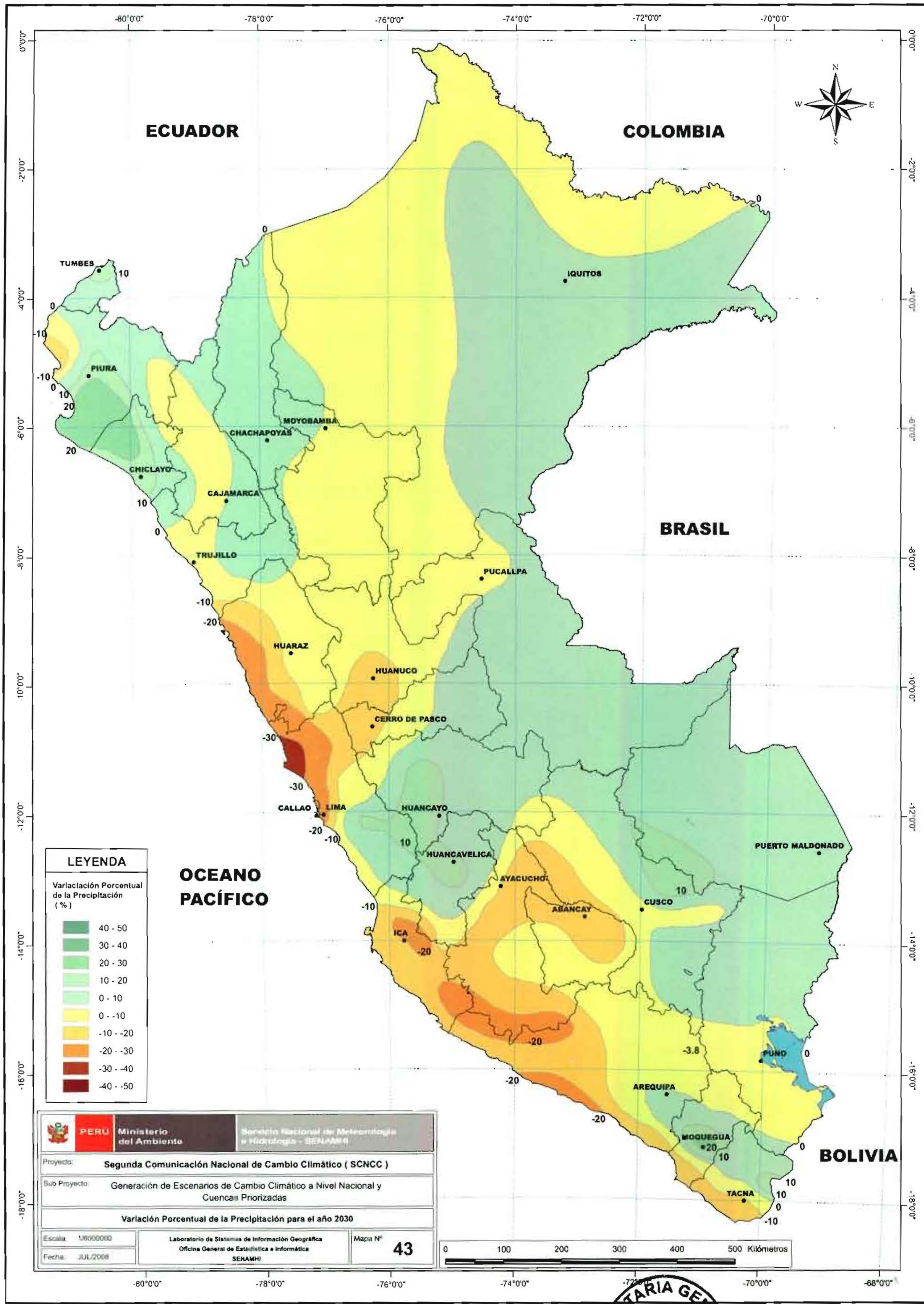
BOLIVIA
OCEANO PACÍFICO
TUMBES
PIURA
CHICLAYO
CAJAMARCA
CHACHAPOYAS
MOYOBAMBA
IQUITOS
TRUJILLO
PUCALLPA
HUARAZ
HUANUCO
CERRO DE PASCO
CALLAO
LIMA
HUANCAYO
HUANCAVELICA
AYACUCHO
ABANCAY
CUSCO
ICA
PUERTO MALDONADO
PUNO
AREQUIPA
MOQUEGUA
TACNA
LEYENDA
Temperatura (°C)
2.4 - 2.8
2 - 2.4
1.6 - 2
1.2 - 1.6
0.8 - 1.2
0.4 - 0.8
0 - 0.4
-0.4 - 0
-0.8 - -0.4
PERÚ Ministerio del Ambiente
Servicio Nacional de Meteorología e Hidrología - SENAMHI
Proyecto: Segunda Comunicación Nacional de Cambio Climático (SCNCC)
Sub Proyecto: Generación de Escenarios de Cambio Climático a Nivel Nacional y Cuencas Priorizadas
Variación de Temperatura Mínima Anual para el año 2030
Fecha: 1/6000000
Escala: JUL/2008
Laboratorio de Sistemas de Información Geográfica
Oficina General de Estadística e Informática
SENAMHI
Mapa N° 27
0 100 200 300 400 500 Kilómetros


ECUADOR
COLOMBIA
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BOLIVIA
OCEANO PACÍFICO
TUMBES
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HUANCAVELICA
AYACUCHO
ABANCAY
CUSCO
PUERTO MALDONADO
ICA
PUNO
AREQUIPA
MOQUEGUA
TACNA
LEYENDA
Variación Porcentual de la Precipitación (%)
40 - 50
30 - 40
20 - 30
10 - 20
0 - 10
0 - -10
-10 - -20
-20 - -30
-30 - -40
-40 - -50
PERU Ministerio del Ambiente
Servicio Nacional de Meteorología e Hidrología - SENAMHI
Proyecto: Segunda Comunicación Nacional de Cambio Climático (SCNCC)
Sub Proyecto: Generación de Escenarios de Cambio Climático a Nivel Nacional y Cuencas Priorizadas
Variación Porcentual de la Precipitación para el año 2030
Escala: 1/6000000
Fecha: JUL/2008
Laboratorio de Sistemas de Información Geográfica
Oficina General de Estadística e Informática
SENAMHI
Mapa N° 43
0 100 200 300 400 500 Kilómetros
-80°0'0" -78°0'0" -76°0'0" -74°0'0" -72°0'0" -70°0'0" -68°0'0"
0°0'0" -2°0'0" -4°0'0" -6°0'0" -8°0'0" -10°0'0" -12°0'0" -14°0'0" -16°0'0" -18°0'0"
N
S
E
W

PERÚ Ministry of Environment

Ministry of Environment - MINAM
Av. Javier Prado Oeste 1440 - San isidro - Lima - Perú
Phone: (511) 6116000
www.minam.gob.pe

National Meteorology and Hidrology Service - SENAMHI
Jr. Cahuide 785, Jesús María, Lima - Perú
Phone: (511) 6141414
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