

## Using climate information to support adaptation planning and policy-making: A step-by-step guide

With a case study in Cape Town, South Africa



A VEGETABLE FARMER IN PHILIPPI, A SUBURB OF CAPE TOWN. FLICKR/KOSMOSELEEVIKE

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## INTRODUCTION

There is a growing recognition that climate change should be considered, amongst other factors, in planning and managing resource allocations, investments and infrastructure, both public and private. This involves accounting for the range of climate conditions experienced in the past and the trends in how these conditions might change in the future. Some of the information needed for such an analysis can be drawn from personal observations: how people have experienced the climate through cropping cycles, vegetation cover, river and sea levels, etc. over their lifetimes. However, this will only cover past conditions in a specific place, and provide limited details.

Thus, it is often useful to supplement such information with scientific data that is systematically collected through observation networks and analysed using carefully tested methods, including computer-based modelling. It is these large volumes of data and analytical methods that also make it possible to generate information about future climate conditions (climate projections) in addition to those measured in the past and the present (climate observations).

Such data and analyses are not equally available around the globe, but their quantity, quality and accessibility are rapidly increasing, including in developing countries. Part of this progress is an increase in the spatial and temporal resolution of the data: where only country-scale information and projections to 2100 might have previously been available, there may now be data for a specific district or river catchment, measured over the last 30 years and projected for the next few decades. This means that climate information is becoming more relevant and valuable to specific decisions being made by government departments, large companies, local businesses, households, community organisations, investors, donors, etc.

This document describes how weADAPT can be used together with the Climate Information Portal (CIP) to quickly and easily access climate data for many locations across Africa, using an interactive map. (This functionality may be expanded to other regions, based on demand.) By linking the two portals, we have enabled users to see the climate data context as they read about a project, or to find data to support their own research, project planning or policy design in a specific place or area.

This guidance is based on an understanding that adaptation is not simply a technical exercise in reducing projected climate impacts. Rather it is a process of socio-institutional learning in a specific context, involving multiple people and organisations that have a stake in the present and the future of that place, who are making complex, multi-faceted choices about managing climate-related risks and opportunities, often in the face of resource constraints and competing agendas. Information about these climate risks, opportunities and adaptation options is never going to be perfect or perfectly complete; there will always be some sources of uncertainty, but that does not mean that a robust and defensible decision cannot be made. What is required is accountable leadership and broad-based deliberation that brings together multiple perspectives, knowledge, expertise and value sets.

In this context, there is value in accounting for a range of possible climatic and non-climatic conditions (e.g. different global market forces, national subsidies or demographic trends), and there is value in keeping plans flexible, iteratively testing, monitoring, assessing, and revising them as needed to facilitate and leverage on-going learning. Of course this kind of adaptive management is not as easy in a five-year policy cycle as it is in a five-month technology cycle – but the principles are similar. Adaptation strategies should address present needs and priorities, but in a way that builds capacity to deal with future changes.<sup>1</sup>

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<sup>1</sup> To see the full set of principles for adaptation and collaborative capacity-building we have developed for weADAPT, go to <http://weadapt.org/knowledge-base/guidance/principles>.

The section that follows offers a step-by-step guide to using the linked resources through weADAPT and CIP.

## USING WEADAPT AND CIP TO ACCESS CLIMATE DATA

Before you embark on this process, you should conduct a basic vulnerability assessment, which will provide the foundation for your work.<sup>2</sup> In such an assessment, you will identify the key climate sensitivities in your study area or project site, based on the livelihoods / economic activities practiced and the infrastructure and services relied upon there. You might ask questions such as: When have climate impacts been experienced in the past? What time of year was it (episodes to look at in the climate data)? How often does it happen? What else was happening at that time that compounded the unfavourable climate conditions and made the impacts worse?

1. With that knowledge in mind, **clearly define the question** you wish to answer when looking at the climate data. For any location, there may be a wide range of climate data available, only some of which are relevant to what you are doing – for example, temperature projections are unlikely to be relevant in gauging future flood risks, but they would be in evaluating future irrigation needs. A clear planning or policy question will help you decide which data are important, and what level of detail is required. You should only include climate data and graphs in your reports that help explain the problem you are highlighting, the course of action you propose, and your reasons for selecting certain actions or interventions over other options.
2. Go to the map in weADAPT, called the Adaptation Layer.<sup>3</sup> Turn on the climate stations with the “**view climate stations**” button at the top of the page. Go to the place on the map where you are working and look at what placemarks are around there in terms of stations where climate data is available (indicated by yellow sun icons). Also check the other placemarks in the area to see what other projects are going on there: Has anyone else already conducted a climate analysis, vulnerability assessment, done an impact assessment or implemented an adaptation plan in the vicinity of your project site and uploaded information about it on weADAPT that you can learn from?

