

Dominica: Climate Trends and Projections

1.1 Current Climate: General Features

The combination of its size and location results in the climate of Dominica being strongly influenced by features of the north tropical Atlantic. There is modulation by the annual migration of the north Atlantic subtropical high, the eastward spreading of the tropical Atlantic warm pool, the fairly steady easterly trades, and the passage of tropical waves, depressions, storms and hurricanes. The resulting climate regime is described as humid tropical marine and is characterized by a dry winter-wet summer pattern and high and fairly uniform temperatures year-round. The rugged topography of Dominica’s interior also results in micro-climatic variability within very short distances on the island.

Table 1.1 at the end of the chapter gives climatological values for selected climate variables for Dominica. A brief discussion of the patterns, variability and historical trends exhibited by some of the variables is presented below.

Rainfall

The country is among the wettest in the eastern Caribbean. Dominica receives, on average, between 250 and 380 cm of rain each year. The rainfall climatology depicted in Figure 1.1 shows a dry season from January through April and a primary wet season from September through November. More than half the rainfall received in the course of the year, occurs in the primary rainfall season which coincides with peak tropical storm activity in the tropical Atlantic. There is a bimodality in the rainfall climatology as May is a wetter month prior to the onset of the main rainy season. The mountainous interior produces a rainfall shadow on the western Caribbean coast, where average rainfall falls below 200 cm per year. In contrast, rainfall in the mountainous inland regions can reach as high as 500 cm per year.

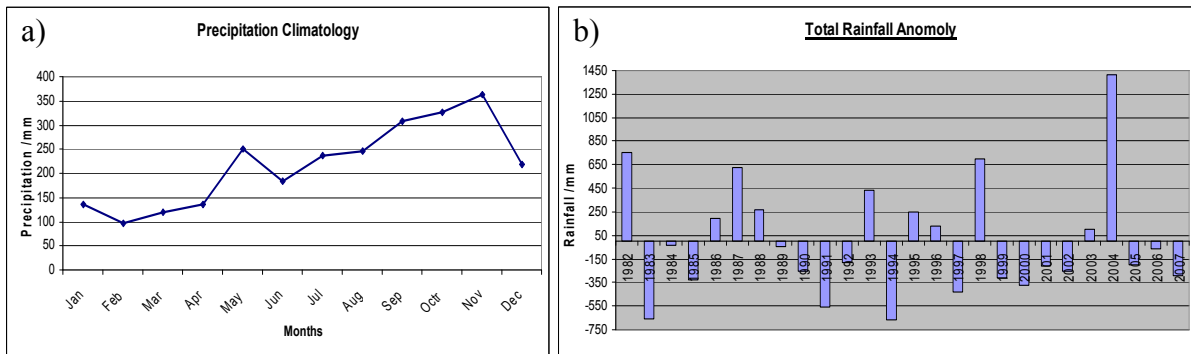


Figure 1.1 (a) Mean annual monthly rainfall. Units are mm/month. (b) Rainfall anomaly with respect to full base period. Units are mm. Data for Melville Hall Airport 1982 -2007.

There is considerable interannual variability in the rainfall record. The rainfall data for Melville Hall Airport indicate that 1983 and 1994 were among the driest years on recent record (less than 200 cm) while 2004 was amongst the wettest (in excess of 400 cm).¹ The

¹ Meteorological data (1982-2007) provided by the National Meteorological Service for Melville Hall Airport.

variability is evident even when rainfall in the dry and wet seasons is considered separately. Dry and wet spell years are also evident in the rainfall record. Some of the variability is driven by global climatic fluctuations such as the El Niño Southern Oscillation (ENSO) or by large scale gradients in tropical Atlantic and Pacific sea surface temperatures. The associations between Dominican rainfall and ENSO events are discussed below.

There is a *negligible* downward trend in the mean annual rainfall i.e. toward increasingly drier conditions, for the period and dataset analyzed (see footnote on previous page). The trend is *not* statistically significant. Peterson et al. (2002) found that this pattern of significant year to year variability in the annual mean but no statistically significant long term trend is generally true for Caribbean precipitation over the past 50 years. Significant downward trends are however evident for rainfall in September-November, January-March, and May-June. The exception is in July-August which trends upward over the period analyzed.

Temperature

The annual variation in maximum, minimum and mean temperatures is shown in Figure 1.2a. The annual range is small for the mean temperature (~3 degrees), with peak temperature values occurring between July and August. Maximum temperature values may reach as high as 31°C and peak slightly later in the year, while minimum temperature values may drop to less than 22 °C in the mean in January/February. Diurnal ranges are usually no greater than 3°C in most places.

The steep interior slopes of Dominica also alter temperatures. During the warmest period of the year a maximum of 33°C may be observed along the coast compared to 27°C in the mountains. In the nights, minimum temperatures of 18°C and 13°C respectively are not uncommon.

Both the maximum and minimum temperature records show a statistically significant warming trend over the past 25 years (Figure 1.2b). This is consistent with the rest of the Caribbean (Peterson et al. 2002) and the globe (Alexander et al. 2006). Like the global averages, minimum temperatures at the Melville Hall station are increasing at a faster rate (0.57°C/decade) than maximum temperatures (0.22°C/decade). The opposite scenario is however true for the Canefield Airport station.

