DEMOCRATIC REPUBLIC OF THE CONGO

AFRICAN DEVELOPMENT BANK

NATIONAL CLIMATE CHANGE PROFILE

PRODUCED IN COLLABORATION WITH:
African Climate & Development Initiative, University of Cape Town;
Climate Systems Analysis Group, University of Cape Town;
Energy Research Centre, University of Cape Town; Cirrus Group.

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DEMOCRATIC REPUBLIC
OF THE CONGO

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ACKNOWLEDGEMENT

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1. BACKGROUND

1.1 Geographic and socio-economic context

The Democratic Republic of the Congo (henceforth 'the DRC', shown below in Figure 1-1) is a hot and humid country in Central Africa, lying across the equator. The DRC borders the Central African Republic and South Sudan to the north; Uganda, Rwanda, Burundi and Tanzania to the east; Zambia and Angola to the south; the Republic of the Congo to the west and the Atlantic Ocean to the southwest. It is the second largest country in Africa by area (2,266,000 km^2) and the fourth most populous (~82,200,000 people) country in Africa. Approximately 38% of the DRC's population is urban, of which ~75% are living in informal settlements, and ~13.5% of the total population have access to electricity Despite the country's relatively large total GDP (14th largest in Africa at ~35 billion USD per year), the DRC has a relatively low GDP per capita (~445 USD per year, ranked 43rd in Africa). Besides the capital Kinshasa, the two next largest cities Lubumbashi and Mbuji-Mayi are both mining communities and the DRC's largest export is raw minerals. The DRC has a low level of human development and according to the Human Development Index (0.44, one of the lowest in Africa) is 176th out of 187 countries. In addition, the DRC has a high gender inequality index (~67, 5th highest in Africa), and a GINI co-efficient score of ~42.1, indicating a wide disparity in wellbeing, income and access to opportunity between different social and gender groups. The ND-GAIN index summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience. The DRC's ND-GAIN index is 32.5, the 7th lowest in Africa, due to a high vulnerability score and a low readiness score. This means the country has both a great need for investment and innovations to improve readiness and a great urgency for action. Key socio-economic and demographic indicators are further presented and summarised in Table 1-1, below.

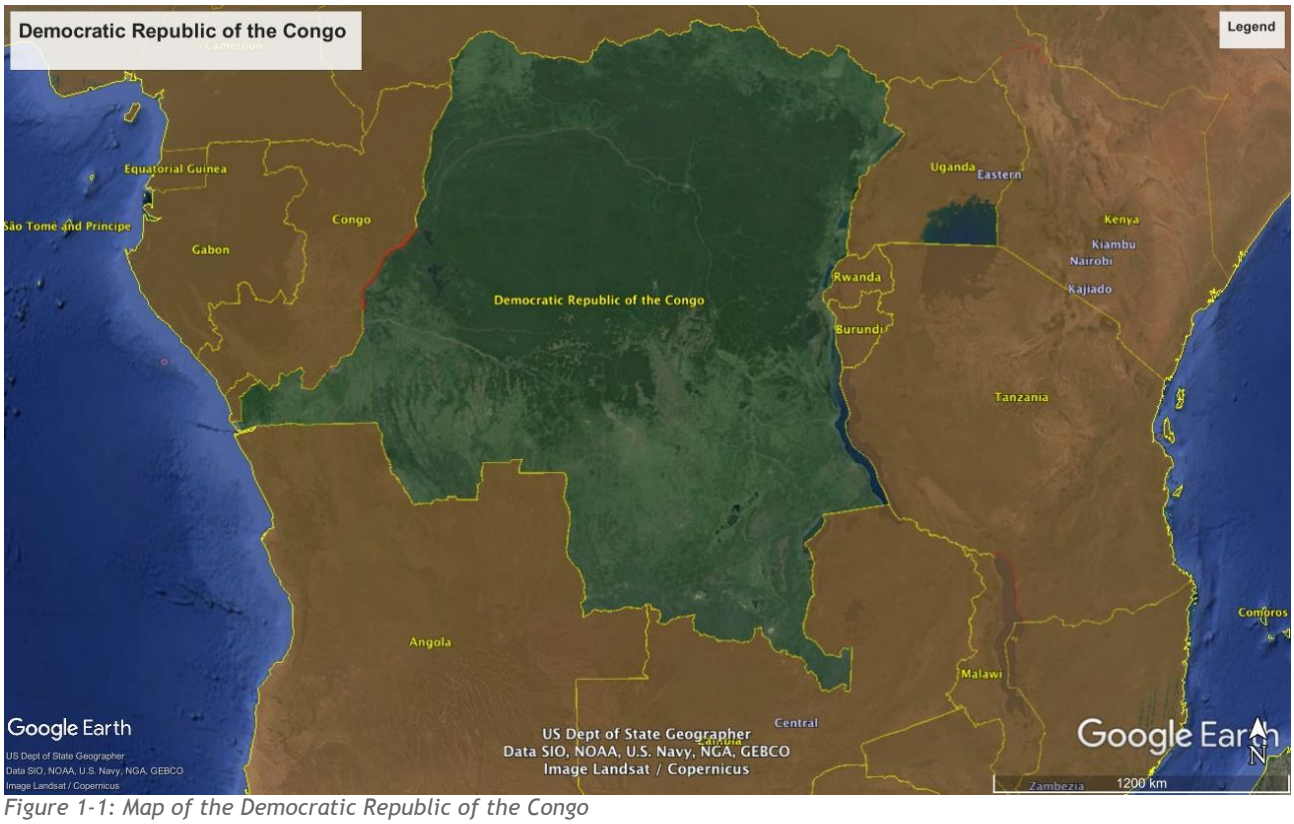


Figure 1-1: Map of the Democratic Republic of the Congo

Table 1-1: Socio-Economic Context of the Democratic Republic of the Congo (reference year ranges from 2014 - 2017)

VARIABLE		SCORE/TOTAL	UNIT	RANK (OUT OF 54)
Geography, socio-economy and demographics				
Population[1]		82,242,685	people	4
Population growth rate[1]		3.2	% population .yr^{-1}	7
Population density[1]		36	People/km^2	37
Land area[1]		2,265,639	km^2	2
% Urban population[1]		38.3	% population	33
% Urbanisation rate[2]		4.5	% population .yr^{-1}	10
Economy: total GDP[2]		35.0	USD billions .yr^{-1}	14
Economy: GDP by PPP[2]		63	billion international dollars per capita .yr^{-1}	17
Economy: GDP/capita[2]		445	USD per capita /yr	43
Population below the poverty line[3]		77.1	% below USD 1.90 per day	3
Gender Inequality Index[4]		67.3		5
GINI co-efficient[3]		42.1		31
HDI[5]		0.44		41
Access to electricity[6]		13.5	% population	47
Summary indicators of climate change vulnerability				
Number of people affected by flood events[7]		441,605	people	20
Population living within 100 km of coast[8]		1,376,366	people	25
Population living in informal settlements[6]		74.8	% urban population	11
Incidence of malaria[9]		246	cases per 1000 population at risk	16
ND-Gain Vulnerability Index[10]	Total	32.5		47
	Readiness	0.24		49
	Vulnerability	0.59		14

2. CLIMATE AND WEATHER

The Democratic Republic of Congo (DRC) is a large country which straddles the equator and the climate varies from hot and humid in the Congo River basin to cooler and dryer over the southern highlands.

The DRC can be divided into 5 climatic regions based on annual total rainfall as well as variations in the seasonal cycle of rainfall. These zones are illustrated in **Figure 2-1** and **2-2** below and a summary description can be found in **Table 2-1** below.