Click on the station closest to your study area or project site that has the most similar climate conditions. In some cases the closest station in terms of distance is not the most similar. Think about the influence of elevation, mountains, water bodies, forests, etc. when making your station selection. You will be shown a graph of **historical climate monthly averages** recorded at that location. Depending on your questions, you may want to look at data such as:

- When the rainy periods are – which month gets the most rainfall on average?
- The average temperature range through the year;
- What time period data are available for (how far back does the record go, and how recently does it end?).

You might like to download this graphic so that you can add it to your project documentation, because it gives a good overview of the average climate as it has been in this place over the last few decades. If the station is not close to your project / study site, you might want to add some text drawing attention to the extent that there might be local variability in the climate.

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<sup>2</sup> For our guidance on assessing vulnerability, go to <http://weadapt.org/knowledge-base/vulnerability/guidance-for-assessing-vulnerability>.

<sup>3</sup> See <http://weadapt.org/placemarks/maps>.

The extent of such variability is place-specific, depending on the topography, land cover, proximity to the ocean, etc.

3. Click through into CIP from the weADAPT placemark to look at more information that lies “behind” this overview of the **historical climate** at this station. Now you can look at the whole time series of the historical data (click on historical monthly data record), looking across all the years. Which climate variables are available in CIP? (Look at the drop-down menu.) How do these match up with the ones you wanted to look at, identified in Step 1? What extremes and patterns do you notice? What if the variables, derivatives and thresholds you are interested in are not shown in the graphs? You can download the raw data and create your own graphics.

**If you can’t find station data** for your city or project site on weADAPT or CIP, contact the national meteorological service and/or the local government office responsible for strategic information / GIS / scientific services and ask if they have data for your location. When you do, make sure to ask two important questions: Do they have the meta-data to give you, and has the data been quality-controlled?<sup>4</sup> If not, then this needs to be done before you can use it. The Climate Systems Analysis Group will do it for you if they can add it to their dataset and use it for downscaling. However, do note that this may take a few months to complete, depending on workloads. Contact us for more information.<sup>5</sup>

If you are doing a project at the **national or regional scale**, you might want more aggregate information than data collected at individual stations / point locations.

4. Next you can look at **future climate projections**. Clicking through to the future climate scenarios (also referred to as downscaled projections) for that station, you are presented with results from running numerous global climate models that have then been statistically downscaled to the station location. Look at the variables you are interested in and compare the spread of projections (generated by 10 different climate models) across the two different emissions scenarios (RCP 8.5 and RCP 4.5).<sup>6</sup> The default time period of projections displayed is 2040-2060, but you can change these on the slider bar as relevant to your needs.

While looking at the projections you might ask questions such as:

- What do these results suggest regarding the difference between what the climate has been in the recent past and what it might be by the middle of the century? Tip: Click on the grey “observed” series in the key of the graph to show the historical records “behind” the projected anomalies to show how big the projected (future) change is relative to the observed (historical) climate.
- Is there a clear direction of change at critical times of year that most of the models agree on? How much is that change? How wide is the uncertainty range? It is important to report the extent of projected change as a range, thereby communicating the spread of results from the various models (i.e. the extent to which the models agree or disagree).

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<sup>4</sup> Meta-data refers to information about the data (for example, how the data were generated, whether any processing has been carried out, etc.).

<sup>5</sup> You can email the weADAPT team at [info@weadapt.org](mailto:info@weadapt.org). To reach the CIP team, email [cip@csag.uct.ac.za](mailto:cip@csag.uct.ac.za).

<sup>6</sup> RCP = Representative Concentration Pathways, a new set of scenarios, based on different radiative forcing levels (linked to different concentrations of greenhouse gases), that are being used in generating the climate projections for the Intergovernmental Panel on Climate Change (IPCC) *Fifth Assessment Report* (due to be published in 2014). There are four RCPs. The climate projections based on two of these RCPs are presented in CIP. RCP 8.5 is the high-end scenario (most countries have continued with carbon intensive industries and lifestyles) and RCP 4.5 is the lower-middle scenario (emissions have been cut considerably, but more could still be done).

Remember that we are looking at multi-year averages here, so the values for single years would vary on either side of these average figures. You may want to download a few of the most relevant graphs that help to illustrate the headline messages you are coming up with.