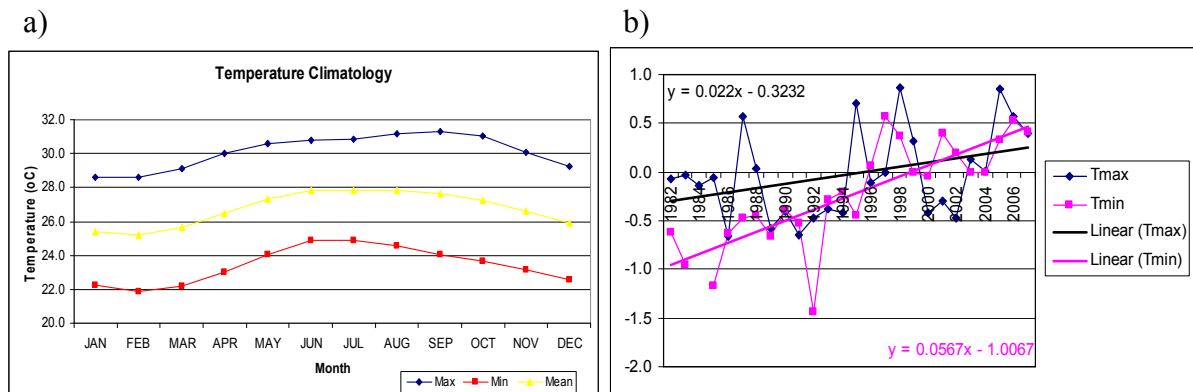


Figure 1.2 (a) The climatology of minimum, maximum, and mean temperature for Dominica (Melville Hall Airport 1982 -2007). Units are °C. (b) Annual maximum and minimum temperature anomalies for Dominica (Melville Hall Airport 1982 -2007). Anomalies are with respect to a full period. Trend lines added.

Other Climate Variables

Relative humidity across the country tends to be high (in excess of 75%) year round with little seasonal variation. Predictably the interior of the island sees highest humidity (> 85%).

Winds are generally from the E or ESE, and wind speeds are fairly constant year round (3-5 metres per second) (See Table 1.1). Though weakest mean winds occur in September-October, strong wind gusts are possible from June to November especially during the passage of tropical waves, depressions, storms or hurricanes.

Hurricanes

Dominica's location in the hurricane belt makes it susceptible to tropical storms and hurricanes. Since 1979, tropical systems of note (storms and hurricanes) which have impacted Dominica include David (1979), Gert (1981), Gilbert (1988), Hugo (1989), Iris (1995), Marilyn (1995), Hortense (1996), Lenny (1999) and Dean (2007). The island is impacted (brushed or hit) approximately once every four years. The severity of the impact on both the social and economic infrastructure is dependent on the approach, proximity and intensity of the system at the time of passing.

It is to be noted that, in general, north Atlantic hurricane frequency is characterized by a multidecadal cycle which yields active and inactive phases lasting 10 or more years (Goldenberg et al. 2001). Since 1995, the north Atlantic has swung into an active hurricane phase. Some of the country's most devastating recent hurricane experiences (e.g. Marilyn, Lenny, Dean) have occurred in the current active phase of the north tropical Atlantic.

There is also significant year to year modulation of hurricane frequency and track by El Niño Southern Oscillation (ENSO) events.

ENSO

The El Niño-Southern Oscillation (ENSO) is a global coupled ocean-atmosphere phenomenon. The El Niño (La Niña) is an unusual warming (cooling) of the tropical Pacific Ocean, and the Southern Oscillation is an accompanying fluctuation in the air pressure difference between Tahiti and Darwin, Australia. The ENSO phenomenon occurs irregularly at approximately 3-6 year intervals and prompts changes in weather patterns across the globe.

Caribbean rainfall is impacted by ENSO events through its effect on both sea surface temperatures and vertical shear in the north tropical Atlantic. El Niño events are associated with a wet north-dry south Caribbean during December-February, and a drying tendency and diminished hurricane activity during El Niño summers (Gray 1994, Taylor et al. 2002, Stephenson et al. 2007). The early rainfall season (May-June) in the central and southern Caribbean also tends to be wetter (drier) in the year after an El Niño (La Niña).

Not surprisingly, fluctuations in Dominica's early season rainfall can be statistically linked to ENSO events. Warm Caribbean waters in early spring resulting from the occurrence of an El Niño are positively (and significantly) correlated with enhanced rainfall over Dominica during May-June. The drying influence of an El Niño in the late rainfall season is also discernible (e.g. 1983, 1994, 1997), though the correlation with September-October-November rainfall is weaker than for the early season. The El Niño-induced drying is in part due to the strong vertical shear induced in the Caribbean during an event, which proves unfavourable for tropical convection including storm or hurricane formation.

El Niños have become more frequent, persistent and intense during the last 20-30 years. It is not certain whether this is due to natural variation or the effect of increasing greenhouse gases. Other global phenomenon e.g. the North Atlantic Oscillation (NAO) can also modulate ENSO's impact on the Caribbean region (Giannini et al. 2001).

1.2 Determining the Future Climate

The strong linkages between climate and Dominican society provide adequate justification for attempts at projecting the country's future climate. A tourism driven economy (particularly with its bias to eco tourism), and the abundance of and reliance on the island's forestry and terrestrial resources, point to the usefulness of making future rainfall, temperature, and seasonality projections, particularly for planning purposes. Additionally, the sensitivity of coastal infrastructure and settlements to storm and hurricane activity (particularly wind and surges) indicate the usefulness of projections of future storm activity and sea level rise.