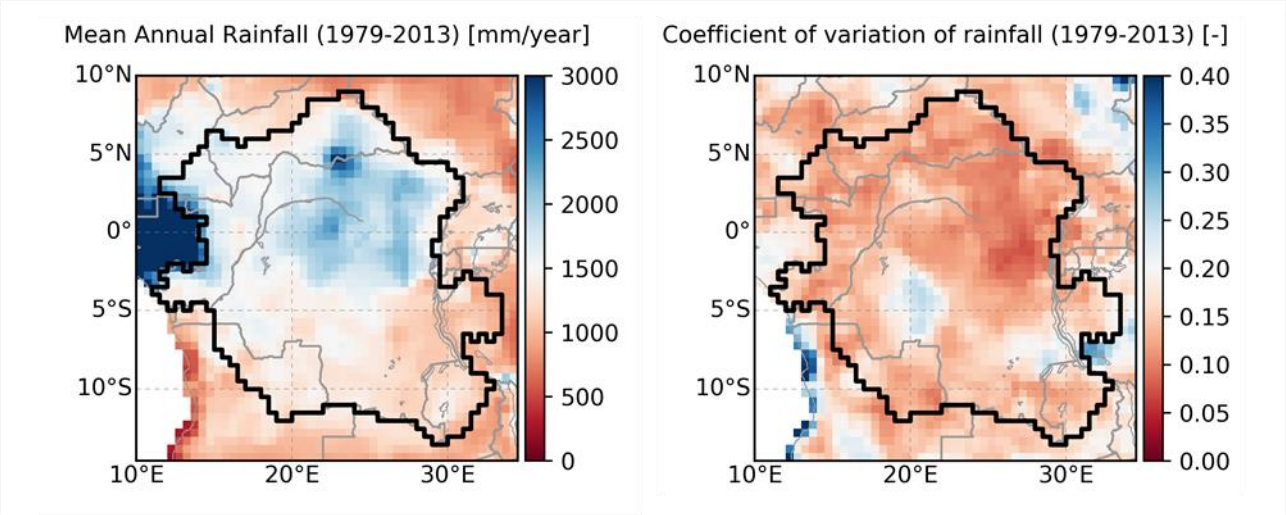
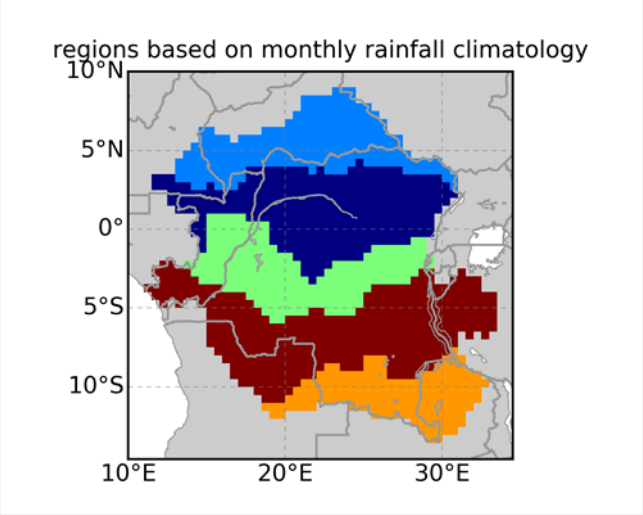


Figure 2-1: Main characteristics (magnitude and variability) of rainfall in the DRC and its region



Coloured regions on the map (above) correspond to the colours used in rainfall and temperature graphs (below)

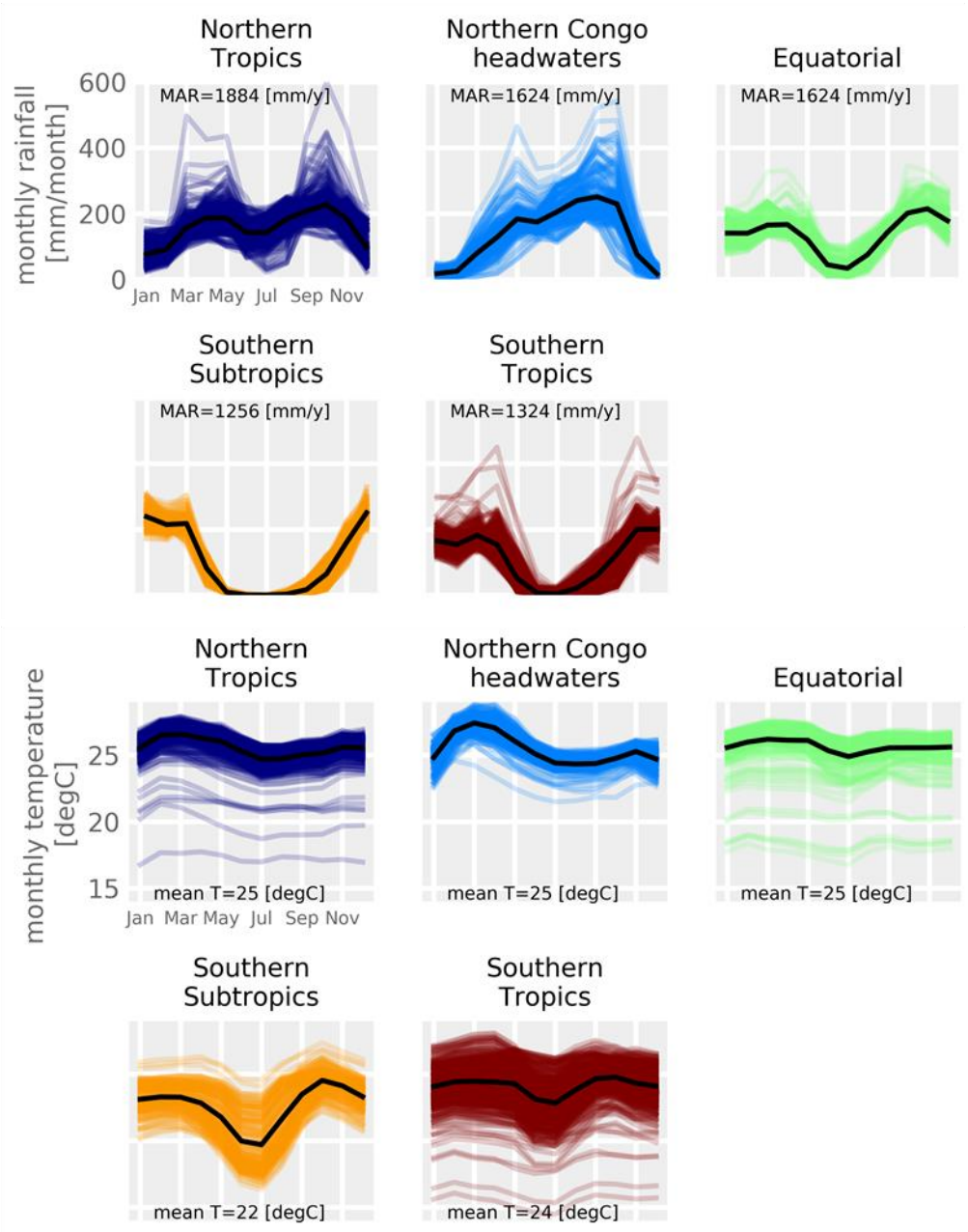


Figure 2-2: Rainfall regions of the Democratic Republic of the Congo based on similarity of standardised rainfall climatology, and their rainfall and temperature climatologies

Table 2-1: Main rainfall regions of the DRC

Northern Tropics	Very high rainfall region where the mean annual total rainfall averages 1900 mm/year and the daily mean temperature is 25° C. Interannual variability of rainfall is low. Rainfall occurs all year round but primarily from March – November with two peaks during March – May and September – November. Seasonal variation in temperature is very low (< 5° C).
Equatorial	A high rainfall region which receives annual total rainfall of 1620 mm/year and a daily mean temperature of 25° C. Interannual variability of rainfall is low. Rainfall displays a clear seasonal cycle with a short relatively dry season from June – August. Rainfall during the rest of the year is relatively constant with the exception of a small peak during March – May and October – November. Seasonal variation in temperature is very low (<4° C) and spatial variation is almost absent.
Northern Congo headwaters	A high rainfall region which receives annual total rainfall of 1620 mm/year but reaches almost 3000 mm over the southern-central parts, and a daily mean temperature of 25° C. Interannual variability of rainfall is low. Rainfall displays a clear seasonal cycle with rainfall occurring from March to November and peaking in April (~200 mm/month) and especially from August – October (~250 mm/month). Seasonal variations in temperature are low (<4° C) with warmest temperatures around the onset of the rainy season (March – May).
Southern Tropics	A high rainfall region which receives annual total rainfall of 1320 mm/year and the daily mean temperature is 24° C. Interannual variability of rainfall is generally low. Rainfall displays a clear seasonal cycle with a relatively dry season from May – September. Rainfall during the rest of the year is relatively constant averaging around 190 mm/month. Seasonal variations in temperature are very low (<4° C), however spatial variations are high (varying by up to 15° C).
Southern Subtropics	A high rainfall region which receives annual total rainfall of 1260 mm/year and the daily mean temperature is 22° C. Interannual variability of rainfall is low. Rainfall displays a clear seasonal cycle with a dry season from May – September and wet season from December to May where it averages just over 200 mm/month. Seasonal variations in temperature are low (~5° C).