5. Close the content box to reveal the map behind it. Look at what **other stations** are also nearby the project site (check across the different datasets). Look at the data for one or two other nearby stations to see if they reinforce what you saw at the first station or whether anything shows up as being quite different, either in the historical patterns and/or the future projections. If there are notable differences, then you need to give some thought to why that might be the case (e.g. significant differences in height of the station above sea level), or ask others with the relevant expertise to help. Don't ignore or smooth over those differences (e.g. by averaging); they may be important "red flags" about microclimates, inconsistencies in the historical climate record and/or about uncertainties in future projections. The decision-makers you are hoping to inform need to be aware of those considerations.
6. Look back over the information you have gathered during Steps 2-5 and ask: **So what?** What can you now say about how the climate has been in this place, how it might change in the future under various scenarios, and what this might mean for the people who live there, the work that they do, or the infrastructure and services that they rely on (i.e. the policy or planning question you set out to address in step 1). What could, and will you argue should, be done differently to adapt to current climate conditions and prepare for how these patterns might shift in the future?
7. Go back into weADAPT and search the Adaptation Layer for projects **elsewhere** tackling similar climate risks to see:
  - What adaptation options they are testing or promoting that might be worth considering as options in your study / project;
  - Who has experiences of implementing adaptation measures that you might be able to learn from? (For example, how did they select which option to go for? How did they finance it? How are they monitoring the impacts?)
8. Finally, document what you've done and **add it** to the weADAPT platform; the easiest way to do this is through the QuickShare form.<sup>7</sup> This way, if someone else wants to learn from your experience, or build on it further, they can. And if they need to do a climate assessment for their location, they can look at the steps you've followed as an example!

In the section that follows, we work through these steps in a case study to show how you might go about applying this guidance, using the resources available in both weADAPT and the Climate Information Portal (CIP).

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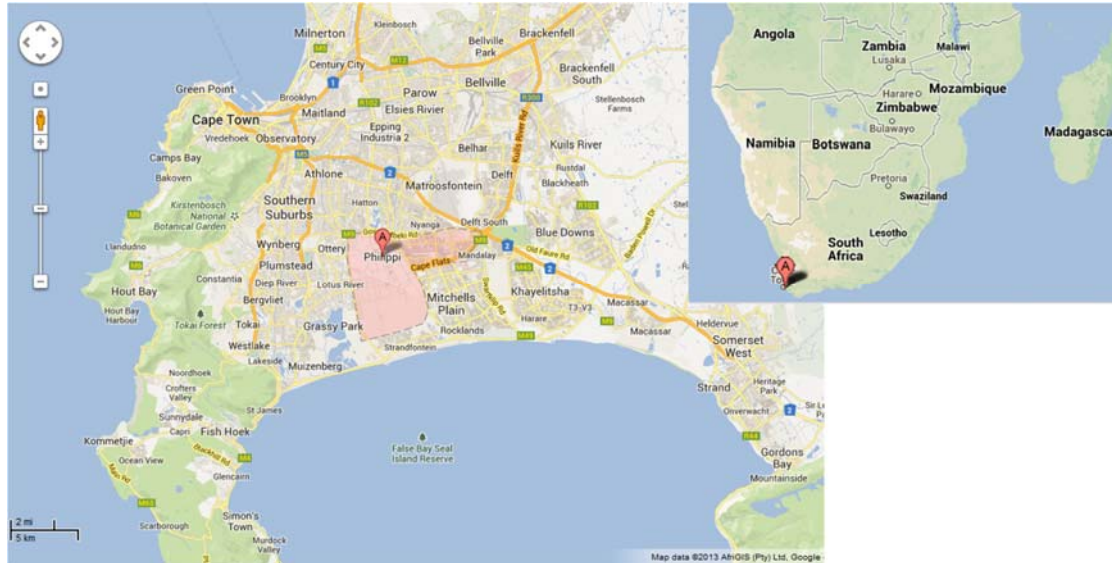
<sup>7</sup> See the QuickShare link at the bottom of this weADAPT page that guides users on how to share content: <http://weadapt.org/knowledge-base/guidance/share>.



## CASE STUDY: CAPE TOWN, SOUTH AFRICA

This case study focuses on land use management and zoning in a suburb of the city of Cape Town, South Africa, called Philippi (see Figure 1).