GCMs, RCMs and Statistical Models

Global Circulation Models (GCMs) are useful tools for providing future climate information. GCMs are mathematical representations of the physical and dynamical processes in the atmosphere, ocean, cryosphere and land surfaces. Their physical consistency and skill at representing current and past climates make them useful for simulating future climates under differing scenarios of increasing greenhouse gas concentrations (Scenarios are discussed further below).

Projections of rainfall and temperature characteristics for Dominica through the end of the century are extracted from two GCM projects. In each case data from multiple GCMs were analyzed (9 in one instance and 3 in the other) and it is the consensus results which are presented. Details of both projects are provided in the Appendix at the end of the chapter.

An inherent drawback of the GCMs, however, is their coarse resolution relative to the scale of required information. The size of Dominica precludes it being physically represented in the GCMs, and so there is a need for *downscaling* techniques to provide more detailed information on a country or station level. The additional information which the downscaling techniques provide do not however devalue the information provided by the GCMs especially since (1) Dominica's climate is largely driven by large-scale phenomenon (2) the downscaling techniques themselves are driven by the GCM outputs, and (3) at present the GCMs are the best source of future information on some phenomena e.g. hurricanes.

Data from two downscaling methods are applied. *Dynamical* downscaling employs a regional climate model (RCM) driven at its boundaries by the outputs of the GCMs. Like GCMs, the RCMs rely on mathematical representations of the physical processes, but are restricted to a much smaller geographical domain (the Caribbean in this case). The restriction enables the production of data of much higher resolution (typically < 100 km).

Available RCM data for Dominica are from the PRECIS (Providing Regional Climates for Impact Studies) model (Taylor et al. 2007). Details of the PRECIS project are provided in the Appendix. The PRECIS model resolution is 50 km.

Statistical downscaling enables the projection of a local variable using statistical relationships developed between that variable and the large scale climate. The relationships are premised on historical data and are assumed to hold true for the future. Statistical downscaling is

especially useful for generating projections at a location, once sufficient historical daily data are available.

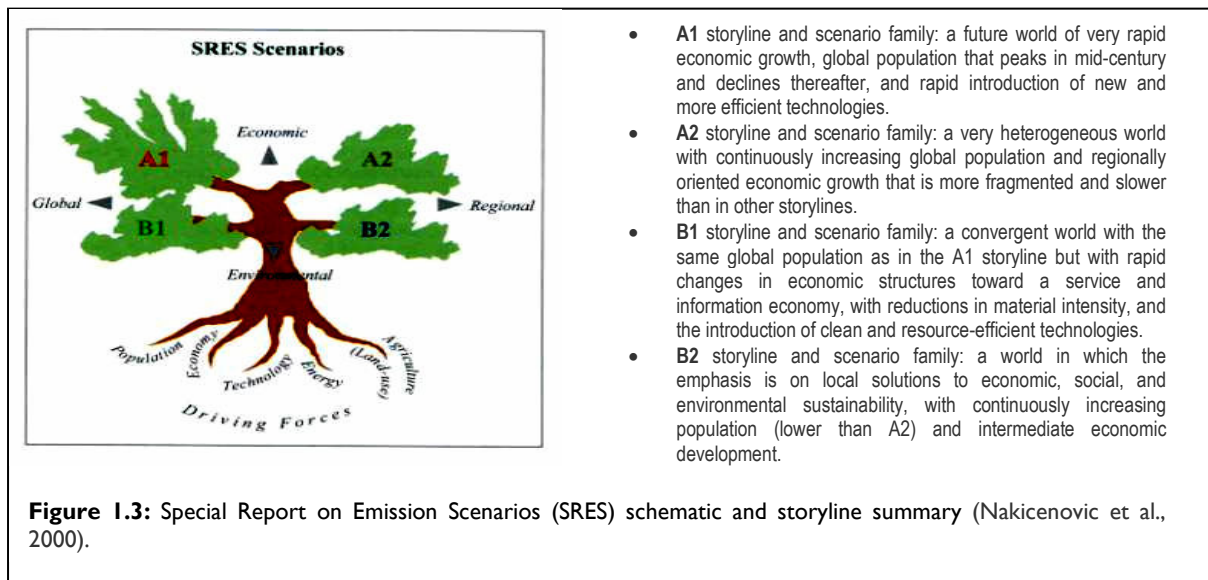
Statistical downscaling was undertaken for rainfall and temperature data for Melville Hall Airport station. The process was facilitated using the Statistical Downscaling Model (SDSM) (Wilby et al. 2002) for which details are provided in the Appendix.

Scenarios

The GCMs, RCM, and statistical downscaling model are run using the Special Report Emission Scenarios (SRES) (Nakicenovic et al., 2000).² Each SRES scenario is a plausible storyline of how a future world will look. That is, the scenarios explore pathways of future greenhouse gas emissions, derived from self-consistent sets of assumptions about energy use, population growth, economic development, and other factors. They however explicitly exclude any global policy to reduce emissions to avoid climate change. Scenarios are grouped into families according to the similarities in their storylines as shown in Figure 1.3.

