



Climate Monitoring in the Mediterranean Coast Network 2014

Channel Islands National Park

Natural Resource Report NPS/MEDN/NRR—2015/1064



ON THE COVER

Photograph of Anacapa Island, Channel Islands National Park.
Photograph courtesy of the National Park Service.

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Executive Summary

This report details the climate (temperature, precipitation, and drought) of Channel Island National Park (NP) during 2014. Gridded maps are used to present broad-brush conditions across the region for each month. This regional presentation is compared to detailed data from Remote Automated Weather Stations (RAWS) and manual, ranger-managed weather stations. Prior to analysis, a set of data quality control checks were performed by the authors in accordance with a National Park Service protocol (Rocky Mountain Climate Working Group 2010). The region entered into drought conditions in April 2012 and became progressively drier throughout 2013 and 2014. By the end of 2014, Channel Islands National Park was classified as “D4 - Exceptional Drought” by the US Drought Monitor, which is the most severe classification on this scale. PRISM maps show that December 2014 had 125 – 200% normal precipitation but that all other non-summer months had below average precipitation. Precipitation during summer months is very low, and it is therefore easy to misinterpret calculations of “percent normal,” when only a few hundredths of an inch of rain can mean the difference between below vs. above average precipitation. According to PRISM, every month of 2014 had temperatures near or above average. January was particularly warm, with Tmax and Tmin both more than 6 degrees above normal throughout much of the park. There was significant spatial and month to month variability in the data that provided exceptions to these generalizations, so an examination of the regional maps are key to understanding the climatic patterns for 2014. Readers can download the data used in this report and make custom climate graphs and tables of their own by visiting www.ClimateAnalyzer.org

Acknowledgments

Funding for this report was provided by National Park Service Mediterranean Coast Network Inventory and Monitoring Program. Rocky Rudolph provided technical support for all CHIS weather stations.

Glossary

30-year average or “normal” – Official 30-year averages for each weather station are issued every 10 years by NOAA. Prior to 2011, the official reference period was 1971 – 2000.

NOAA - National Oceanic and Atmospheric Administration

PRISM - Parameter-elevation Regression on Independent Slopes Model. See <http://www.prism.oregonstate.edu/>

RAWS – Remote Automated Weather Station

US Drought Monitor - A broad brush assessment of drought conditions. See <http://drought.unl.edu/dm/monitor.html>

Tmax / Tmin – daily Maximum / Minimum Temperatures. Monthly Tmax and Tmin are averages of daily Tmax and Tmin, respectively.

Introduction

Channel Islands National Park is comprised of five offshore islands 20 to 61 kilometers from mainland Southern California, including San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara. Remote, rugged and geographically diverse, each island experiences unique weather and climate conditions, in part, because the park islands span a major transition in climate that begins at the California coastline where the cool waters of the northern Humboldt Current mix with the warmer California Current from the south (Redmond and McCurdy 2005).

This report summarizes all the climate data for Channel Islands NP that were complete enough to support monthly and annual summaries for calendar year 2014 at the time of writing. Only a subset of the weather stations located in Channel Islands NP were used because instrumental failure and incomplete data entry led to a large number of missing values in the time series from some of the weather stations, making them intractable to analysis. Climatic events in this report are presented both from a local perspective, with data from individual weather stations, and from a regional perspective, with maps that depict broad-scale conditions across southern California during each month of the year.

Channel Islands National Park began monitoring weather in the mid-1980s, although weather records extend back into the early 1900's for some islands. The program consists of four Remote Automated Weather Stations (RAWS), one on each island except San Miguel, supplemented by daily observations made at six sites by island staff when stationed on the islands (Ranger Station data). The RAWS data are downloaded via satellite and archived by the Western Regional Climate Center (WRCC) at the Desert Research Institute in Reno, Nevada. WRCC also archives the Ranger Station data for the Park. The weather data used in this report are available from the WRCC or from the NPS sponsored web interface located at www.ClimateAnalyzer.org. RAWS parameters measured include precipitation, air temperature, relative humidity, wind speed and direction, solar radiation, fuel moisture, fuel temperature, and barometric pressure.

Redmond and McCurdy (2005) discuss an approach to weather and climate monitoring among the Channel Islands in the context of broader climate monitoring and modeling nationwide. Their rationale and specific design considerations form the basis for the Channel Islands National Park weather and climate monitoring program, including the choices of parameters to measure, RAWS and manual weather station siting, considerations for data handling and display, and operating procedures for site maintenance.

Each island except San Miguel has one park-owned and maintained RAWS, supplemented by weather instruments manually operated by island staff. Collectively, the stations provide data on weather from both the marine layer and terrestrial climate regimes of the islands (McEachern et al. 2008). In addition to the Park, a number of agencies and organizations including the National Interagency Fire Center (NIFC), the U.S. Navy, the County of Santa Barbara, California State University, Northridge (CSUN), the University of California, Santa Barbara, and the Santa Barbara Amateur Radio Club have invested in island weather stations. Collectively, these stations address the

needs of Park resource management, Park operations, fire planning and management, Navy operations, mariner safety and specific research needs.

Those interested in additional climate-related information for Channel Island NP and the surrounding areas should seek:

The ClimateAnalyzer: www.ClimateAnalyzer.org. This web site allows you to create custom graphs and tables from both “official,” unedited data and from the corrected datasets used in this report. You can also download all the data from the weather stations in the area as spreadsheets.

Western Regional Climate Center (<http://www.wrcc.dri.edu/>)

Drought Monitor (<http://drought.unl.edu/dm/monitor.html>)

National Oceanic Atmospheric Administration (NOAA) National Weather Service
(<http://www.cpc.ncep.noaa.gov/>)

U.S. Geological Survey (USGS) Water National Information System
(<http://waterdata.usgs.gov/nwis>)

Approach and Methods

Selection of Datasets

In order to place Channel Islands NP within a regional context, grid-based estimates of precipitation and temperature were used to provide a broad overview of climatic conditions in the area. These estimates were generated with a statistical modeling technique that interpolates precipitation and temperature values between actual climate stations while also accounting for the effects of aspect and elevation. Known as the Parameter-elevation Regression on Independent Slopes Model (PRISM; <http://www.prism.oregonstate.edu/>), this approach has a long history of use in the western United States, and it has been shown to provide robust products in a wide variety of studies (Daly et al. 2008).