**Figure 1: Case study location: Philippi suburb, Cape Town**



Currently a large part (approximately 2000 ha) of Philippi, referred to as the Philippi Horticultural Area, is zoned as rural and mainly used for farming vegetables. To a much lesser extent, there is also livestock farming (cows, sheep and goats). Carrots, cauliflowers, lettuce, cabbages and a number of other crops are grown year-round and harvested four or five times a year. These vegetables supply local supermarkets as well as local informal traders. The Philippi Horticultural Area is thought to yield about 40% (some estimate up to 80%) of Cape Town's fresh produce and thus plays a key role in keeping healthy, nutritious food affordable. The farms also provide numerous jobs, especially low-skilled jobs, which are highly sought after in a city with roughly a quarter of the work force unemployed, many with very low levels of education.<sup>8</sup>

Philippi has a microclimate that keeps it cooler than its immediate surrounds in the summer, which is why it was earmarked for vegetable production a long time ago (mid-1800s) and remains highly productive.<sup>9</sup> The area overlays an aquifer making groundwater relatively cheap and easy to access by digging depressions where water collects (sump pits) and/or pumping from boreholes. However, it also makes many parts prone to regular flooding during the winter rainy season.

The city of Cape Town has rapidly grown around the farmlands and continues to do so. This places huge pressures on the land. Many Cape Town residents, both within the Philippi area and beyond, live in informal settlements (or slums), without land tenure, in temporary shacks and with only the most basic public services: communal taps and toilets, few access roads and open trenches for drainage. An estimated 400,000 households across the city qualify and are waiting for government subsidised

<sup>8</sup> For more background, including the history and demographics of the area, see Anderson, V., Azari, S. and van Wyk, A. (2009). *Philippi Community Profile*. South African Education and Environment Project, Mowbray, South Africa. [http://oscarsaunderson.co.za/downloads/Community\\_Profile\\_-\\_SAEP.pdf](http://oscarsaunderson.co.za/downloads/Community_Profile_-_SAEP.pdf).

<sup>9</sup> For a detailed history of the area and farming community see Rabe, L, 1992. *Die Groenteboere van Philippi*, Lantern, Special Edition, 1992. For a brief overview of the area's heritage see City of Cape Town, 2007. *Philippi Heritage Information Brochure*, City of Cape Town Heritage advice pamphlet #16: [http://www.capetown.gov.za/en/EnvironmentalResourceManagement/publications/Documents/HAP16\\_PhilippiHeritage.pdf](http://www.capetown.gov.za/en/EnvironmentalResourceManagement/publications/Documents/HAP16_PhilippiHeritage.pdf).

housing that has been promised. This places huge pressure on the government to secure suitable tracts of land where low-cost housing can be constructed to meet this growing demand. This is also a very political issue because votes in the local, provincial and national elections are tightly linked to public service delivery, moving people out of conditions of poverty and informality.

### Step 1: Clearly define the question

The planning question is: From an urban climate resilience/adaptation perspective, should Philippi Horticultural Area remain in use for vegetable production, or should it be rezoned from rural to urban and used to build low-cost housing?<sup>10</sup>

While there are of course many dimensions to making this choice, we have been asked to provide an input on the climate dimension of this question. We want to be able to say something about what climate risks farmers and farm-workers currently face, those that local residents face, and how these risks manifest as impacts. We then want to look at what projections of future climate suggest about how these risks might change in the medium to long term, so that decision-makers can factor these climate considerations into their land use zoning decisions, along with other priorities and decision criteria.

From a housing and mobility perspective we know that heavy winter rains are a key climate hazard that triggers extensive flooding in and around Philippi. Water collects in people's homes (especially in shacks), and along footpaths and roads. This standing water often mixes with local sources of waste and sewage. It makes people sick, makes it difficult to travel to work and school, damages household goods (furniture, electronics, clothes, bedding, etc.), and keeps people from doing other tasks because they spend their time bailing water.

Many residents of Philippi are particularly vulnerable to these climate impacts because they have pre-existing low levels of nutrition, immunity and poor health (many suffer from tuberculosis, and HIV prevalence is high). Local clinics and hospitals are overburdened and under-resourced, so access to health care is highly constrained. In addition, many Philippi residents who have jobs do low-skilled work and are readily fired and replaced if they miss work. Most households also have very low monthly incomes and no insurance cover, such that replacing possessions damaged by floodwaters is unaffordable.<sup>11</sup>

From a vegetable production perspective, excessive summer heat can be a problem. In prolonged hot, windy spells, plants can suffer from heat stress, scorching, sunburn and ultimately death.