Since there is an equal probability of each storyline becoming the future, the results presented in the following section cover a range of scenarios, namely the A2, B1, B2 and A1B (see again Figure 1.3). A2 and B2 are representative of medium-high and medium-low emissions scenarios respectively (see Figure 1.4), while A1B can be seen as a compromise between the two. The A1B scenario is characterized by an increase in carbon dioxide emissions through mid century followed by a decrease.

The future climate is presented as absolute or percentage deviations from the present day climate which is in turn represented by averaging over 30 year periods, usually 1961-1990 or 1971-2000. The results are presented for 10 year bands centered on 2015, 2030, 2050 and for the end of the century (2070-2100).



² In 2000, the Intergovernmental Panel on Climate Change (IPCC) published a Special Report on Emissions Scenarios (SRES), presenting multiple scenarios of greenhouse gas and aerosol precursor emissions for the 21st century.

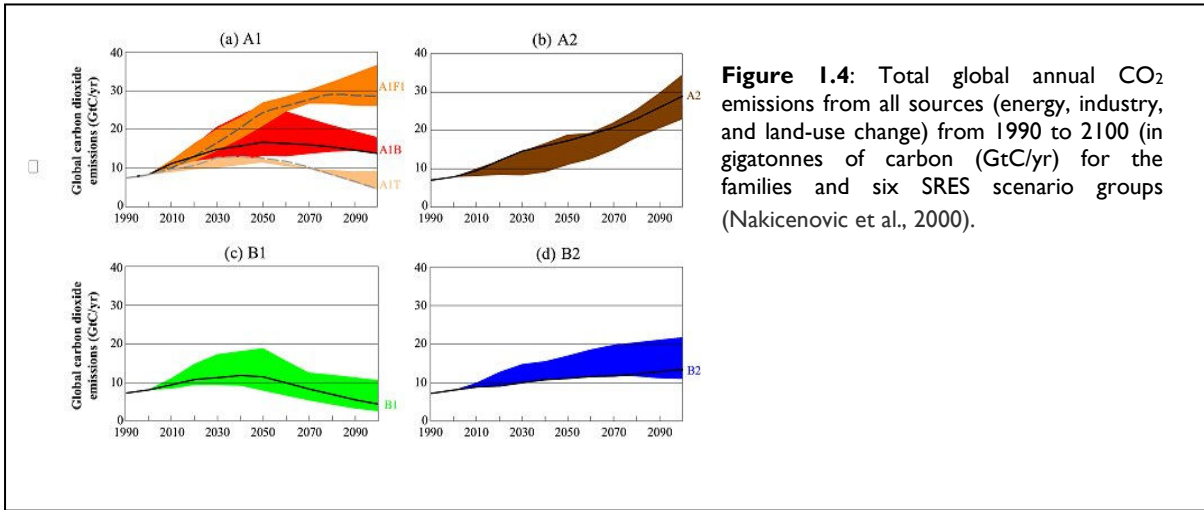


Figure 1.4: Total global annual CO₂ emissions from all sources (energy, industry, and land-use change) from 1990 to 2100 (in gigatonnes of carbon (GtC/yr) for the families and six SRES scenario groups (Nakicenovic et al., 2000).

1.3 Future Climate: Results

Temperature

Irrespective of scenario, model or methodology used, there is a projected annual mean temperature increase for Dominica. Table 1.2 gives the range of increase projected for each time slice above as gleaned from the GCMs and RCM.

The GCMs suggest that the mean annual increase in temperature will be between 0.4°C and 0.5°C by the 2015s, 0.6°C - 0.8°C by the 2030s, 0.9°C - 1.3°C by the 2050's and between 1.5°C (B1 scenario) and 3°C (A2 scenario) by the end of the century (2100) (Figure 1.5). The RCM shows a similar rate of increase with an annual temperature change of 1.8–2.3°C by the 2090s. These projections are consistent with IPCC projections for the Caribbean which show annual mean temperatures increasing by 1.4°C to 3.2°C, with a median increase of 2.0°C by 2100. The increases are however slightly less than the anticipated global average warming.

The projections also suggest slightly less warming during the summer months when compared to the cooler December-March period. This becomes evident toward the end of the century

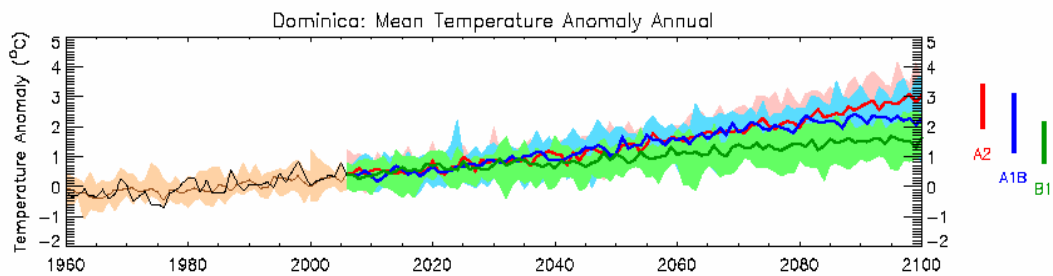


Figure 1.5 Annual mean temperature anomaly 1960-1990. Units are °C. Black line: Average of observational datasets for current climate. Brown line and brown shading: Ensemble median and range for model projections of recent climate. Coloured lines and shading: Ensemble median and range of projections under 3 emissions scenarios. Bars at the far right demonstrate the change by 2080-2100 under each emissions scenario. All values are given as an anomaly from 1971-2000 mean climate.

when the GCMs show a difference of 0.6°C (0.4°C) between the projected increase in July and that for February under the high (low) emission scenario. This differential warming effect across seasons has implications for the concept of seasonality (see below). SDSM analysis (not shown) also indicates a difference in warming according to seasons, though the pattern is slightly different.