2.1 Observed historical climate variations and climate change trends

The majority of the Democratic Republic of Congo experiences **relatively low rainfall variability** on an inter-annual basis. On **decadal time scales** the DRC also experiences some decadal variability with some periods being relatively drier or wetter than others. This variability can be seen in the supporting evidence plots provided in the supplementary Appendix **(Figures A-1 to A-4).**

Long term trends across the region show **increasing temperatures** over the period 1979 – 2015, although that trend appears to be slightly weaker in the latter part of that period. The trends are strongest for the two more northern regions. Long term trends in total annual rainfall and rainfall frequency are strongly negative and statistically **significant** for the Northern Tropics and Equatorial regions, but no trend is evident in the frequency of extreme rainfall events, a similar though less significant change is seen in the Southern Tropics. The far northern and southern regions show a different story with an increase in total annual rainfall and an increase in extreme rainfall frequency. Long term trends and variability in the Democratic Republic of Congo region are summarized in **Table 2-2** below and illustrated further in the supplementary Appendix **(Figures A-1 to A-4).**

Table 2-2: Summary of trends in rainfall and temperature attributes in the DRC (1979 - 2015)

REGION	MEAN T [DEG C/DECADE]	TOTAL RAINFALL [MM/DECADE]	EXTREME RAINY DAYS [DAYS/DECADE]	RAINY DAYS [DAYS/DECADE]
Northern Congo headwaters	+0.27	slight upward	+1.48	-4.02
Northern Tropics	+0.23	-44.2	not evident	-5.64
Equatorial	+0.07	-48.4	not evident	-4.33
Southern Tropics	+0.10	downward	not evident	-1.61
Southern Subtropics	+0.13	upward	+1.14	not evident

2.2 Projected (future) climate change trends, including temperature, precipitation and seasonality

Projected changes in main attributes of climate for the Democratic Republic of Congo region are summarized in Table 2-3, below, and described in Sections 2.2.1 and 2.2.1. Additional analysis and visualisation of projections be found in **Figures A-5 to A-8** in the supplementary Appendix.

2.2.1 Projected changes in precipitation from present to 2100

Rainfall projections across the Democratic Republic of Congo regions show a pattern of **potential increased rainfall** emerging in the second half of the 21st Century. That pattern appears to be consistent for at least half the CMIP5 model ensemble, with the remainder projecting no significant change. **The increase in rainfall** seems to be strongly associated with increase **in the high intensity rainfall events rather than in the frequency of rainy days**. It must be noted that these results are derived from GCM projections which may not accurately represent changes in extreme rainfall dynamics. They are, however, consistent with the increased convective rainfall intensity (e.g. thunderstorm-related rainfall) expected in a warmer climate.

2.2.2 Projected changes in temperature from present to 2100

Daily mean air temperature is projected to be between 1.5and 2.5°C warmer in the Democratic Republic of Congo regions by the 2050s. By 2100 the range of projected temperatures is greater with increases of between 3°C to 6°C.

Table 2-3: Summary of projected climate changes across regions of the DRC for key climate variables by 2050

REGION	AVERAGE DAILY MEAN TEMPERATURE [°C]	TOTAL ANNUAL RAINFALL [MM/YEAR]	NUMBER OF HEAVY RAINFALL [DAYS/YEAR]	RAINY DAYS [DAYS/YEAR]
Northern Tropics	Increasing +1.5°C to +2.5°C by 2050s but changes evident in next decades	Normal to increasing, ranging from no change to up to 15% increase by 2100. could become evident after 2060s	Increasing, ranging from small increase up 50% by 2100. Change could become evident in the 2040s	No consistent signal in projections
Equatorial		Normal to increasing, ranging from no change to 15% increase by 2100. Change could become evident after 2050s		
Northern Congo headwaters		Normal to increasing, ranging from no change to 15% increase by 2100. Change could become evident after 2050s		
Southern Tropics		Normal to increasing, ranging from no change to 10% by 2100. Change could become evident after 2050s		
Southern Subtropics		Normal to slight increasing, ranging from no change to up to 15% by 2100. Change could become evident after 2070s		Normal to decreasing, ranging from no change to a decrease of up to 10%. Change could become evident in the 2040s

2.3 Expected climate vulnerabilities

NOTE: Determining vulnerability of different sectors to climate variations or change is extremely challenging as there are many factors involved in vulnerability and different approaches can yield different results. The vulnerabilities presented here are based on UNFCCC reporting documents, such as national communications or national adaptation plans of action where available, and other literature where UNFCCC documents are not available.

In wet and tropical DRC access to drinking water is largely inadequate, despite the country being rich in water resources. Possible increase in extreme rainfall events and increasing temperatures is likely to further complicate access to safe drinking water, as well as worsen the ecological conditions of already degraded natural environments. Political instability and conflict has resulted in displacement of people, and with the highly uneven distribution of benefits from the DRC's rich natural resources the majority of the population operates in the unofficial economic sectors with very limited capacity to adapt to increase in extreme temperatures and rainfall events, as well as to the slower knock-on effects that climate change may have on income generating activities. Low topography coastal areas, where land is already flooded by sea water at high tide, are vulnerable to sea-level rise and associated stresses, while hydropower may stand to benefit from a possible increase in annual rainfall if managed appropriately.

Table 2-4: Broad scale sectoral vulnerabilities and potential climate change impacts in the DRC

SECTOR	IMPACTS
Agriculture	Reduced maize yields owing to drought at sowing or flowering time Increased groundnut yields owing to increased temperatures Changing crop yields owing to changing soil characteristics Change to the incidence of pests, disease and insects Reduced agricultural yields owing to marine flooding
Fisheries	Reduced coastal biodiversity owing to changing ocean dynamics Salinization of water tables and mangrove soils owing to marine flooding Maritime navigation disturbed owing to sand silting of the lower course of the Congo River
Water resources	Decreased water quality and destruction of infrastructure owing to extreme rainfall Reduced availability of water resources in the South-Eastern part of the country (Katanga), owing to reduced rainfall Declining lake levels related to changes in snow melt Increased potential for transboundary conflicts over water
Built infrastructure and human settlements	Increased coastal erosion and loss of coastal infrastructure, including residential houses, roads, hotel establishments, owing to changing ocean dynamics Damage to or destruction of Infrastructure due to flooding of the Congo River owing to extreme local rainfall, with the Mateba Island particularly at risk
Human health	Increased prevalence of water-borne diseases, due to flooding of the Congo River owing to extreme local rainfall Increased prevalence of vector-borne diseases such as malaria, especially in the Low-Congo area, owing to increased temperatures Increased frequency of Cerebral Vascular Accidents (CVA), particularly amongst the elderly

3. CLIMATE CHANGE MITIGATION, GREENHOUSE GAS EMISSIONS AND ENERGY USE

The major carriers of the DRC's energy mix, and the energy demands of major economic sectors, are summarised in Section 3.1, below. The major sources of GHG emissions, described by fuel source and sector, are described in Section 3.2. The latter section also includes summarised statistics on the DRC's agriculture sector, historical land use change and vegetation cover.

3.1 National energy production and consumption

The majority of DRC's energy sector is driven by the domestic and industrial use of biofuels, which accounts for ~93% of energy production and 90% of energy consumption, (Table 1-1 and 1-2 below). With respect to national energy production, the remaining 7% is accounted for by oil (4%) and hydropower (3%). Total national production of electricity is limited to ~0.8 MTOE per annum, of which ~99.9% is generated by hydroelectricity and the remaining ~0.1% provided by a mix of oil and gas. Electricity is used mainly for industry and in some urban areas. The split between formal and informal energy use is reflected in the total amounts of energy consumed by various sectors (Table 3-3 below). The residential sector accounts for the majority of national energy consumption (16.6 MTOE), followed by industry (3.4 MTOE) and then transport (1.5 MTOE). The total annual GHGs emitted by the abovementioned sectors and fuel carriers are described further in Section 3.2.