Ranger-managed, manual weather stations, often referred to as “ranger” stations, were included because they have long, established records that can be meaningfully compared to the RAWS stations. Both RAWS and “Ranger weather stations” are owned and maintained by Channel Islands National Park. Data from the “Ranger stations” are archived by the National Oceanic and Atmospheric Administration (NOAA) and are available from the Western Regional Climate Center or from the NPS sponsored web interface located at www.ClimateAnalyzer.org. The locations of weather stations cited in this report are shown in Figure 1. Metadata for these stations can be accessed from the internet links provided in Appendix 1.

As a way of presenting the integrated effects of temperature and precipitation, maps from the US Drought Monitor (<http://drought.unl.edu/dm/monitor.html>) were used to depict broad-brush conditions across the region.

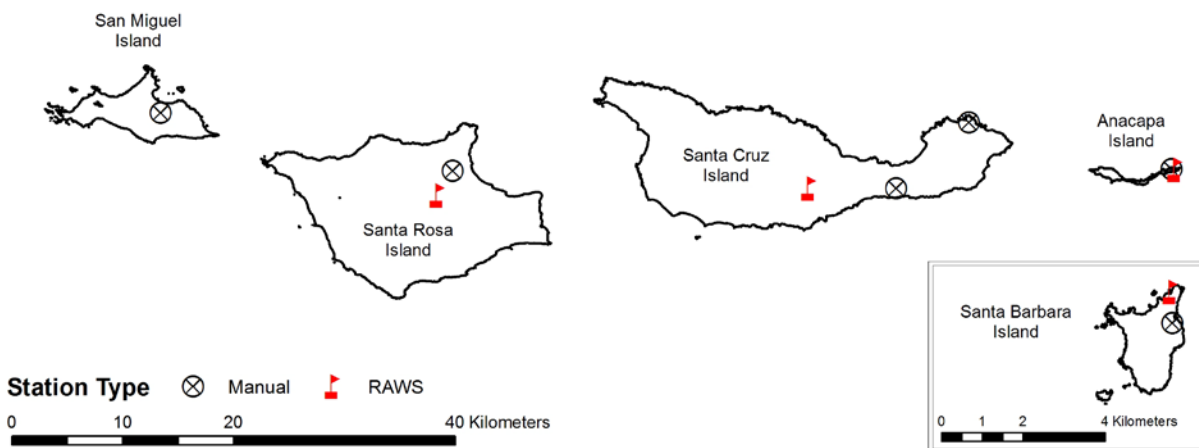


Figure 1. Map showing key climate stations used in this report. There are additional weather stations in Channel Islands NP, but data from those stations was not complete enough for 2014 to merit inclusion.

Quality Control of Ranger-Managed (Manual) Weather Stations

All of the “Ranger stations” used in this report are operated and maintained by Channel Islands NP. These stations are sometimes referred to as “Cooperative Observer” stations because in most cases their measurements are recorded by human and entered into the Western Regional Climate Center website where the data is then aggregated and error checked by NOAA.

Data from these weather stations undergo quality control and error-checking by NOAA, and as part of this process many of the observations in the data files are assigned “flags” (letter or number codes) that indicate potential problems or other factors that should be taken into consideration when interpreting the data. Consequently, the authors of this report have created software tools that assist in the interpretation of the data flags and diagnostic plotting of the data. Following guidelines from Kittel (2008), Kittel et al. (2009), and Rocky Mountain Climate Working Group (2010), the Qa/Qc employed by these software tools involved graphing and visual inspection of each time series, evaluation of the data quality flags that accompany each observation, comparison with historical observations and observations from surrounding sites, and logical consistency tests (e.g., confirming that minimum daily temperatures were lower than the daily maximum temperatures). Point observations provided by the Ranger (manual) weather stations were also compared to corresponding estimates from the PRISM datasets and to the original datasheets used by weather station staff. When possible, data missing in the electronic records were recovered from the original datasheets and hand entered by the authors of this report. If more than 3 days of precipitation data were missing for a particular month, a monthly total was not calculated, and the entire month was considered missing. Similarly, if more than 5 days of mean daily maximum temperature (Tmax) or mean daily minimum temperature (Tmin) were missing, monthly average temperatures were not calculated. The data handling was conservative, i.e., no data points were changed unless it was very clear that an erroneous value, for example a precipitation measurement with a missing decimal point that could be verified on the original station records, was found.

Quality Control of RAWS Data

All of the RAWS stations used in this report are maintained by Channel Islands NP. The park swaps RAWS sensors annually as part of the National Interagency Fire Center Weather Program. The Program maintains a parts depot in Boise, ID which exchanges clean, recalibrated sensors with sensors from the field. A detailed record of station maintenance is found in Appendix 2. Occasionally sensors fail during the year resulting in a data gap for that parameter. When this occurs, a replacement sensor is ordered from the parts depot in Boise, ID and the faulty sensor is replaced as quickly as possible.

Because RAWS data are collected hourly, daily Tmax, Tmin, and precipitation values must be derived from the automated data stream. Furthermore, precipitation is recorded as a running total that must be translated into daily measurements. If any particular day in a record was missing more than 6 hours of measurements, the entire day was considered missing. In addition, if the temperature during any day varied by less than 2 degrees Fahrenheit, data for the entire day was considered invalid due to instrumental error and replaced with missing values. Once daily statistics had been calculated, diagnostic plots were used to screen for physically impossible measurements, which were ascribed to

instrumental error and considered missing; and the missing data criteria just described for Ranger stations were used to calculate monthly statistics.

All the data used in the preparation of this report (including original and quality checked files) are available electronically from www.ClimateAnalyzer.org. Readers can download the data used in this report and make custom climate graphs and tables of their own by visiting www.ClimateAnalyzer.org

Results

Temperature, Precipitation, and Drought Status During Calendar Year 2014

The patterns described in this section are often stated as broad generalizations. In most cases there was significant variability across the region and exceptions to the patterns described here were common. In order to appreciate this variability, it is important to examine the PRISM maps (Figures 3 – 5) and compare them to the weather station data presented in Figures 6a and 6b and Tables 1 – 2.

Broader Picture – The Ongoing Drought Became More Severe

The region entered into drought conditions in April 2012 (Tercek 2013) and became progressively drier throughout 2013 and 2014. By the end of 2014, Channel Islands National Park was classified as “D4 - Exceptional Drought” by the US Drought Monitor, which is the most severe classification on this scale (Figure 2).