The GCM projections also reveal that the percentage frequency of occurrence of very hot days (nights) approaches 55% (53%) by the 2060's and 84% (82%) by the century's end. In contrast the percentage frequency of occurrence of very cool days and nights falls to zero by 2100. A very hot day (night) is defined as one with temperatures greater than the hottest 10% of days (nights) in the current climate. Similarly, very cool days (nights) are those with temperatures less than the coolest 10% of days (nights) in the current climate.³

Rainfall

There are fewer consensus in the projected rainfall for Dominica than for temperature. Figure 1.6 shows the annual percentage change for three GCMs running a variety of scenarios. The projected percentage change for each month after averaging over the three GCMs, is also given in Table 1.3.

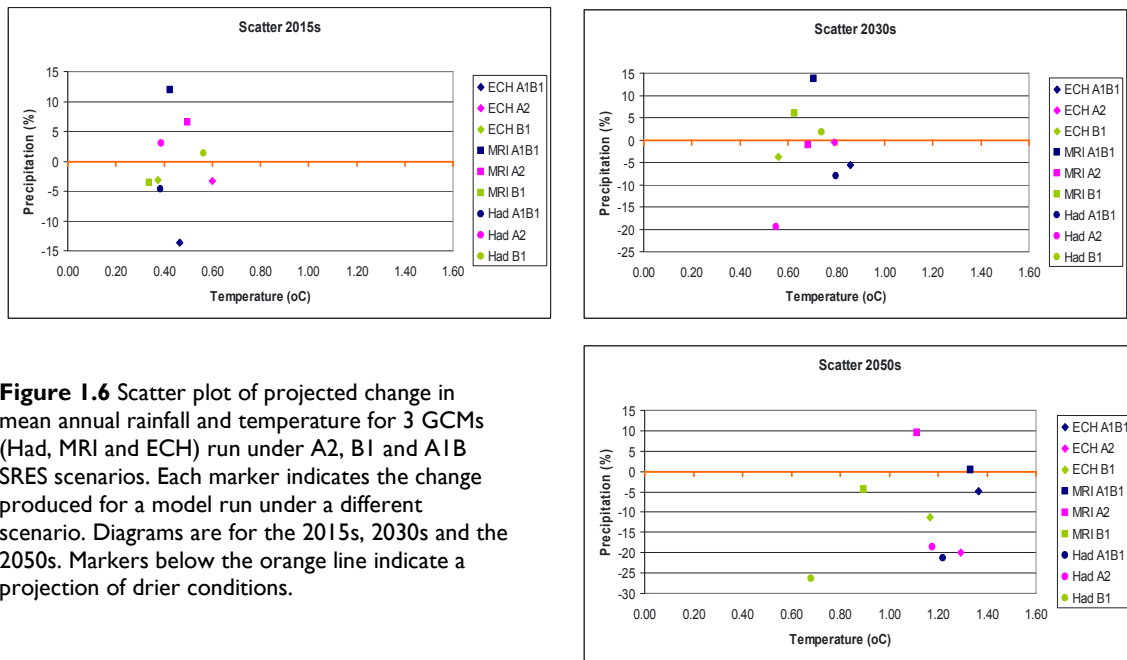


Figure 1.6 Scatter plot of projected change in mean annual rainfall and temperature for 3 GCMs (Had, MRI and ECH) run under A2, B1 and A1B SRES scenarios. Each marker indicates the change produced for a model run under a different scenario. Diagrams are for the 2015s, 2030s and the 2050s. Markers below the orange line indicate a projection of drier conditions.

There is a clear tendency toward drier in the annual mean, with greater consensus toward the end of the century. For the 2015s, the models project changes ranging from -15% to +13% (dependent on scenario and model), with 5 of 9 model runs indicating a decrease in the annual mean rainfall (see again Figure 1.6). For the 2030's the range is from -20% to +15% and 6 of 9 runs indicate a drier Dominica. By the 2050's the range is -21% to +10% and 7 of 9 runs indicate drier conditions than the present. The RCM captures the same drying trend but is

³ From the Caribbean Model Intercomparison Project. See the Appendix for details.

more drastic. It projects the annual rainfall to be 30%-50% less than present day amounts by the end of the century. This is consistent with the IPCC projections of a drier Caribbean by the century's end.

There are also trends in the rainfall pattern for some months for all time periods. Both the 3 GCM study⁴ and the RCM project a reduction in rainfall in March, July, and October for all three time slices and through the end of the century (see again Table 1.3). The drying in July is consistent with the modelling study of Mitchell et al. (2004)⁵ which shows drying of up to 15% by the end of the century in June-August for Dominica. It is to be further noted that this early summer drying is a feature of other climate projections for the Caribbean (see for e.g. Taylor et al., 2007, Watson et al., 2008) under a global warming scenario.