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<sup>10</sup> This is a real and very contentious question being debated in Cape Town. See, for example: Battersby-Lennard, J. and Haysom, G. (2012). *Philippi Horticultural Area: A City Asset or Potential Development Node? Summary Report*. Report commissioned by Rooftops Canada Foundation Inc. – Foundation Abri International in partnership with the African Food Security Urban Network, Cape Town, South Africa: [http://africancentreforcities.net/download/assets/philippi\\_horticultural\\_area\\_summary\\_report\\_may\\_31\\_2012.pdf](http://africancentreforcities.net/download/assets/philippi_horticultural_area_summary_report_may_31_2012.pdf). iKapa Enviroplan, ICE (Pty) Ltd and City Think Space (2012). *Urban Edge and Development Guidelines Study for the Schaapkraal Smallholdings Area and Environs in the Philippi Horticultural Area*. Report 1560/1.6. Status quo report prepared for the City of Cape Town: [http://www.capetown.gov.za/en/PublicParticipation/Documents/Stat\\_Quo\\_Report\\_Sept2012.pdf](http://www.capetown.gov.za/en/PublicParticipation/Documents/Stat_Quo_Report_Sept2012.pdf).

For media coverage of this issue, see, for example:

Erasmus, D. (2010). Historic farming community under threat. *Farmer's Weekly*, 1 November. <http://www.farmersweekly.co.za/article.aspx?id=5405&h=Historic-farming-community-under-threat>. Swart, H. (2012). Fight for Philippi: Cape farmland could lose ground to housing. *Mail & Guardian*, 16 November. <http://mg.co.za/article/2012-11-16-00-fight-for-philippi-cape-farmland-could-lose-ground-to-housing>.

<sup>11</sup> For a closer look at the nature and effects of flooding in informal settlements in Philippi, see these two articles:

Drivdal, L. (2013). Flooding in the informal settlement of Egoli, Cape Town. *weADAPT*, 12 June. <http://weadapt.org/placemarks/plain/view/886>.

Drivdal, L. (2013). Flooding in the informal settlement of Graveyard Pond, Cape Town. *weADAPT*, 12 June. <http://weadapt.org/placemarks/plain/view/887>.

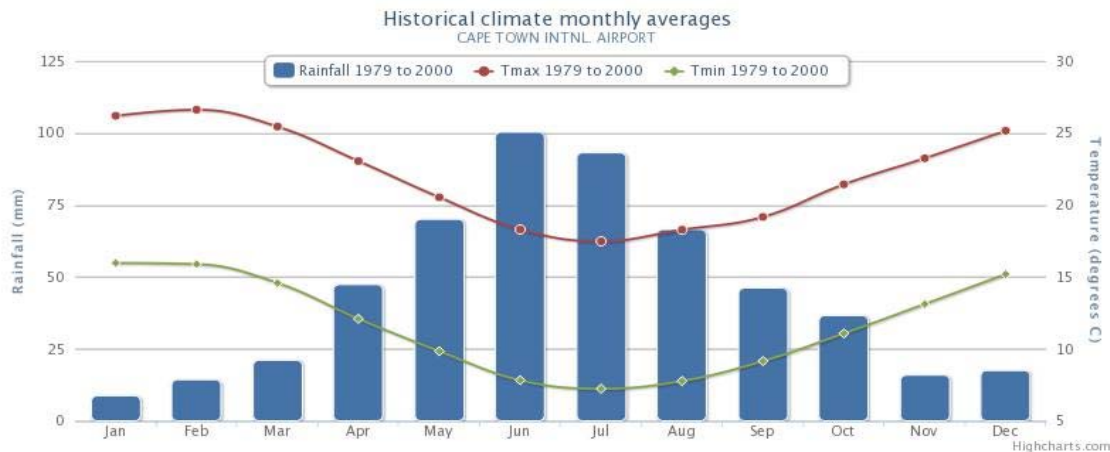
Thus, we want to look at both the available **rainfall data**, as it relates to flooding (i.e. how much rain falls per month, how many days it rains per month, how heavily it rains within a day, etc.), and **temperature data**, as it relates to heat stress (i.e. daily maximum temperatures, number of very hot days, etc.).

### Step 2: View climate stations on weADAPT

When looking at Cape Town on the Adaptation Layer in weADAPT, we find two stations, one of which looks to be quite close to the Philippi area. Clicking on it shows that it is positioned at Cape Town International Airport. The graph of the historical climate monthly averages (see Figure 2 below) shows that:

- There is an observed data record stretching from 1979 until 2000;
- The rainy season starts around April/May and coincides with the onset of the colder winter season (on average 17.5°C maximum and 7°C minimum in July);
- June and July are the months that have had most rainfall, an average of 100.47 mm and 93.49 mm, respectively;
- The rainy season tapers off in October, followed by dry and hot summer months from December through to March, with average monthly maximums peaking at 26.6°C in February.