Unless stated otherwise, all energy figures are derived from UN Stats (2014) [10]; World Energy Council (2016); [11]; and the World Resources Institute (2013) [12]. Agriculture & forestry-related emissions are also reported from Food and Agriculture Organisation (2014-2017) [14] and Global Forest Watch. (2015-2017) [15].

3.1.1 National energy production, primary energy supply and national energy consumption

The tables and figures below describe the DRC's energy sector, including total national energy production, primary energy supply and national energy consumption by fuel carrier and sector.

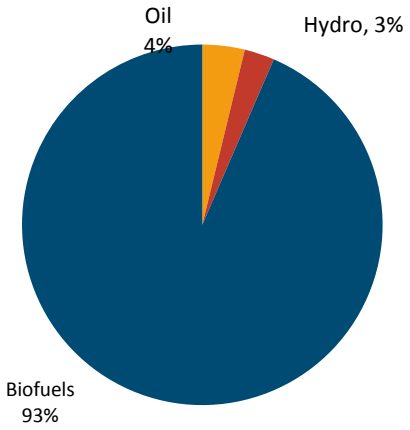


Figure 3-1: Distribution of DRC's national energy production between major energy carriers (2014-2016)

Table 3-1: National energy and electricity production in the DRC (2014-2016)

NATIONAL ENERGY PRODUCTION		
Source	**Total (MTOE)1**	**% of total energy production**
Oil[11]	1.1	3.8
Hydro[11]	0.8	2.7
Biofuels[11]	26.3	93.5
Total national energy production	28.2	
Electricity[6]	Hydro	99.9
	Oil	0.05
	Gas	0.08

[1] *Energy is expressed in 'Megatonnes of Oil Equivalent', where 1 Tonne Oil Equivalent = 11,630 KiloWatt hours (KWh)*

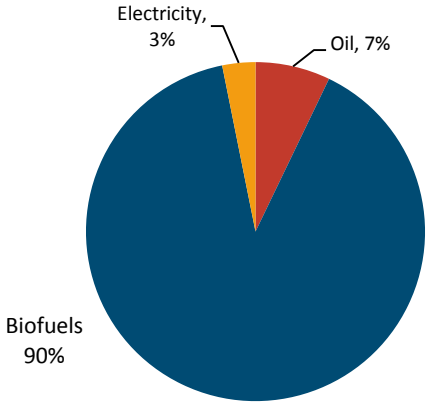


Figure 3-2: Distribution of DRC's national energy consumption by major energy carriers

Table 3-2: The DRC's national energy consumption by energy source

CONSUMPTION BY ENERGY SOURCE[11]	
Source	**Total (MTOE)**
Oil	1.5
Biofuels	19.3
Electricity	0.7
Total national energy consumption by source	21.5

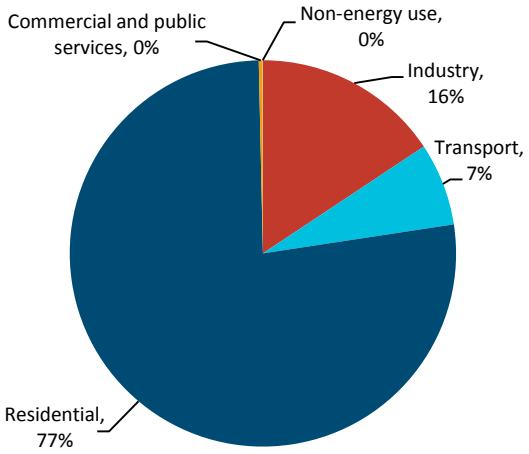


Figure 3-3: Distribution of the DRC's national energy consumption by sector (2014-2016)

Table 3-3: The DRC's national energy consumption by sector (2014-2016)

CONSUMPTION BY SECTOR[11]	
Sector	**Total (MTOE)**
Industry	3.4
Transport	1.5
Residential	16.6
Commercial and public services	0.1
Non-energy use	0.0
Total national energy consumption by sector	21.5

Table 3-4: The DRC's national total primary energy supply (estimated for 2014-2016)

TOTAL PRIMARY ENERGY SUPPLY[11]	
Source	**Total (MTOE)**
Oil	1.5
Gas	0.0
Hydro	0.8
Biofuels	26.3
Electricity	0.09
Total primary energy supply	28.7

3.2 National greenhouse gas emissions by source and sector

As described in 3.1, above, biomass fuels are by far the largest source of energy for domestic and industrial applications. Excluding these biomass fuels, oil is the largest contributor to the DRC's GHG emissions from fuel combustion (~2.6 MT CO_2e). Although gas is also used for fuel combustion, the relative volume of GHG emissions are negligible (IEA, 2013). The sector that accounts for the largest proportion of national GHG emissions from fuel combustion is transport by road (2.4 MT CO_2e), followed by manufacturing and construction (0.2 MT CO_2e) (IEA, 2013). The largest sources of GHG emissions are not from the energy sector, but rather from land use change and forestry (LUCF) (~168 MT CO_2e). Other major sources of emissions are agriculture (~18 MT CO_2e) and waste (~10 MT CO_2e) (CAIT, 2013).

Section 3.2.1, below, describes GHG emissions from fuel combustion – these figures include direct combustion of fuels as well as conversion to other forms of energy (e.g. as electricity). The latter figures are based on statistics from the International Energy Agency (IEA). Section 3.2.2, further below, describes GHG emissions from all sectors of national energy consumption, which therefore includes emissions from fuel combustion, industrial/manufacturing processes, household-level energy consumption and AFOLU (Agriculture, Forestry and Other Land Use). The latter figures are compiled by the World Resources Institute's Climate Access Indicator Tools (CAIT), which employs different methodologies and reporting standards to the IEA. Therefore, while there is some resultant duplication between the two datasets, each provides slightly different approaches to categorisation of major GHG emitting sectors and therefore both are included for consideration.

Section 3.2.3 provides additional details on the DRC's Land Use and Land Use Change sector, including detailed summaries of emissions from the agriculture sector and historical land use changes.

3.2.1 GHG emissions from fuel combustion, by source and sector

Table 3-5: The DRC's national greenhouse gas emissions from fuel combustion

NATIONAL GHG EMISSIONS FROM FUEL COMBUSTION BY FUEL SOURCE AND SECTOR[12]	
Source / Sector	**Total emissions (MT CO2e)**
Oil	2.6
Gas	0.0
Total fuel source emissions	2.6
Electricity and heat production	0.0
Manufacturing industries and construction	0.2
Road Transport	2.4
Residential	0.03
Total sector emissions	2.6

3.2.2 GHG emissions from primary energy consumption, by source and sector

Table 3-6: The DRC's national greenhouse gas emissions from primary energy consumption (estimated for 2014-2016)

NATIONAL GHG EMISSIONS FROM PRIMARY ENERGY CONSUMPTION BY SOURCE AND SECTOR[13]		
Source / Sector		**Total emissions (MT CO_2e)**
Energy	Manufacturing and construction	0.1
	Transport	3.3
	Other fuel combustion	5.7
	Fugitive emissions	0.9
	Energy sub-total	10.1
Industrial processes		0.3
Agriculture		18.4
Waste		10.8
Land use change and forestry (LUCF)		168.8
Total emissions (including LUCF)		208.3