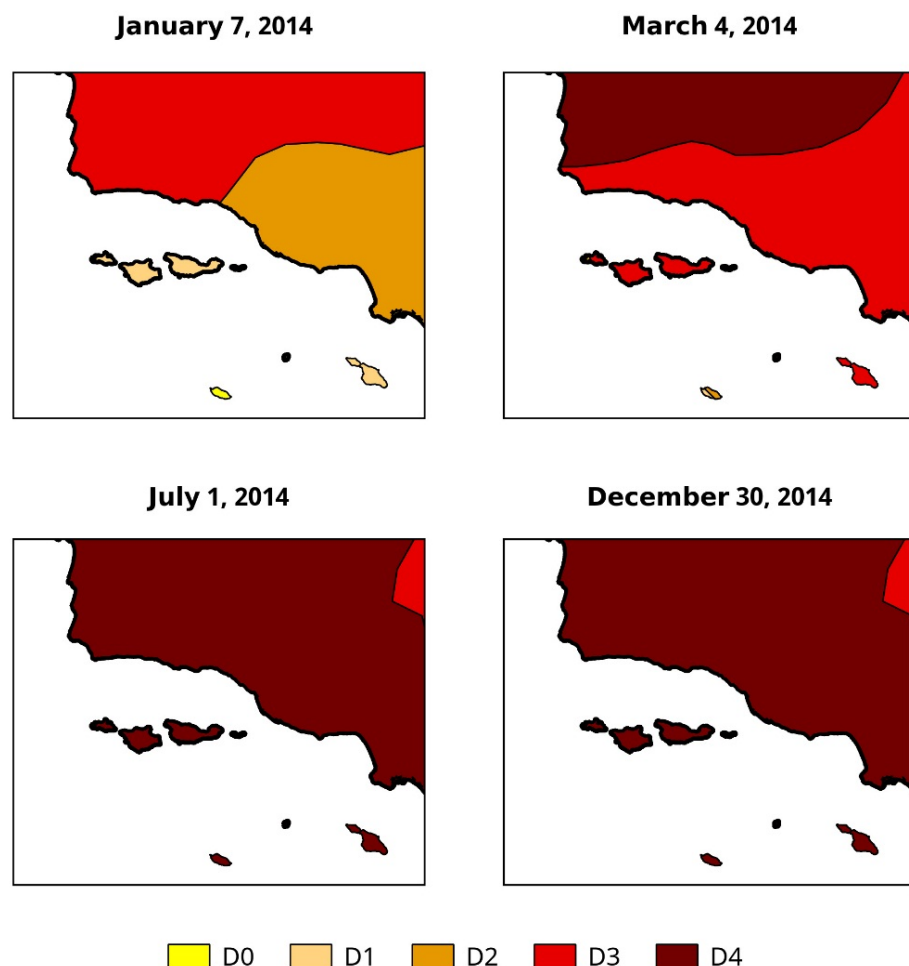


Figure 2. U.S. Drought Monitor maps for Channel Island National Park during calendar years 2014. Drought classifications range from “abnormally dry” (D0) to “exceptional drought” (D4). White areas = Pacific Ocean. For more information visit: www.drought.unl.edu/dm/monitor.html

El Nino – La Nina Status

The El Nino – Southern Oscillation (ENSO) is an oscillation of the ocean – atmosphere climate system centered over the tropical Pacific Ocean that follows a rough cycle of approximately 2 – 7 years. When ENSO is in its “El Nino phase,” sea surface temperatures in the central and eastern tropical Pacific are warmer than average, and this generally produces warmer, drier conditions in the northern continental United States and cooler, wetter conditions in the southern United States, particularly the southwest. In contrast, the opposite conditions prevail when ENSO is in its “La Nina phase.” More information on ENSO can be found on the NOAA web site located here:

<http://www.pmel.noaa.gov/tao/elnino/el-nino-story.html>

ENSO remained in the neutral state between La Nina and El Nino throughout 2014. Normally, La Nina conditions produce drier conditions in southern California while El Nino produces wetter conditions. Given its transitional state, predicting the effects of ENSO on regional weather conditions is difficult. For long-term El Nino patterns, consult NOAA here:

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml

Precipitation During 2014

There are no weather stations with established 30-year averages within Channel Islands National Park, so we rely instead on PRISM maps (Figures 3 – 5) when comparing 2014 to the past. (See the Introduction for more information on how 30-year averages are calculated by NOAA). The PRISM maps (Figure 3) show that December had 125 – 200% normal precipitation but that all other non-summer months had below average precipitation. Note that precipitation during May – August is very low, and it is therefore easy to misinterpret calculations of “percent normal” for these months, when only a few hundredths of an inch of rain can mean the difference between below vs. above average precipitation. Precipitation totals for the islands’ weather stations are summarized in Figures 6a, Figure 6b, and Table 1.

Temperature During 2014

According to PRISM, every month of 2014 had temperatures near or above average. January was particularly warm, with Tmax and Tmin both more than 6 degrees above normal throughout much of the park. Temperature data from the park’s weather stations are summarized in Table 2 and Figures 6a and 6b. Figures 6a and 6b agree with PRISM by showing that 2014 temperatures (red lines) were generally warmer than temperatures measured during earlier years.