**Figure 2: Climate monthly averages at Cape Town International Airport, 1979–2000**



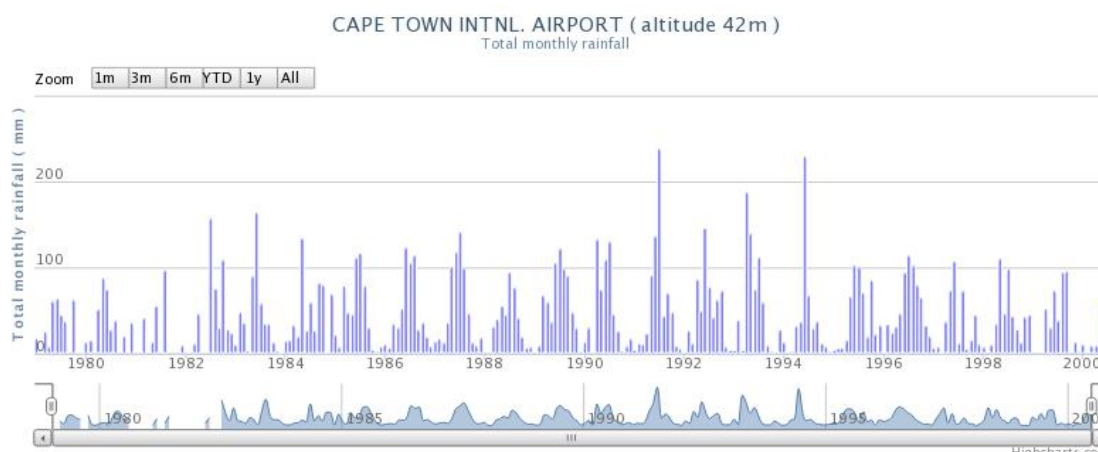
The airport station is only about 15 kilometres from the Philippi area. Both are on the Cape Flats and so away from the climatic influence of the Table Mountain range. The climate record from the airport is thus a good proxy for Philippi. The airport is slightly farther away from the coast than Philippi and so is likely to get slightly hotter in the summer, with less effect from the cool sea breeze.

### Step 3: View historical climate data on CIP

By clicking through to further explore this data in the Climate Information Portal (CIP), we can go on to look at the full timeseries “behind” these averages for numerous temperature and precipitation variables. The timeseries of total monthly rainfall (see Figure 3 below) clearly shows the seasonal cycle, the winters generally reaching around 100 mm per month. It also show considerable variability between years, with some relatively dry winters (e.g. 1988) and some particularly wet years in which there are months that significantly exceed this average (e.g. 1991 and 1993), when the risk of extensive flooding was particularly high.



**Figure 3: Total monthly rainfall, Cape Town International Airport, 1979–2000**



It might not only be total monthly rainfall that indicates high flood risk, but also how many days in the month it rained and/or how many days in the month received heavy downpours (i.e. the distribution of rainfall within a month). These aspects of how heavily and for how long it rained have considerable implications for the saturation of the ground and the volumes of runoff, which translate into flooding.

By looking at the number of rain days per month and the number of heavy rain days (defined as over 10 mm) it becomes clear that the months with most rain days and/or the heaviest rain days do not all correspond with the months with the highest total monthly rainfall. The months that do stand out as having particularly high numbers all round, when extensive flooding would be expected, are shown in Table 1 below.

**Table 1: Months with highest total monthly rainfall, Cape Town International Airport**

Month and year	Total rainfall	Total rain days	Total heavy rain days (>10mm)
June 1983	164.10 mm	13	5
April 1990	133.50 mm	16	5
July 1990	131.20 mm	16	4
July 1991	239.20 mm	15	6
April 1993	188.80 mm	7	4
June 1994	230.00 mm	17	9

The observed temperature data at this station similarly shows a very clear annual cycle, but with some variability between years. It is striking that all the months with the highest average maximum temperature are in the last few years of the record. However, for our purposes of assessing risk of heat stress on vegetable crops, these monthly averages are not so useful. Rather, it is the temperature and number of days of extreme heat (i.e. daily maximum temperatures) that are of interest.