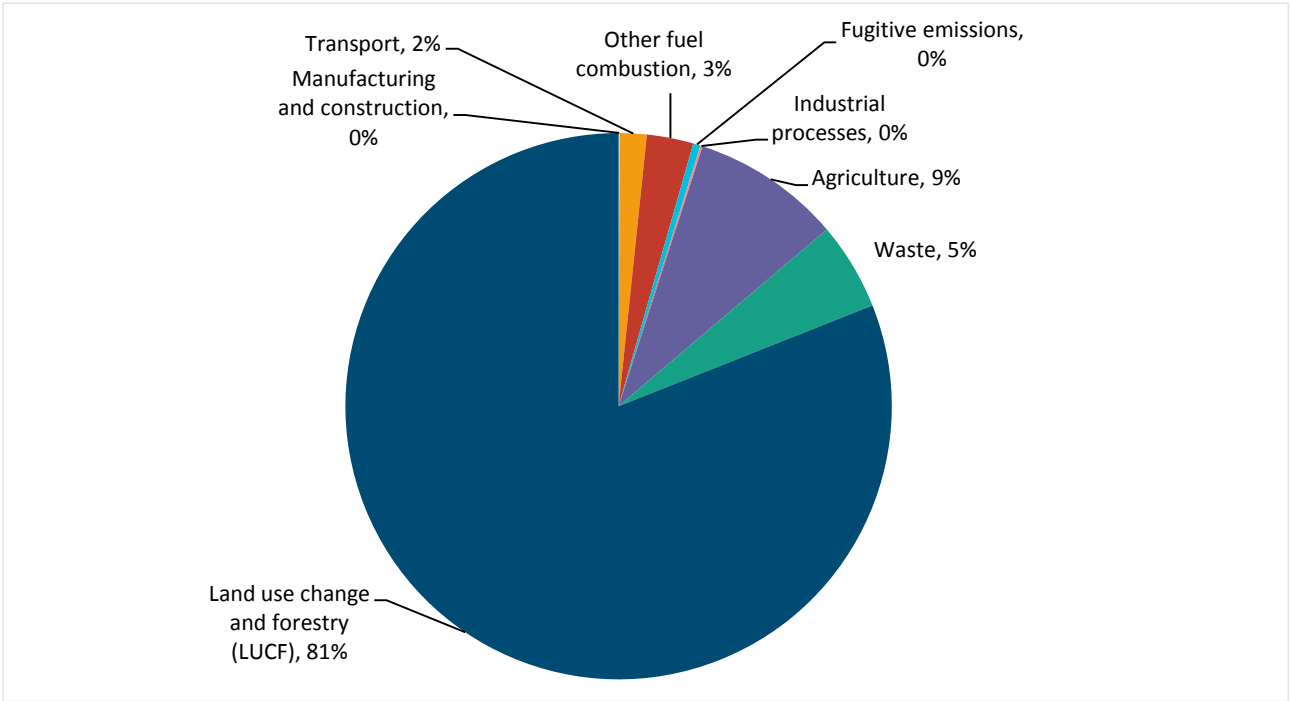


Figure 3-4: Distribution of the DRC's GHG emissions by major sectors

3.2.4 GHG emissions from agricultural practices

Table 3-7, below, summarises GHG emissions from the DRC's agriculture sector (derived from Food and Agriculture Organisation statistics). Although there are multiple agricultural practices which contribute to GHG emissions, in the case of the DRC the land use change sector is by far the largest contributor to GHG emissions. In particular, change in forest land use change and burning biomass contribute almost 90% of total GHG emissions from this sector.

Table 3-7: National annual greenhouse gas emissions from agriculture, forestry and other land use practices in the DRC (estimated for 2014-2017)

	VARIABLE	ANNUAL EMISSIONS (MT CO_2E)
Annual GHG emission from agricultural practices[14]	Burning - crop residues	0.2
	Burning - savanna	15.5
	Crop residues	0.2
	Cultivation of organic soils	0.0
	Enteric fermentation	1.0
	Manure management	0.2
	Manure applied to soils	0.1
	Manure left on pasture	0.9
	Rice cultivation	0.3
	Synthetic fertilizers	0.1
	Sub-total (Agricultural practices)	18.5
Annual GHG emission from land use change[14]	Grassland	0.0
	Cropland	0.0
	Forest land	145.2
	Burning biomass	20.3
	Sub-total (Land use change)	165.6
Total emissions		184.1

Table 3-8, below, summarises the recent historical changes in land use in the DRC through analysis of land use change. Statistics derived from the Global Forest Watch database were used to summarise the total area of wooded vegetation in various categories of canopy cover density (where 10-30% canopy cover can be considered as savanna, 30-50% cover can be considered woodland and 50-100% cover can be considered dense forest), as well as the historical rates of change in each vegetation category. Global Forest Watch reports the total aboveground carbon stock of the DRC's forest biomass as ~19,480.6 million tonnes.

Table 3-8: Vegetation cover and land use change in the Democratic Republic of the Congo estimated for 2015)

VARIABLE			TOTAL (HECTARES)	TOTAL (% OF LAND AREA)	UNIT
Total tree cover[15]	10-30% canopy cover		28,181,896	12.02	% of total land area
	30-50% canopy cover		34,194,517	14.6	
	50-100% canopy cover		155,343,216	66.2	
	Total		217,719,628	92.8	
Land use change and agricultural expansion	Historical annual rate of deforestation[16]	10-30% canopy cover		0.1	% of previous year
		30-50% canopy cover		0.1	
		50-100% canopy cover		0.3	
	Area of agricultural land[17]		26,639,200	11.4	% of total land area

4. SUMMARISED NATIONAL PRIORITIES FOR CLIMATE CHANGE ADAPTATION AND MITIGATION

The DRC's main priority actions related to climate change are described in the country's submissions to the UNFCCC through the Intended Nationally Determined Contributions (NDC) document. The document includes detailed descriptions of the DRC's major commitments and priorities related to GHG mitigations (Table 4-2, below) as well as major priorities related to adaptation, derived from the draft National Adaptation Pan (NAP) (Table 4-1, further below).

The DRC commits to reduce its emissions by 17% by 2030 compared to business-as-usual emissions (430 Mt CO_2e), or a reduction of slightly more than 70 Mt CO_2e avoided (Ministry of the Environment, 2009).

The investment needs identified in DRC's NDC include estimates for both mitigation and adaptation sectors, totalling at least ~USD 21.622 billion. For activities focused on adaptation, DRC estimates the investment needs for the period up to 2030 to be ~USD 9.082 billion, including ~USD1.564 billion for agriculture, ~USD 7.35 billion for energy and transport, ~USD 50 million for the forestry sector, and USD 118 million for the coastal sector. With respect to investment needs for DRC's mitigation priorities, the total investment costs are estimated to be ~USD 12.54 billion, including a range of potential actions for the sectors of agriculture, forestry and land use change, and energy (however no detailed breakdown of sectoral funding needs is provided, noting the need for further study as well as transfer of technical and institutional support).

Table 4-1, below, gives details on the DRC's GHG reduction targets outlined in the country's NDC, with information on target gases and sectors, the use of international markets in achieving targets (e.g. the use of carbon credits), and accounting methods used to quantify GHG emissions (e.g. inclusion of land use and land use change).

Table 4-1: Summary of the DRC's NDC commitments for reduction of GHG emissions

GHG EMISSIONS REPORTED IN NDC (MT CO_2E/YR)	BASE LEVEL	REDUCTION TARGET	TARGET YEAR	SECTORS AND GASES	USE OF INTERNATIONAL MARKETS	LAND-USE INCLUSION / ACCOUNTING METHOD
201.53	BAU	17 percent (conditional)	2030	CO2, CH4, N2O; Energy, agriculture, forestry	Not mentioned	Forestry included, accounting methodology not specified.

4.1 National priorities for climate change mitigation

The DRC's major priorities for actions and investments related to climate change mitigation are summarised in Table 4-2, below, categorised according to sector. Proposed activities and investments within each sector are further categorised according to 'Technology Type', based on the categories of technologies listed by the Green Climate Fund's (GCF) impact indicators for mitigation projects (key for technology types provided below Table 4-2).

The DRC's mitigation priorities for the energy and transport sectors are relatively undetailed. The main sectors prioritised include the Energy, Transport, and AFOLU sectors. In the energy sector, the actions identified in DRC's NDC include increased investments in hydroelectricity, and promotion of improved efficient cookstoves and efficient charcoal production for domestic energy. In the transport sector, priority actions include the provision and rehabilitation of multimodal and public transport. The DRC's mitigation priorities for the AFOLU sector are, in contrast to the previous two sectors, quite detailed. These include the provision of irrigation and general improvement of farm support and monitoring, introduction of good agricultural practices, integration of livestock into agriculture, reforestation and afforestation initiatives and incentives, management of forests and protected areas, and improved environmental monitoring among others. It should be noted that the mitigation benefits of some of these proposed actions, such as promotion of irrigation resources, are unclear and may potentially result in unintended additional GHG emissions and/or maladaptive investments.