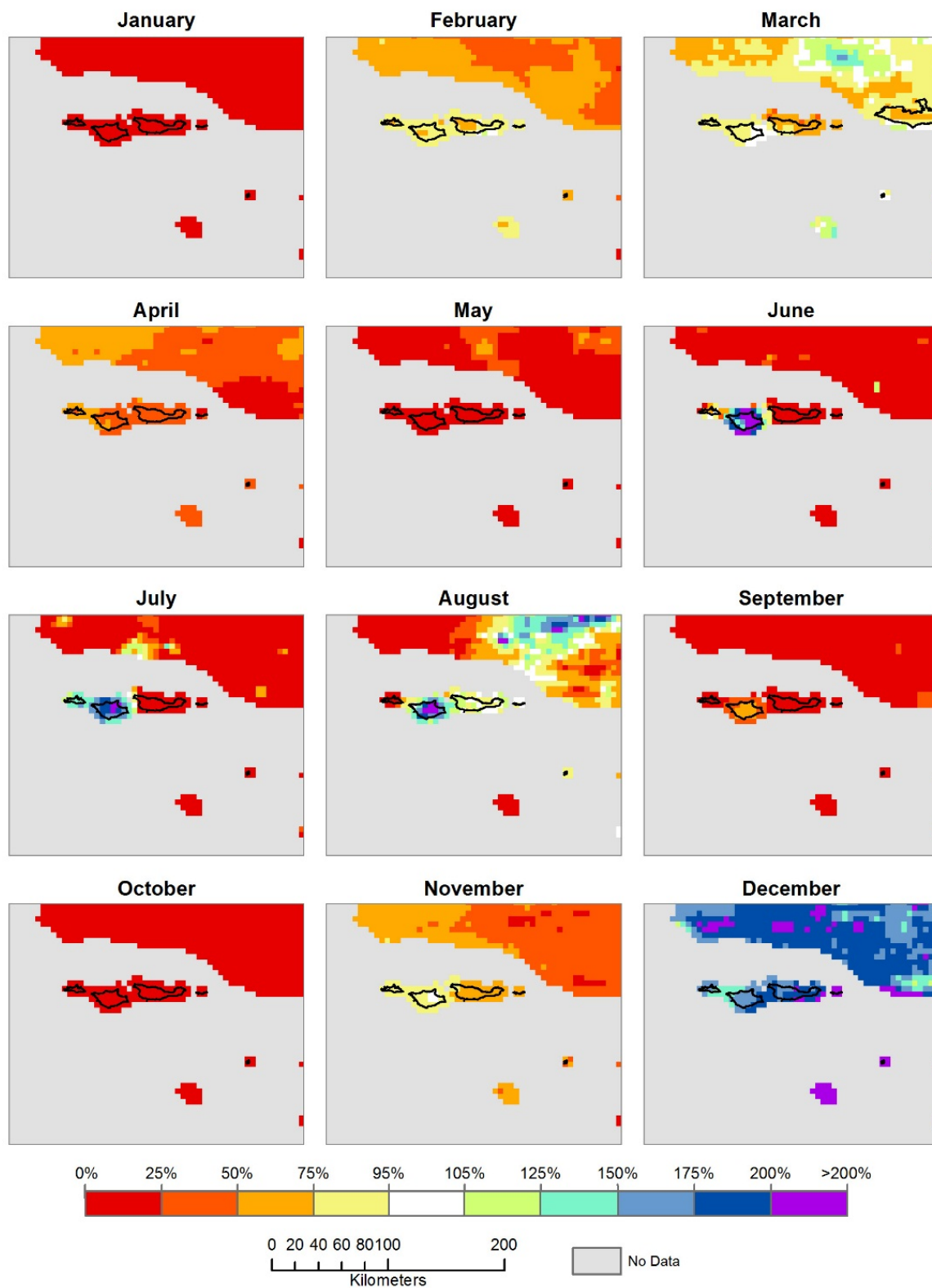


Figure 3. Parameter-elevation Regressions on Independent Slopes Model (PRISM) data showing 2014 monthly precipitation as a percentage of 1981 – 2010 averages. Gray areas = Pacific Ocean. For more information, see <http://www.prism.oregonstate.edu/>.