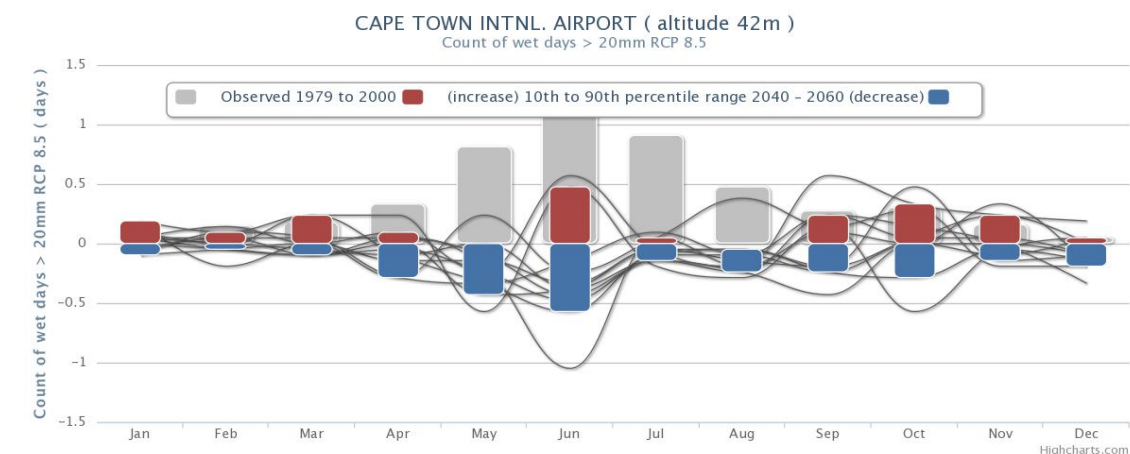
**Step 4: View future climate projections**

Going on to look at the statistically downscaled CMIP5 projections<sup>12</sup> for this station for the middle of the century, 2040–2060, most of the model results are indicating a slight decrease in average total monthly rainfall during the winter months of May, June, July and August. However, for July a few

<sup>12</sup> CMIP5 = Coupled Model Intercomparison Project Phase 5, a new set of climate model experiments coordinated between 20 climate modelling groups from around the world.

models indicate a possible increase in total monthly rainfall under the RCP8.5 scenario (high emissions), so this cannot be ruled out. This possible wetting is less evident under the RCP4.5 scenario (medium-low emissions), where the majority of models show a likely decrease in total monthly rainfall over the winter months. The counts of average number of wet days per month, those >5 mm and the heavy rain days, i.e. >20 mm and > 95 percentile of the observed, mostly show very slight decreases across the winter months for both RCP 8.5 and RCP 4.5. However, in some months the spread of model results span zero, particularly for June in the >20mm rain day projection (see Figure 4 below), which shows an average increase in the number of heavy rain days is also possible.

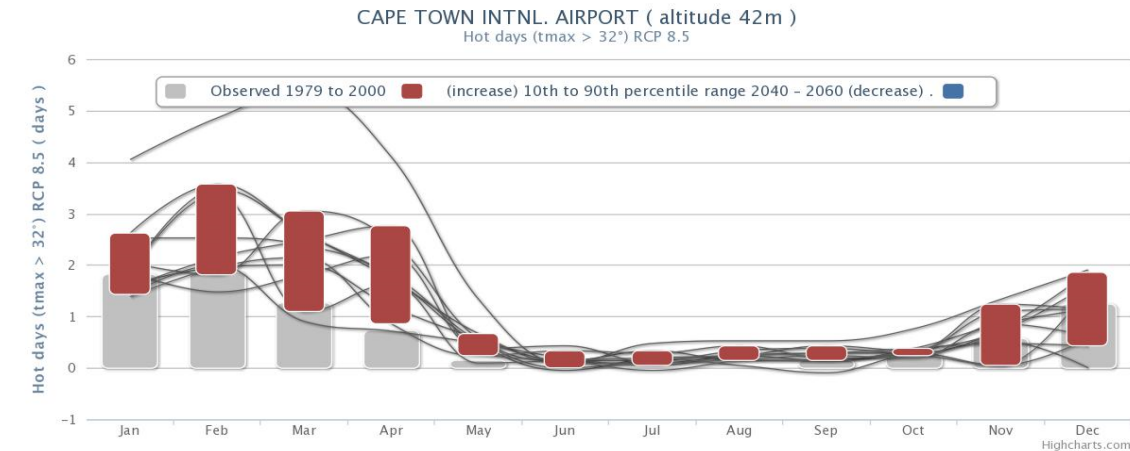
**Figure 4: Anomalies in the count of wet days >20 mm at Cape Town International Airport station projected under RCP8.5 for 2040-2060**



The downscaled general circulation model (GCM) projections using data from this station suggest that, in terms of rainfall, the risk of winter flooding is likely to stay similar to what it is now, or even reduce slightly, in the Philippi area. It is important not to jump too quickly to a conclusion after only looking at one station. We need to check if this pattern is evident at other stations too (step 5).