Table 4-2: Mitigation priorities in the Democratic Republic of the Congo's NDC

PRIORITY SECTOR	SECTOR-SPECIFIC ACTION	TECHNOLOGY TYPE[2]
Energy	Production of 650MW through small and medium scale hydroelectricity plants	1
	Encourage use of improved cookstoves in 3 million households	1
	Promotion of efficient cookstoves and improvement of carbonization techniques	1,4
Transport	Provide the three major urban centres (Kinshasa, Lubumbashi, Matadi) with roadways masterplans.	5
	Improve and equip the public transportation system (bus, rail, etc.)	5, 8
	Rehabilitate and promote multimodal transportation for goods and people	
AFOLU	Layout and equipment of agricultural areas (irrigation) at a rate of 1 million ha	4, 5
	Monitoring, technical and financial support to; professional organization of farmers, support and integrated monitoring of value chain; promotion of agro-forestry and agro-sylvo-pastoral systems, plantations of vegetables and orchards; introduction of good agricultural practices; awareness raising information on agriculture and improved access to agriculture finance mechanisms.	5, 9

[2] **GCF Technology Type Key (derived from GCF's Results Framework for mitigation)*

1. Reduced emissions through increased lower emission energy access and power generation.

2. Reduced emissions through increased access to low-emission transport.

3. Reduced emissions from buildings, cities, industries and appliances.

4. Reduced emissions from land use, deforestation, forest degradation, and through sustainable management of forests and conservation and enhancement of forest carbon stocks.

5. Strengthened institutional and regulatory systems for low-emission planning and development.

6. Increased number of small, medium and large low-emission power suppliers.

7. Lower energy intensity of buildings, cities, industries, and appliances.

8. Increased use of low-carbon transport.

9. Improved management of land or forest areas contributing to emissions reductions.

PRIORITY SECTOR	SECTOR-SPECIFIC ACTION	TECHNOLOGY TYPE[2]
AFOLU (con)	Planning and equipment of 1.6 million ha of land for intensive agricultural use	
	Promoting the integration of livestock to agriculture for the production of fertilizer	
	Recovery of waste and by-products from livestock farming in the form of biogas and natural fertilizers	4, 9
	Reforestation of 19% of 4 million ha of degraded forests or deforested land	
	Afforestation of 15% of 7 million ha of marginal areas	
	Financial incentives for reforestation and reduction of rates of deforestation and forest degradation	
	Improved management of protected areas	5, 9
	Diversify the use of forest species and increase the volume cut per ha to ensure economic viability and environmental sustainability	4, 9
	Implement forest technical management of lower impact through training, awareness and financial incentives	
	Support the control and repression of fraud of lumber	
	Ensure monitoring and mandatory implementation of the Environmental Management Plans of mine and oil sites	5, 9
	Establish monitoring systems and bushfire management plans	4, 9

4.2 National priorities for climate change adaptation

The DRC's proposed activities and investments related to adaptation are categorised according to 'Technology Type', based on the categories of technologies listed by the Green Climate Fund's (GCF) impact indicators for adaptation projects (key for technology types provided below Table 4-3). In terms of national priorities for climate change adaptation, the DRC's priorities include a focus on improving access to, and resilience of, basic services such as water, sanitation and health services. In the coastal areas, the DRC's priorities include measures to reduce coastal erosion, promotion of income-generating activities for local communities, and the strengthening of early warning systems. In the AFOLU sector, priorities are focused on the implementation of the National Agricultural Investment Plan, which aims to increase the productivity and resilience of the agriculture sector through various activities. Adaptation priorities for the AFOLU sector also include the integration of early warning systems into agriculture, the conservation of biological diversity and adoption of sustainable land management practices, among others.

Table 4-3: Adaptation priorities in the Democratic Republic of the Congo's NDC

PRIORITY SECTOR	SECTOR-SPECIFIC ACTION	TECHNOLOGY TYPE[3]
AFOLU	Resilient economic growth in the agricultural sector	2, 7
	Implementation of the Adaptation component of the National Agricultural Investment Plan of the DRC	5
	Integration of climate change resilience into development strategies and climate risk planning	6
	Investment in research and innovation to strength DRC's climate resilience	5
	Strategic coordination of programs, plans, adaptation initiatives and knowledge management	
	Integration of early warning systems in agriculture	2, 6
	Conservation of Biological Diversity (CBD) of forest ecosystems and sustainable land management (SLM)	4, 7
Water	Improving access to drinking water	1, 2
	Improving access to sanitation of used water and of sustainable waste management	
Community-based	Improved access to communication (roads) and improved access to areas vulnerable to climate change	1, 2
	Improving access of poor people to health services	
Institutional	Strengthening of government and non-governmental institutional capacity	5
Coastal Zone	Fight against coastal erosion: Rehabilitation and coastal management	4, 7
	Support to income generating activities	7
	Strengthening of early warning system and capacity building in coastal areas	6, 7

[3] **GCF Technology Type Key (derived from GCF's Results Framework for adaptation)*

1. Increased resilience and enhanced livelihoods of the most vulnerable people, communities, and regions.

2. Increased resilience of health and wellbeing, and food and water security

3. Increased resilience of infrastructure and the built environment to climate change threats

4. Improved resilience of ecosystems and ecosystem services

5. Strengthened institutional and regulatory systems for climate responsive planning and development

6. Increased generation and use of climate information in decision making

7. Strengthened adaptive capacity and reduced exposure to climate risks

8. Strengthened awareness of climate threats and risk reduction processes

5. ASSUMPTIONS, GAPS IN INFORMATION AND DATA, DISCLAIMERS

The observed and projected climate trends described in Section 2 'Climate and Weather' are derived from a combination of publicly-available observational data and CMIP5 climate models. Detailed information is included in Section 6. Appendix 1, including '6.1.b. Historical Trends and Variability Analysis' and '6.1.c. Climate Projections Visualisations'.

Unless stated otherwise, all statistics reported in Section 1 ('Geographic and Socio-Economic Context' and Section 3 'Climate change mitigation, greenhouse gas emissions and energy use') are derived from databases of publicly available datasets managed by international or multilateral agencies including inter alia The World Bank Group, the United Nations, World Resources Institute and International Energy Agency.

Unless stated otherwise, all energy and greenhouse gas emission figures are derived from UN Stats (2014); World Energy Council (2016); the World Resources Institute (2013), and the International Energy Agency (2016). Agriculture & forestry-related emissions are also reported from Food and Agriculture Organisation (2014-2017) and Global Forest Watch. (2015-2017). Full references are provided as a supplementary appendix.

As a result of the use of standardised methodologies and data sources across the 25 countries included in this AfDB Climate Change Profile, statistics and estimates reported herein may differ from other publicly available datasets or national estimates. Readers are advised to always check for updated publications and newly released national datasets.

This AfDB Climate Change Profile series is intended to provide a brief touch-stone reference for climate change practitioners, project managers and researchers working in African countries. The figures and estimates provided herein are intended to inform the reader of the main climate-related challenges and priorities, however these should be used to inform a process of additional research and in-country consultations. The University of Cape Town, the African Development Bank and its Boards of Directors do not guarantee the accuracy of figures and statements included in this work and accept no responsibility for any consequences of its use.

6. APPENDIX 1

1.a Supporting evidence

The climate projections detailed in Chapter 2 (above) are supported by rigorous analysis of observed and model projections data. More details of this analysis and supporting figures can be found below.

1.b Historical trends and variability analysis

The analysis of historical trends and variability of key climate variables is presented below. This analysis uses the WATCH Climate Forcing dataset which has been selected as the most broadly representative of station observations across Democratic Republic of Congo. Long term (1979 to 2013) trends as well as inter-annual variability (decade to decade) has been analysed for total annual rainfall, number of rainfall days, number of heavy rainfall days, and daily minimum and maximum temperatures (1979 to 2014) for each of the four climate regions across DRC. The plots below detail **inter-annual variability** (dotted lines), **decadal variability** (smooth bold solid curves) and **long term trends** (thin straight lines) for each region and statistic. This allows for comparison of different types of variability against the long term trend. It can be seen that for rainfall statistics, inter-annual and decadal variability are typically larger than long term trends, even when there is a statistically significant trend. For example, for total annual rainfall, the Equatorial region has inter-annual variability ranging between +280 to -320mm/year from the mean annual total and has decadal variability ranging between -180 to +120 mm/year from the mean annual total. Long term trends are negative and statistically significant for the Equatorial and Northern Tropics region but are smaller and not statistically significant for the other regions.