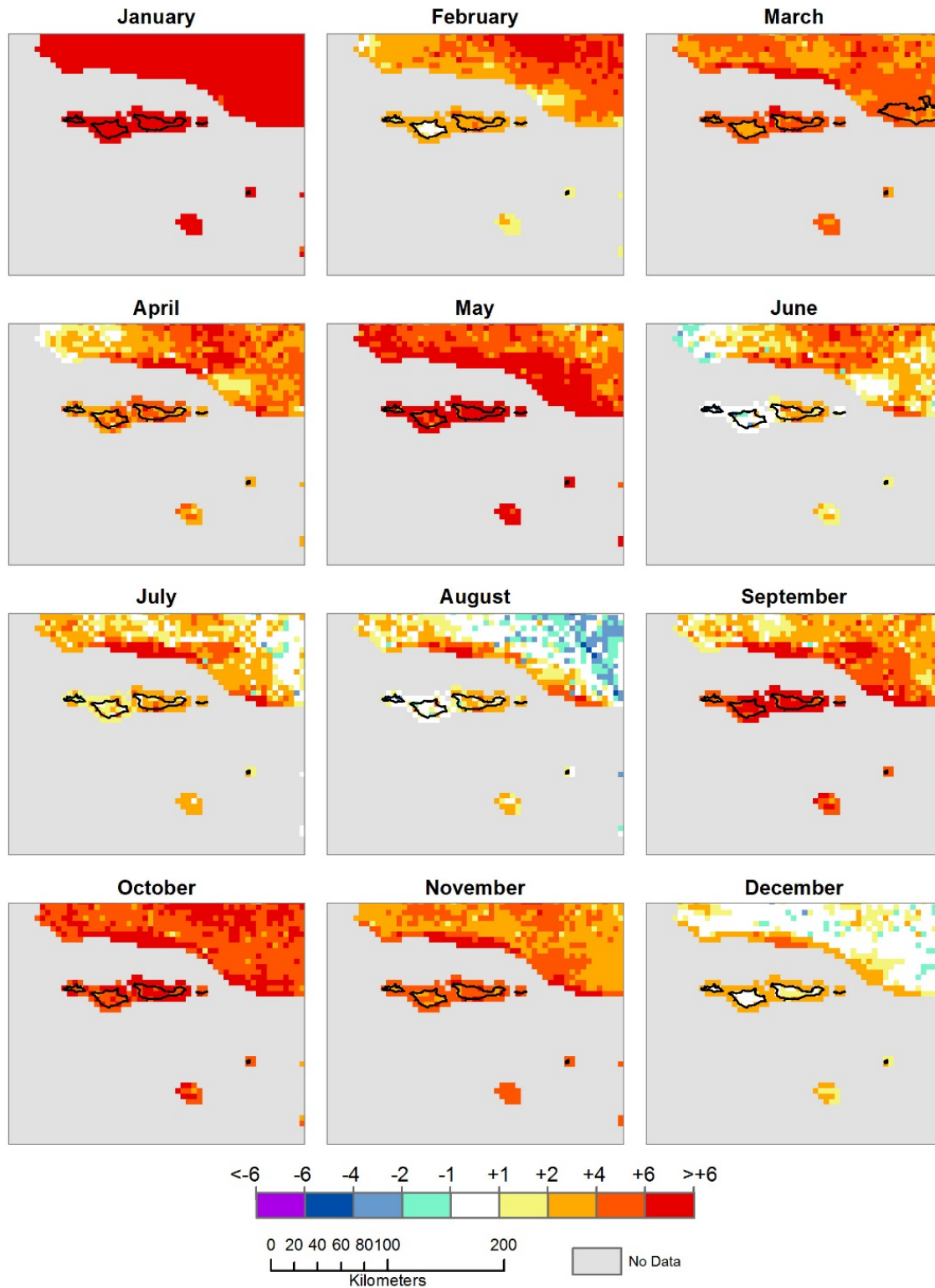


Figure 4. Parameter-elevation Regressions on Independent Slopes Model (PRISM) data showing 2014 monthly average daily maximum temperature (Tmax) departure from 1981 – 2010 averages in degrees Fahrenheit. Gray areas = Pacific Ocean. For more information, see <http://www.prism.oregonstate.edu/>.

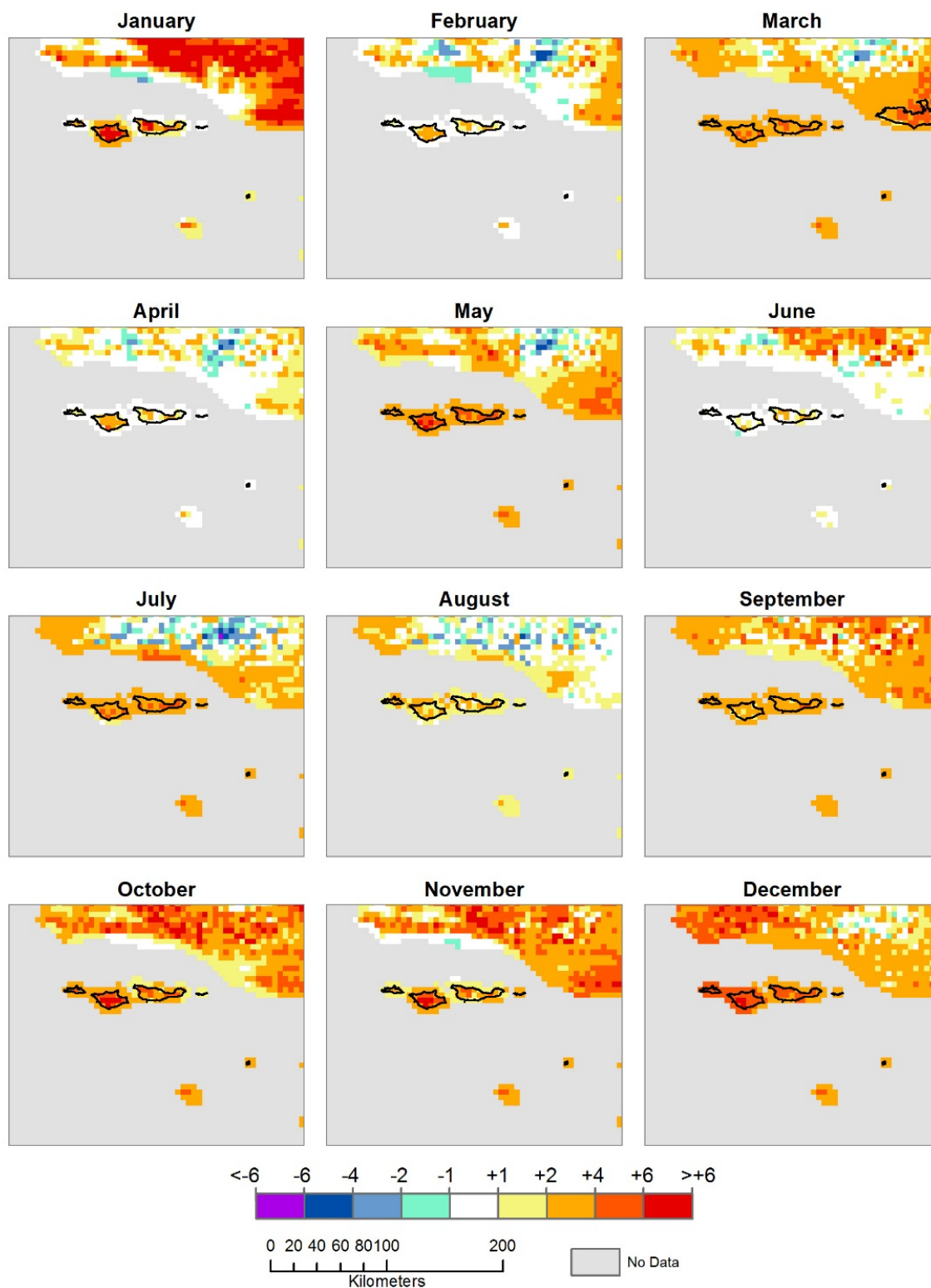


Figure 5. Parameter-elevation Regressions on Independent Slopes Model (PRISM) data showing 2014 monthly average daily minimum temperature (Tmin) departure from 1981 – 2010 averages in degrees Fahrenheit. Gray areas = Pacific Ocean. For more information, see <http://www.prism.oregonstate.edu/>.

Table 1. Monthly total precipitation in inches during 2014 in Channel Islands National Park.

	Anacapa Island RAWS	Santa Rosa Island RAWS	Santa Barbara Island RAWS	Santa Cruz Island RAWS	Santa Rosa Island Manual	Santa Cruz Island Manual	Santa Barbara Island Manual
	2014 Precip. (in)	2014 Precip. (in)	2014 Precip. (in)	2014 Precip. (in)	2014 Precip. (in)	2014 Precip. (in)	2014 Precip. (in)
January	0.00	0.05	0.00	0.00	0.02	N/A	0.01
February	1.41	1.88	1.44	2.48	4.41	N/A	2.41
March	0.61	0.78	0.32	1.99	1.16	2.45	0.58
April	0.07	0.40	0.03	0.12	0.53	N/A	N/A
May	0.00	0.12	0.00	0.00	4.00	N/A	0.00
June	0.00	0.20	0.00	0.00	0.00	N/A	N/A
July	0.00	0.12	0.00	0.00	0.00	0.02	N/A
August	0.01	0.12	0.00	0.02	N/A	0.06	N/A
September	0.00	0.14	0.00	0.00	N/A	N/A	0.08
October	0.36	0.67	0.20	0.67	N/A	0.35	N/A
November	N/A	0.29	N/A	0.03	0.63	1.27	0.66
December	5.41	7.41	N/A	7.25	N/A	N/A	2.29
YR	N/A	12.18	N/A	12.56	N/A	N/A	N/A

N/A = insufficient data for an accurate calculation

Table 2. Monthly average daily maximum temperatures (Tmax) and average daily minimum temperatures (Tmin) during 2014 in degrees Fahrenheit.