SDSM is likewise consistent in its projections of a wetter September - up to 50% by the 2050's. Little more can, however, be confidently said about changes in the peak rainy season due to the wide variations in the projected changes for Dominica, dependent on model and scenario.

Seasonality

The seasonality of Dominica's climate can be represented by plotting the average monthly temperature throughout the year against the average monthly precipitation (Figure 1.7). All the seasonality features are captured by the resulting polygon including the cool-dry first three months of the year, the rainfall peak in May (which is accompanied by modest warming), the slight drying in June, the hot wet late summer months (August-September), and the return to cool dry conditions by beginning in December. Changes in the polygon shape or position (e.g. elongation or flattening or vice versa) under global warming conditions would suggest a shift in seasonality. Results are shown for the A1B1 scenario.

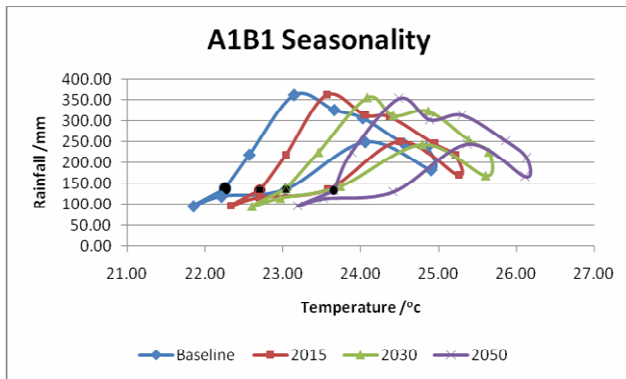


Figure 1.7 Seasonality diagrams for Dominica. Polygons show the variation in mean rainfall and temperature for a given year. Plots are for current climate (baseline), and the 2015's, 2030's and 2050's, under the A1B1 scenario. The black dot indicates January. Each year follows counter clockwise.

In general the seasonality of Dominica remains the same in the future i.e. the pattern of cooler dry winter-hot wet late summers will still prevail, though monthly temperatures will be on average 2 degrees higher by the 2050's (as indicated by the rightward shift of the polygons). Other discernible changes in the polygon shape are accounted for by the aforementioned drying tendency as the century progresses, which is captured by the polygon progressively becoming shorter.

⁴ From the Climate Change Country Profile Project. See the Appendix for details

⁵ Mitchell et al. (2004) examines four models and four scenarios. The models are the CGCM2 (Canada), CSIRO mk2 (Australia), DOE PCM (USA) and the HadCM3 (UK). The scenarios are the A1F1, A2, B2, and B1.

Hurricanes

Since the models examined do not explicitly model hurricanes, it is the IPCC's projections which are relied on. Based on a range of models, the IPCC suggests that future hurricanes of the north tropical Atlantic will *likely*⁶ become more intense, with larger peak wind speeds and heavier near storm precipitation.

The stronger hurricanes result from ongoing and projected increases in tropical ocean temperatures (from surface through 450 m) and atmospheric water vapor content (Barnett et al. 2005; Levitus et al. 2005; Anthes et al. 2006). Increases in both variables can be linked to warmer air temperatures. The warmer ocean temperatures would satisfy the warm sea surface temperature criterion for hurricane intensification and would also likely limit a natural 'braking' process of hurricanes. That is, colder deeper waters typically serve to weaken a storm as they are churned up by the strong wind field. If deeper waters become too warm the natural braking mechanism will be diminished.

There is however less confidence in model projections of (i) a *decrease* in the *number* of relatively *weak* tropical cyclones, (ii) *increased numbers* of *intense* tropical cyclones, and (iii) a global *decrease* in the *numbers* of tropical cyclones. Some modelling studies attribute any possible global decrease in the number of cyclones to increased stability of the tropical troposphere (due to differential warming in the vertical in a warmer climate) which compensates for the impact of the warmer ocean temperatures.

Sea Level Rise

Ocean expansion (due to warming) and the inflow of water from melting land ice have raised the global sea level over the last decade. Large deviations among the limited set of models addressing the issue, however, make future estimates of sea level change uncertain, including for the Caribbean.

As with hurricanes, it is the IPCC's projections which are relied on. Whereas it is not presently possible to project sea level rise for Dominica, changes in the Caribbean are projected to be near the global mean. Under the A1B scenario, sea level rise within the Caribbean is projected to be between 0.17 m and 0.24 m by 2050 (IPCC 2007). For comparison, global sea level rise is projected to average 0.35 m (0.21 to 0.48 m) under the same scenario by the end of the century (relative to the period 1980-1999). It is important to note, however, that changes in ocean density and circulation, will ensure that the distribution of sea level rise will not be uniform across the region.

Sea Surface Temperatures and ENSO

North tropical Atlantic sea surface temperatures (SSTs) and SSTs in the main hurricane development region of the Atlantic have shown a non linear upward trend in the recent past (Mann et al. 2006; Knutson et al. 2008). Some of the increase is attributable to anthropogenic forcing (Santer et al. 2006).