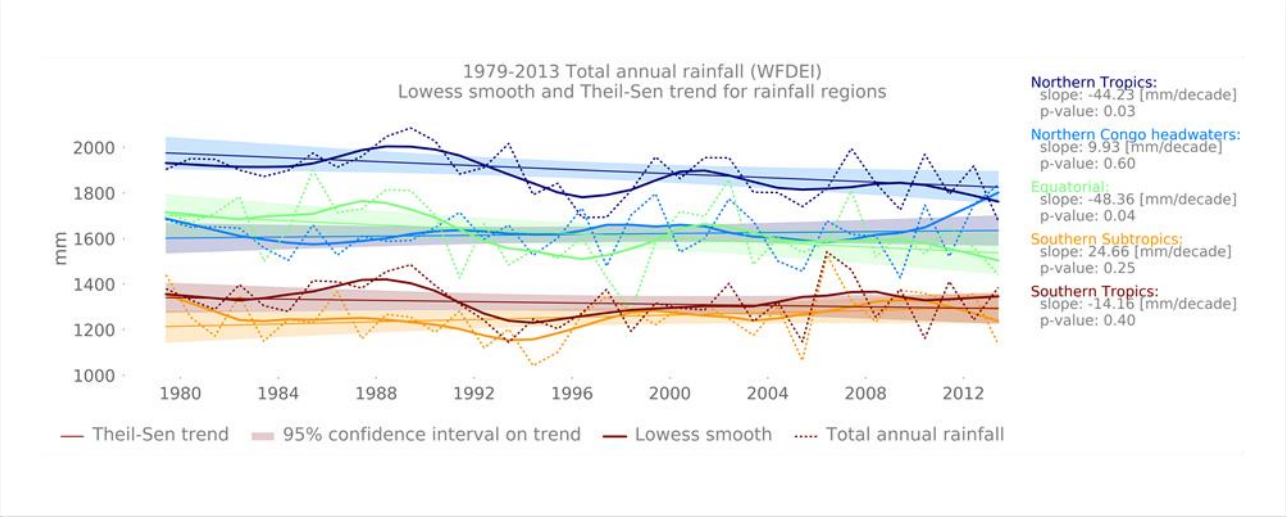


Figure A-1: Long term trends and variability in total annual rainfall for rainfall regions

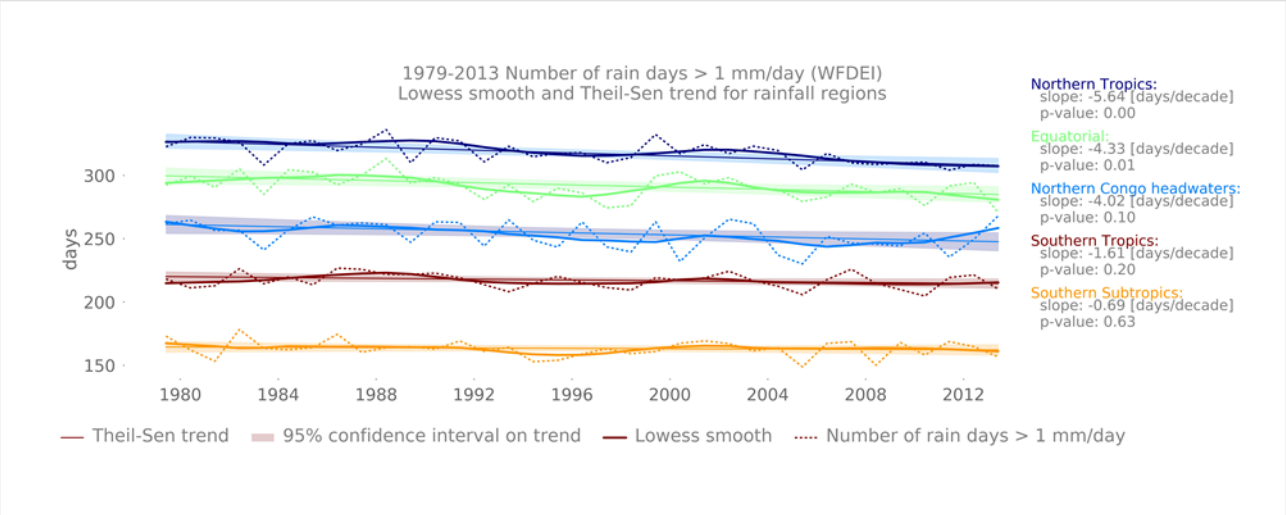


Figure A-2: Long term trends and variability in frequency of rainfall events for rainfall regions

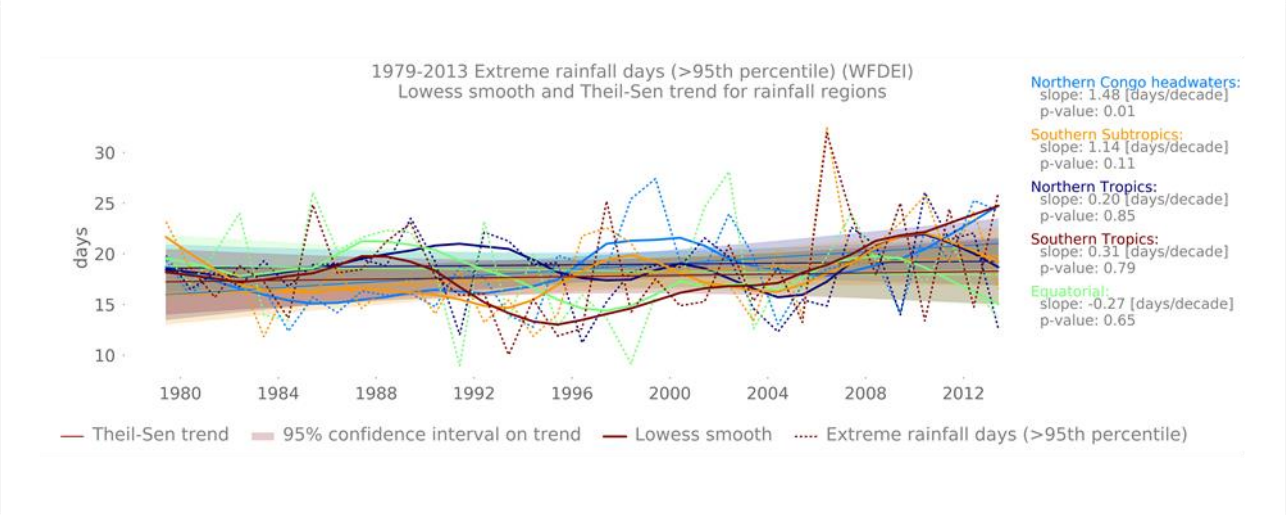


Figure A-3: Long term trends and variability in extreme rainfall events for rainfall regions

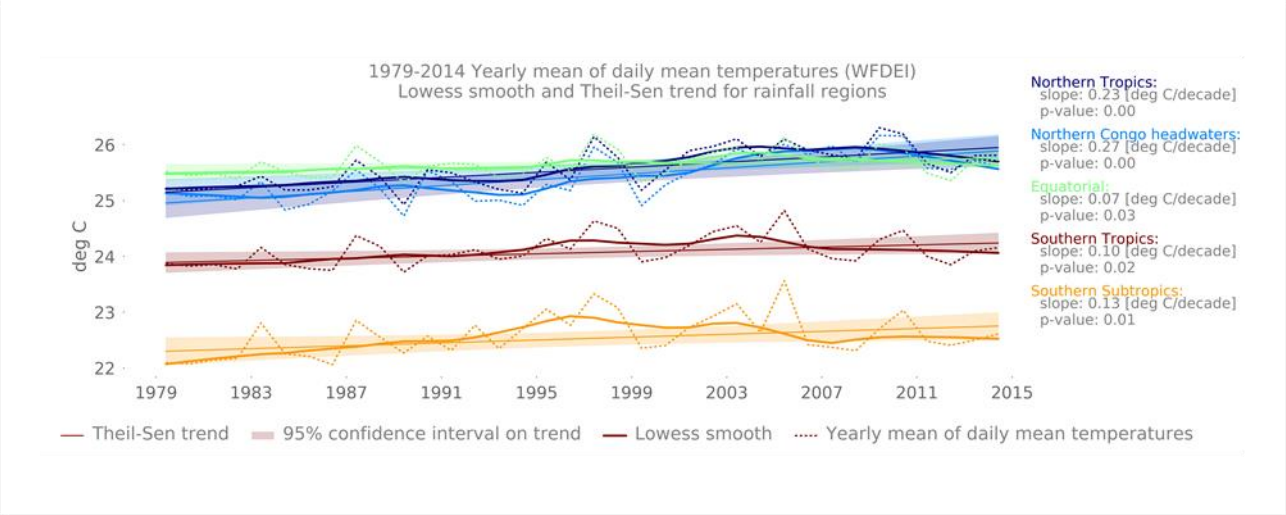


Figure A-4: Long term trends and variability in daily mean air temperatures for rainfall regions