	Anacapa Island RAWS	Santa Rosa Island RAWS	Santa Barbara Island RAWS	Santa Cruz Island RAWS	Santa Rosa Island Manual	Santa Cruz Island Manual	Santa Barbara Island Manual
	2014 Tmax (F)	2014 Tmax (F)	2014 Tmax (F)	2014 Tmax (F)	2014 Tmax (F)	2014 Tmax (F)	2014 Tmax (F)
January	69.97	68.00	65.90	73.35	68.93	N/A	71.00
February	65.74	60.15	61.63	68.67	62.79	67.08	67.50
March	67.68	62.00	63.97	70.39	64.84	68.97	70.00
April	66.43	64.10	63.57	73.73	65.10	N/A	71.41
May	70.71	66.48	69.10	79.65	71.38	76.56	78.43
June	72.53	63.18	66.77	77.00	65.77	76.00	72.81
July	79.97	70.77	70.90	82.00	72.97	76.06	78.00
August	77.77	70.10	71.00	82.13	72.52	74.16	N/A
September	76.70	70.63	71.60	85.10	72.43	N/A	80.27
October	77.58	74.65	73.35	80.74	N/A	80.14	78.92
November	70.08	69.17	N/A	75.07	70.31	72.25	73.52
December	64.40	59.57	N/A	66.17	62.33	65.85	66.97
YR	71.74	66.67	N/A	76.26	N/A	N/A	N/A

	Anacapa Island RAWS	Santa Rosa Island RAWS	Santa Barbara Island RAWS	Santa Cruz Island RAWS	Santa Rosa Island Manual	Santa Cruz Island Manual	Santa Barbara Island Manual
	2014 Tmin (F)	2014 Tmin (F)	2014 Tmin (F)	2014 Tmin (F)	2014 Tmin (F)	2014 Tmin (F)	2014 Tmin (F)
January	57.90	55.26	56.68	48.16	53.69	N/A	55.06
February	55.48	48.70	54.70	47.41	50.25	51.75	54.18
March	56.90	50.19	56.00	48.90	51.39	52.13	55.50
April	55.47	49.87	55.07	48.93	50.40	N/A	54.93
May	60.10	53.32	58.81	54.45	54.97	55.78	59.20
June	63.30	50.68	58.87	53.00	51.30	60.22	57.58
July	70.61	57.03	63.32	58.90	56.97	60.39	64.92
August	68.94	56.10	63.77	57.58	56.93	58.77	N/A
September	68.57	57.10	65.43	58.40	58.89	N/A	65.57
October	65.68	59.97	63.77	55.13	N/A	58.25	62.81
November	61.32	57.03	N/A	50.77	56.07	59.15	60.29
December	57.33	52.47	N/A	49.37	52.89	53.04	56.00
YR	61.89	54.06	N/A	52.65	N/A	N/A	N/A

N/A = insufficient data for an accurate calculation

Accumulated Growing Degree Days, an Index of Growing Season Length

Accumulated Growing Degree Days (AGDD) are often used as an index of growing season length. They are calculated as the sum of the differences between the average temperature for each day of the year and a base temperature. This base temperature is often chosen as the threshold below which plants are thought to be metabolically inactive. In the case of AGDD 40, the base temperature is 40 degrees Fahrenheit. Consequently, 40 is subtracted from the mean temperature for each day, and these differences are added up for the entire year, giving a single number. Similarly, AGDD 50 is calculated with a base temperature of 50 (F).

The Channel Islands RAWS have not been in operation long enough to calculate a “normal” growing season length. The manual stations has insufficient data for growing season calculations during 2014. Summary calculations for 2014 appear in Table 3.

Table 3. Accumulated Growing Degree Days (AGDD) and days above or below critical temperature thresholds during 2014 at RAWS in Channel Islands National Park.

Station Name	Station ID	AGDD40	AGDD50	# days ≥ 80 F	# days ≥ 90 F	# days ≤ 32F
Anacapa Island	RAWS	9599	6019	60	3	0
Santa Rosa Island	RAWS	7353	3759	36	7	0
Santa Barbara Island	RAWS	N/A	N/A	N/A	N/A	N/A
Santa Cruz Island	RAWS	8877	5247	120	26	0