The temperature projections downscaled to this station show a clear increase in monthly average maximum temperature, about 1.5°C to 2.5°C in the summer months (January, February, March) under RCP8.5 and 1°C to 2°C under RCP4.5. However, the more useful variable for us is the count of very hot days, those with maximum temperatures exceeding 32°C. On average, between 1979 and 2000, there were one or two days per month of such heat in January, February and March. By the period 2040-2060 this is projected to increase by a further two or three days (i.e. the incidence of hot days >32°C could double or even triple), as shown in Figure 5. This could threaten the productivity of various crops unless adaptation measures are taken, such as covering with shade cloth and/or additional irrigation.

**Figure 5: Anomalies in the count of hot days >32°C at Cape Town International Airport projected under RCP8.5 for 2040-2060**



### Step 5: Look at data for other nearby stations

Looking through the data provided for two of the other stations in the broader region, the Cape Point and Cape Agulhas stations, the projections for winter rainfall in the months of May, June, July and August seem to show similar patterns that support our earlier conclusion.

In terms of temperature, the Cape Point station shows much smaller observed and projected numbers of hot days >32°C, but this might be expected because the station is right on the coast and so kept cooler by the influence of the sea. An inland station in the region, Robertson, shows much higher figures, with an average of nine hot days >32°C per month in January, eight in February and 5.5 in March observed in 1979-2000. The projections show this could increase by a further four to six days, three to five days, and 2.5 to 4.5 days, respectively, by the period 2040-2060 under RCP 8.5. This pattern of increasing hot days is consistent with the trend at the airport station, near Philippi.

### Step 6: Ask, 'so what?'

The data for observed rainfall and projected rainfall suggests that flood risk is likely to stay similar to what it is now, or even reduce slightly. As discussed in the introduction section, the risk of flooding in Philippi is currently high, marked by the regular need for disaster response interventions, which means that adaptation is urgently required. The fact that the climate projections show a slight decrease in winter rainfall means that adaptation choices and investments can be designed around current levels of risk without concern that these will be exceeded in the coming decades.

However, rainfall is only one component of flooding. Whether an area floods and how badly it floods depends to a large extent on what the ground surface is, how much the rainwater runs off over the surface or seeps into the ground, what the groundwater level is, what drainage there is and how functional that drainage is (e.g. are the gutters and inlets blocked with litter and garbage?). Climate data cannot tell us this. We could therefore advise that while the climate data does not suggest an increasing risk of flooding linked to changing rainfall patterns, it would be worth modelling the hydrology of the area based on the range of current conditions experienced and see how the flood risk changes with a shift in surface cover from plants to paved surfaces.

The temperature data shows a clear and considerable increase in monthly average maximum temperatures projected by the middle of the century. Even more significantly, they suggest a sizable increase in the number of very hot days (exceeding 32°C), which poses a threat to vegetable crop

yields in the Philippi area and thus to the viability of farming in the area, unless investments are made in adaptation measures such as installing shade cloth tunnels and increasing irrigation capacity. However, these adaptation measures could further strain the water availability in the area. That said, having housing instead of vegetable production could well increase the total annual water demand in the area even more. This is something that would require a detailed technical study to assess and be important in making a decision over zoning and potential changes in land use in the area.

### **Step 7: Find other places facing similar issues**

Searching the Adaptation Layer revealed a very interesting study on the effects of urbanisation and climate change on flooding in Quy Nhon City, Vietnam, which could provide some useful ideas and methods for taking this work forward.<sup>13</sup> Searching the weADAPT site as a whole led to an article on water-sensitive urban design in the context of Australia that also looks like it could be very relevant to this question of flooding, stormwater management and increasing heat stress in Cape Town.<sup>14</sup>

### **Step 8: Add your story to weADAPT**

We hope that developing and sharing this case study on using climate information to inform land use management decisions in Philippi, Cape Town, South Africa, will be useful to you in your work on adapting to current and emerging climate risks. If you do something similar please share your results with others in the weADAPT user community so that we can learn from each other and avoid needless replication. The online version of this case study is available as a weADAPT article at: <http://weadapt.org/knowledge-base/using-climate-information/using-climate-information-case-study>.

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<sup>13</sup> See DiGregorio, M. (2013). Study on the impact of Climate Change on the Urban Plan of Nhon Binh Ward, Quy Nhon City. *weADAPT*, 26 March. <http://weadapt.org/placemarks/maps/view/881>.

<sup>14</sup> See Demuzere, M. (2012). Watering our cities: The capacity for Water Sensitive Urban Design to support urban cooling and improve human thermal comfort in the Australian context. *weADAPT*, 9 November. <http://weadapt.org/knowledge-base/urban-adaptation-to-climate-change/watering-our-cities-an-australian-perspective>.