The warming trend is likely to continue, with one multimodel study suggesting an increase of ~1.7°C by the end of the century under the A1B scenario (Knutson et al. 2008). Other recent studies have however shown that there is considerable uncertainty in projected regional

⁶ In the IPCC Summary for Policymakers, the following terms have been used to indicate the assessed likelihood, using expert judgement, of an outcome or a result: *Virtually certain* > 99% probability of occurrence, *Extremely likely* > 95%, *Very likely* > 90%, *Likely* > 66%, *More likely than not* > 50%, *Unlikely* < 33%, *Very unlikely* < 10%, *Extremely unlikely* < 5%.

warming rates for tropical basins due to differing climate sensitivity, ocean heat uptake, and other regional-scale processes in the models (see for example Knutson and Tuleya 2004). Further uncertainty also arises due to uncertainties in future anthropogenic emission scenarios and radiative forcing.

All models also show continued ENSO interannual variability in the future. However, there is no consistent indication of discernible changes in projected ENSO amplitude and frequency in the 21st century (IPCC 2007).

1.4 In Summary...

In summary the following is noted about the climate of Dominica:

- There is evidence to suggest that the climate of Dominica is changing. Both maximum and minimum temperatures have increased in the recent past.
- The warming trend is expected to continue. The country is projected to be warmer by up to 1.3°C by the 2050s, and between 2 and 3 degrees by the end of the century.
- Winter months will see marginally larger increases in temperature than summer months.
- The frequency of very hot days and nights will increase, while the number of very cool days and nights will decrease.
- The country is likely to be drier in the mean. Projections are for up to 20% drier by mid century when models show more consensus about the trend, and up to 50% drier by 2100.
- July-August will likely be drier.
- The seasonality of Dominica will be largely unchanged. The cooler (with respect to late season temperatures) dry early months and wet hotter late months will still prevail.
- Hurricane intensity is likely to increase (as indicated by stronger peak winds and more rainfall) but not necessarily hurricane frequency.
- Caribbean sea levels are projected to rise by up to 0.24 m by mid century.
- Sea surface temperatures in the Caribbean are projected to warm, up to approximately 2°C by the end of the century.
- ENSO's impact on Dominican rainfall (early and late season) will likely continue, given projections of the phenomenon's continued occurrence in the future.

Appendix

The data used in this chapter were from four modeling projects.

In the **Climate Change Country Profile Project** output from 9 GCMs is examined to determine temperature and rainfall changes through the end of the century. Changes are with respect to the 1970-2000 mean climate. For the observed climate, gridded station datasets (from CRU, University of Delaware and GPCP) (0.5° resolution), plus NCEP and ERA-40 re-analysis (temperature only) are used. In calculating extreme indices, the HadEX dataset (UK met office) is used and indices are calculated from daily observed data and gridded datasets, as well as from 5 of the 9 GCMs. The A2, A1B, and B1 scenarios are analysed.

The **Caribbean Model Intercomparison Project** uses output from 3 GCMs. The GCMs are HadCM3 (UK), MRI-CGCM2 (Japan) and ECHAM 5/MPI-OM (Germany). Climate change is determined relative to a 1960-1999 baseline climate. The A1B1, A2 and B1 scenarios are analysed for three 10 year future time slices centered on the 2015's, 2030's and 2050's.

Available RCM data are obtained from the **PRECIS** (Providing Regional Climates for Impact Studies) model which was run at the University of the West Indies (Taylor et al., 2007). PRECIS has a 50 km resolution and is restricted to a Caribbean domain. The model is forced at its boundaries by HadCM3 data and results extracted for the baseline (1960-1999) and for a future time slice (2070-2099) for the A2 and B2 scenarios.

For further downscaling of the HadCM3 model results, the **Statistical Downscaling Model** (SDSM) (Wilby et al. 2002) was used. Projections were done using the A2 and B2 scenarios for the 2015s, 2030s and 2050s. SDSM was used to assess regional scale predictor impacts on weather conditions (maximum and minimum temperature and precipitation) at the Melville Hall Airport.

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Table 1.1 Climatological values for selected climate variables. Data are from observations taken at Melville Hall International Airport (Dominica). Years over which averages are taken are given. Data provided by Meteorological Service

	Mean Temp. (1974 – 2007) °C	Max. Temp. (1982 – 2007) °C	Min. Temp. (1982 – 2007) °C	Avg. Monthly Rainfall (1960-1990) mm	Normal Wind Speed (2003 – 2008) m/s	Normal Wind Direction (1981 – 2005)
JAN	26.1	29.4	19.6	136.8	4.1	E
FEB	25.9	29.4	18.9	98.9	4.1	E
MAR	26.5	30.0	19.3	119.4	4.6	E-ESE
APR	27.3	30.7	20.0	136.0	4.1	E-ESE
MAY	28.1	31.1	21.6	249.8	4.1	E-ESE
JUN	28.5	31.6	22.5	183.0	4.1	E
JUL	28.6	31.5	22.6	235.8	4.1	E
AUG	28.8	31.8	22.5	245.8	4.1	E-ESE
SEPT	28.7	32.1	22.0	307.2	3.1	E-ESE
OCT	28.2	31.8	21.6	326.6	3.1	E-ESE
NOV	27.4	31.1	21.1	362.3	3.6	E-ESE
DEC	26.7	29.9	20.1	219.3	4.1	E
MEAN	27.6	30.9	21.0	218.2	3.6	E-ESE

Table 1.2 Future projections of absolute temperature change for Dominica from GCMs and an RCM for decadal periods centered on 2015, 2030 and 2050. In each column a range of values is provided. For the GCMs the range is determined by averaging for the same scenario the absolute change for the decadal period relative to a 1960-1990 baseline simulation as produced by each of the 3 GCMs in the Caribbean Model Intercomparison Project. The values presented are then the range of the averaged GCM produced temperature change for the three scenarios considered (A2, A1B1, and B1). For the RCM the range is for the two scenarios considered (A2 and B2) using the PRECIS model and an identical technique, but for temperature change at the end of the century.