(-) = insufficient data for an accurate calculation

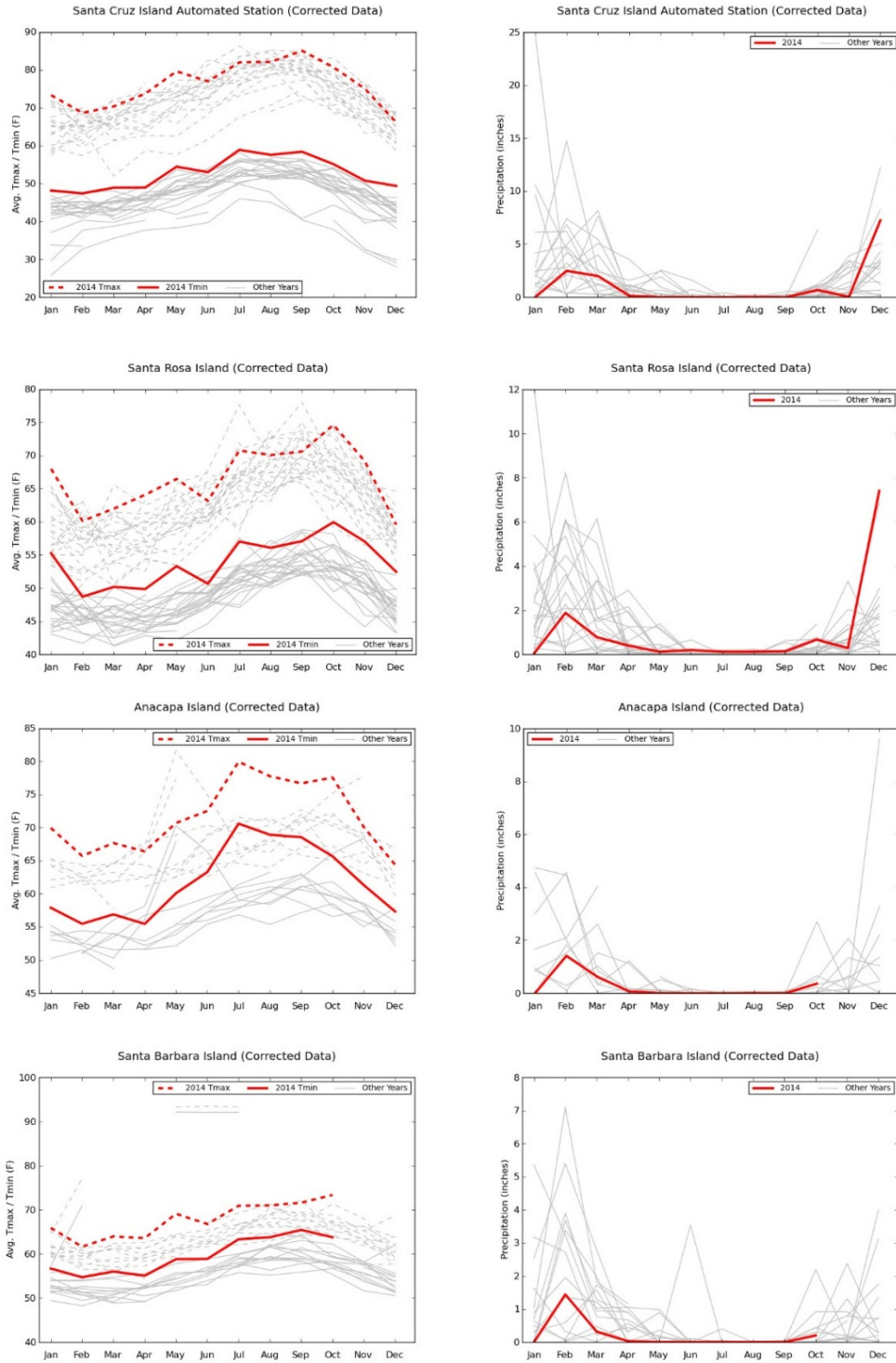


Figure 6a. Monthly precipitation and temperature data collected by RAWS in Channel Islands National Park. Red = 2014 measurements. Gray = other years.

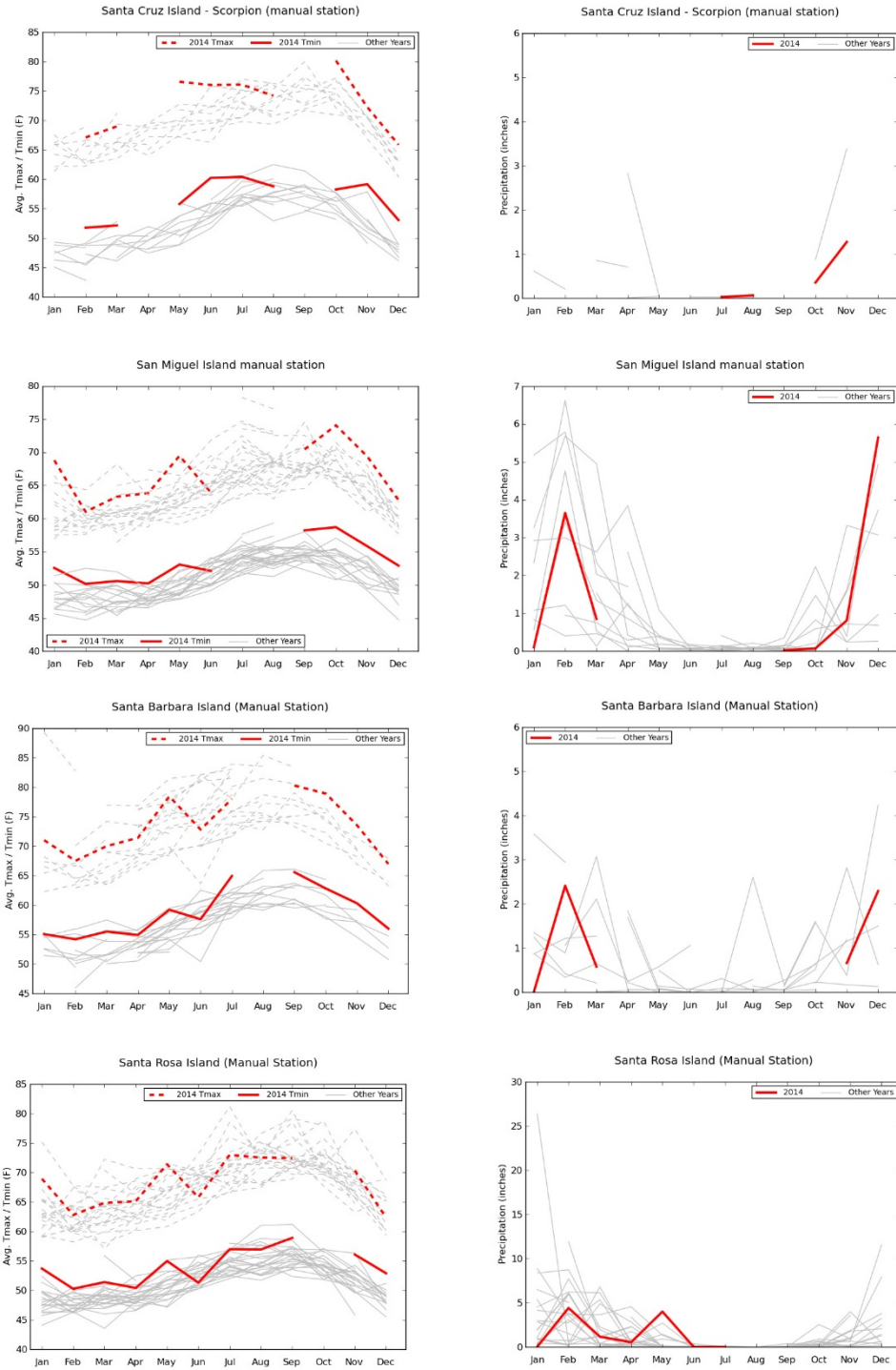


Figure 6b. Monthly precipitation and temperature data collected by manual “ranger” weather stations in Channel Islands National Park. Red = 2014 measurements. Gray = other years.

Conclusions

- The region entered into drought conditions in April 2012 (Tercek 2013) and became progressively drier throughout 2013 and 2014. By the end of 2014, Channel Islands National Park was classified as “D4 - Exceptional Drought” by the US Drought Monitor, which is the most severe classification on this scale (Figure 2).
- The PRISM maps (Figure 3) show that December had 125 – 200% normal precipitation but that all other non-summer months had below average precipitation. Precipitation during summer months is very low, and it is therefore easy to misinterpret calculations of “percent normal,” when only a few hundredths of an inch of rain can mean the difference between below vs. above average precipitation.
- According to PRISM, every month of 2014 had temperatures near or above average. January was particularly warm, with Tmax and Tmin both more than 6 degrees above normal throughout much of the park.

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Appendix 1

Table of climate stations used in this report. Detailed histories, period of record, and 30-year averages can be accessed from the links provided.

Name	Stn type	Metadata
Santa Cruz Island (NPS)	RAWS	http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCSCI
Anacapa Island (NPS)	RAWS	http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCANA
Santa Barbara Island (NPS)	RAWS	http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCSBB
Santa Rosa Island (NPS)	RAWS	http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCSRI
Santa Cruz Island - Scorpion	Manual	http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7802+sca
Santa Rosa Island	Manual	http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7804+sca
Santa Barbara Island	Manual	http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7801+sca
San Miguel Island	Manual	http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7803+sca

Appendix 2. 2014 Station Maintenance Log

Santa Barbara

- 07/14/2015 09:39 Rocky Rudolph:
On July 10, 2015 Rocky Rudolph performed annual maintenance on the SBI station. The solar rad sensor was down and needed replacing. The RH/AT sensor was the only sensor on scheduled replacement. I did not replace the second test RH/AT sensor connected to the FM/FT port. Corrosion on the support cables of the mast was noticeable even after less than a year. Overall the station looked good.
- 12/03/2014 18:01 Rocky Rudolph:
On Nov 19th 2014, seabird crew installed 2nd RH/AT using the FM/FT sensor port. Sensor was leveled and secured. 2nd sensor is for testing purposes in harsh marine environment.
- 11/18/2014 13:40 JDOPP:
Updated spare parts list and PM dates. Station has a GOES EON antenna which is not currently supported by the RAWs Depot so it will not be on the parts list.
- 11/10/2014 12:07 Rocky Rudolph:
Nov 5 through 7, 2014. R. Rudolph with seabird tech Mike swapped out all station parts with FTS F6 logger and FTS equipment. Installed a standard height WSWD tower and RM Young. Also installed Omni antenna, Solar Rad, Tipping bucket, RH/AT, and additional testing RH/AT plugged into FM/FT port. Station was sending weak signals so we bumped the transmit power level 300bps to 38 dBm. It was also set incorrectly to transmit at 00:13:10 so we changed it to 00:13:15. This seemed to solve all transmitting issues.

Anacapa

- 01/15/2015 14:19 Rocky Rudolph:
On 1/14/2015 R. Rudolph visited Anacapa station to replace faulty Solar Rad sensor. After swap, readings appeared normal. Sensor was placed on an SDI splitter with PB sensor. No issues detected.
- 12/05/2014 14:18 Rocky Rudolph:
Nov 26, 2014 - R. Rudolph visiting new FTS station to troubleshoot malfunctioning Solar Rad and install SDI splitter. Splitter didn't work when Solar Rad was connected. So it was left unplugged and only the BP was connected to the splitter. Station is operating normally, but WRCC has the sensors incorrectly mapped.
- 11/18/2014 09:23 JDOPP:
Updated spare parts list and PM dates. Station has an EON antenna which is not currently supported by the RAWs Depot so It will not be on the parts list.
- 11/10/2014 13:41 Rocky Rudolph:
October 24th, 2014. R. Rudolph and Tyler Smith from FTS installed new FTS F6 logger on standard tripod tower. The station was been moved off of the foghorn building and is now closer to housing. A new station form will be sent to NIFC with coordinates. All parts are new: RM Young, Tipping bucket, FM/FT, RH/AT, Solar Rad, Omni antenna, F6 Datalogger.

Santa Cruz Main Ranch

- 08/17/2015 18:17 Rocky Rudolph:
R. Rudolph visited site 8/13/2015 to replace faulty Goes antenna and do an annual service. Station was skipping transmits and Goes was suspected culprit. New Goes seemed to have solved the problem. RM Young, RH/AT, and FM/FT was also swapped on annual maintenance. Increased the transmit power to 38 instead of 32. Also noticed one of the guy wires on the mast was totally broken and loose. I truckers hitched it then put tension on all the wires with another truckers hitch of paracord as a surprisingly decent temporary fix. Needs new guy wires ASAP.
- 07/21/2015 11:18 Rocky Rudolph:
Adding an entry from last year: On April 8, 2014 R. Rudolph visited station to change out FM/FT and RH/AT.
- 05/28/2015 10:56 Brian Fuller:
Low signal strength--parts list says they have OMNI TOP HAT antenna and they have new CS2 F6. Recommended updating antenna to new EON which they have on

Santa Rosa

- 09/25/2015 11:41 Rocky Rudolph:
D. Adams replaced RH/AT sensor by drilling out the seized lock nut.
- 08/31/2015 15:49 Rocky Rudolph:
On 8/24/2015 R. Rudolph with maintenance staff D. Adams visited station to swap RH/AT, FM/FT, Omni antenna, and RM Young. Also increased transmit power to 38. RH/AT lock bolt broke due to no lithium grease applied to it when installed. RH/AT will be installed week of 8/31/2015 week by Adams. Waiting for his installation to send back parts.
- 07/21/2015 11:26 Rocky Rudolph:
Adding missed entry from last year: On April 15, 2014 Ryan O'Neill from SAMO swapped RH/AT and FM/FT.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 159/130110, October

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