	GCMs			RCM
	2015s	2030s	2050s	2080s
JAN	0.5 to 0.6	0.7 to 0.8	0.9 to 1.4	2.0 to 2.5
FEB	0.4 to 0.6	0.7 to 0.8	0.9 to 1.3	2.0 to 2.6
MAR	0.4 to 0.5	0.7 to 0.8	0.9 to 1.3	1.9 to 2.5
APR	0.4 to 0.6	0.7	1.0 to 1.4	1.8 to 2.4
MAY	0.4 to 0.5	0.6 to 0.8	0.9 to 1.3	1.7 to 2.2
JUN	0.4	0.6 to 0.7	0.9 to 1.2	1.7 to 2.1
JUL	0.4	0.6 to 0.8	0.9 to 1.3	1.62 to 2.0
AUG	0.4 to 0.5	0.6 to 0.8	0.9 to 1.3	1.6 to 2.0
SEP	0.4 to 0.5	0.6 to 0.8	0.9 to 1.3	1.6 to 2.1
OCT	0.4	0.6 to 0.8	0.9 to 1.2	1.6 to 2.3
NOV	0.4 to 0.5	0.6 to 0.9	1.0 to 1.3	1.7 to 2.4
DEC	0.5 to 0.6	0.7 to 0.9	1.0 to 1.3	2.0 to 2.5
Annual	0.4 to 0.5	0.6 to 0.8	0.9 to 1.3	1.8 to 2.3

Table 1.3 Future projections of percentage rainfall change for Dominica from (a) GCMs and an RCM and (b) SDSM for decadal periods centered on 2015, 2030 and 2050. In each column a range of values is provided. For the GCMs the range is determined by averaging for the same scenario the percentage change for the decadal period relative to a 1960-1990 baseline simulation as produced by each of the 3 GCMs in the Caribbean Model Intercomparison Project. The values presented are then the range of the averaged GCM produced temperature change for the three scenarios considered (A2, A1B1, and B1). For the RCM the range is for the two scenarios considered (A2 and B2) using the PRECIS model and the identical technique, but for percentage rainfall change at the end of the century. For the SDSM the range is for the two scenarios considered (A2 and B2) but for downscaled rainfall at the Melville Hall Airport.

(a)

	GCMs			RCM
	2015s	2030s	2050s	2080s
JAN	C	13.7 to 2.1	-16.2 to -10.2	-43.9 to -14.5
FEB	-13.3 to 1.7	-11.6 to 8.9	-22.3 to 2.5	-38.9 to -11.0
MAR	-16.0 to -5.1	-16.3 to -8.8	-29.0 to -20.7	-61.5 to -27.1
APR	-9.0 to 2.0	-0.8 to 47.1	-20.9 to 11.0	-48.8 to -38.9
MAY	-11.2 to 11.0	-14.6 to 5.6	-23.7 to -10.4	-36.5 to -31.9
JUN	-16.4 to 6.8	-19.6 to 21.5	-25.2 to -13.2	-75.5 to -55.7
JUL	-14.9 to -9.7	-23.7 to -8.0	-23.2 to -22.5	-54.9 to -30.7
AUG	-1.3 to 5.5	-8.6 to 13.1	-11.7 to 4.7	-35.4 to -15.6
SEP	-1.3 to 9.3	4.6 to 14.2	-6.6 to 6.2	-33.9 to -22.4
OCT	-8.6 to -1.3	-13.0 to -11.1	-20.8 to -9.6	-47.1 to -41.8
NOV	-5.6 to 10.4	-11.2 to -7.3	-12.0 to 0.1	-43.4 to -34.0
DEC	-0.8 to 14.0	-1.4 to 18.4	-3.9 to 14.5	-62.9 to -49.4
Annual	-17 to 10	-20 to 18	-26 to 7	-49 to -31

(b)

	SDSM		
	2015s	2030s	2050s
JAN	0.3 to 1.9	5.3 to 6.3	-0.6 to 8.0
FEB	-6.0 to 2.8	-9.6 to -8.3	-15.0 to -5.9
MAR	-2.4 to 6.4	-0.9 to 8.6	11.4 to 13.5
APR	-2.5 to -1.9	-2.8 to -1.9	4.0 to 8.1
MAY	-13.5 to -0.1	-16.3 to -15.9	-19.7 to -15.0
JUN	3.6 to 6.1	7.7 to 15.1	4.3 to 37.1
JUL	4.5 to 8.9	9.8 to 19.6	19.1 to 21.0
AUG	0.6 to 4.2	-2.5 to 9.1	1.7 to 10.3
SEP	11.8 to 18.8	18.4 to 26.9	24.6 to 52.1
OCT	-3.8 to 1.0	-1.7 to 1.2	-2.6 to 2.4
NOV	-1.6 to -3.1	-11.1 to -6.7	-14.8 to -11.4
DEC	-5.4 to 1.5	3.9 to 10.1	-3.6 to 1.0