1.c Climate projections visualizations

The plots below (Figures A-5 – A-8) are called plume plots and they are used to represent the different long term projections across the multiple climate models in the CMIP5 model archive used to inform the IPCC AR5 report. The plots show projected variations in different variables averaged over the climate regions. The blue colours indicate variations that would be considered within the range of natural variability, so in other words, not necessarily the result of climate change. The orange colours indicate projection time series where the changes would be considered outside of the range of natural variability and so likely a response to climate change. It is important to note that these are global climate model projections and so likely do not capture local scale features such as topography and land ocean boundary dynamics. They also may not capture small scale features such as severe thunderstorms that can have important societal impacts. Finally, these projections are averages over relatively large spatial areas and it is possible that different messages would be obtained at small spatial scales and if various forms of downscaling are performed.

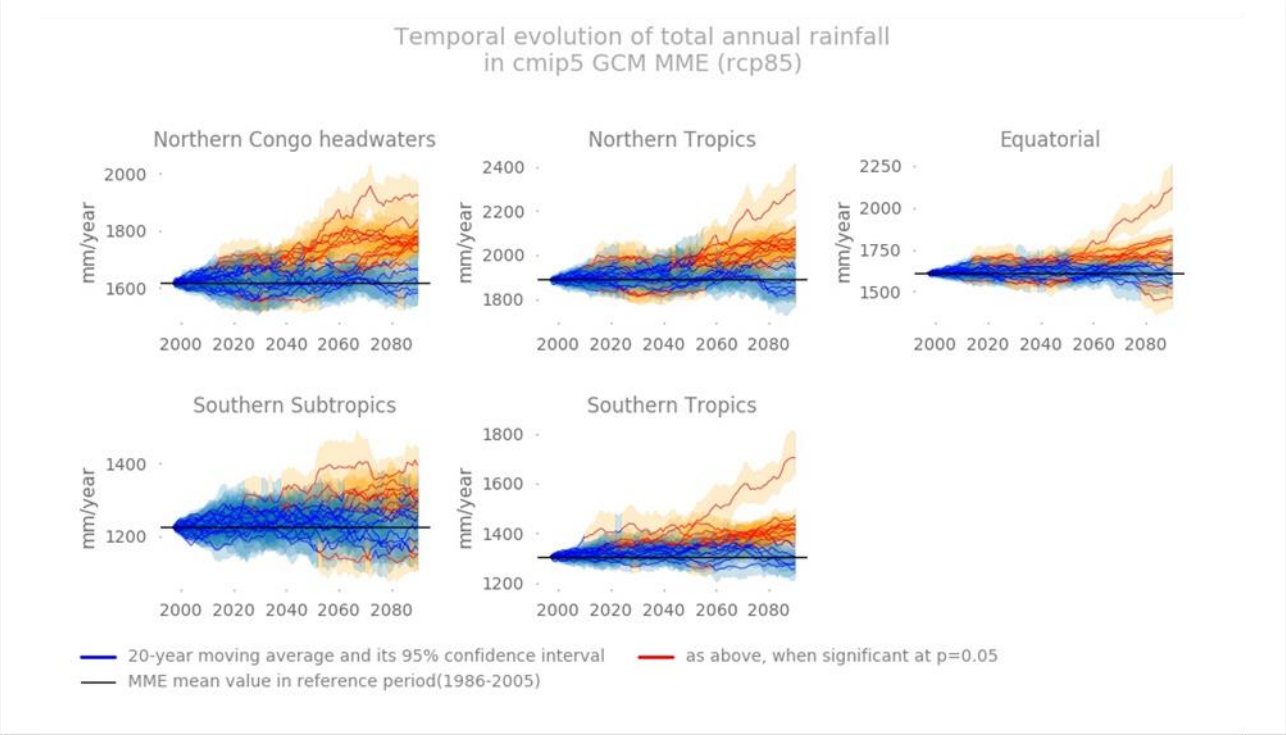


Figure A-5: Projected changes and emergence of changes in total annual rainfall

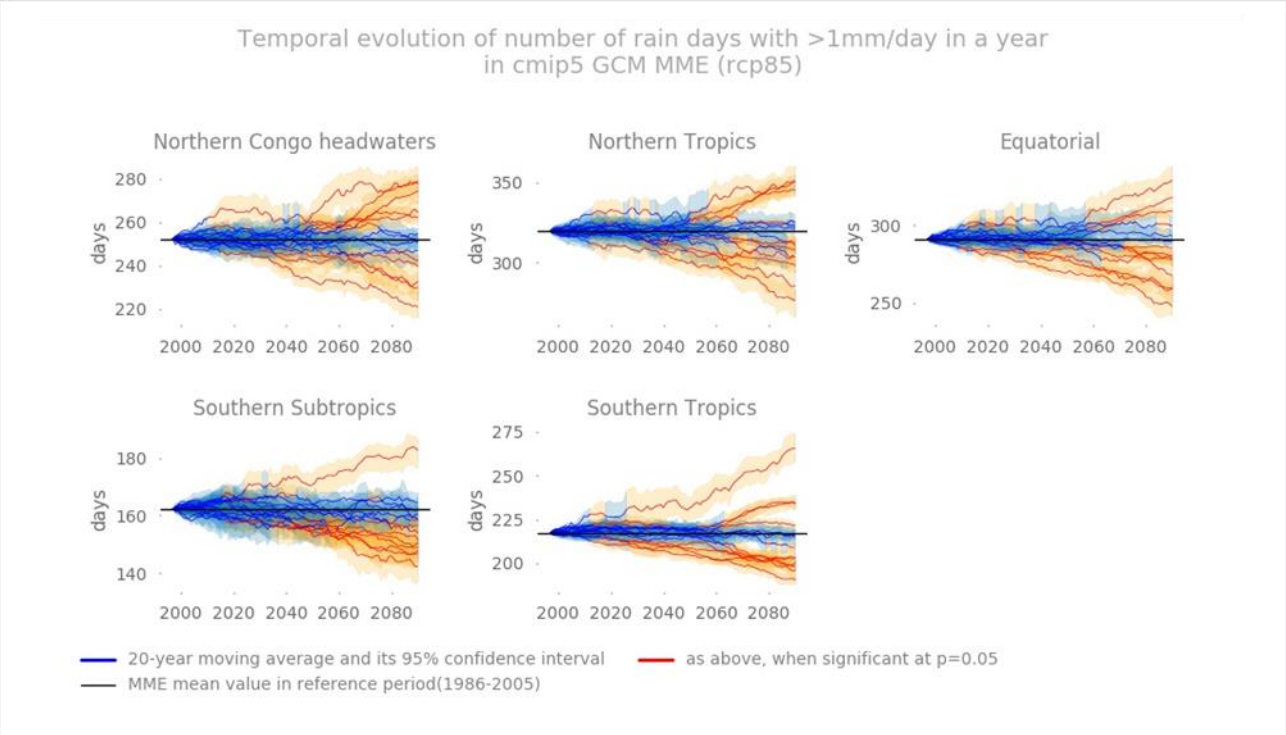


Figure A-6: Projected changes and emergence of changes in number of rain days per year

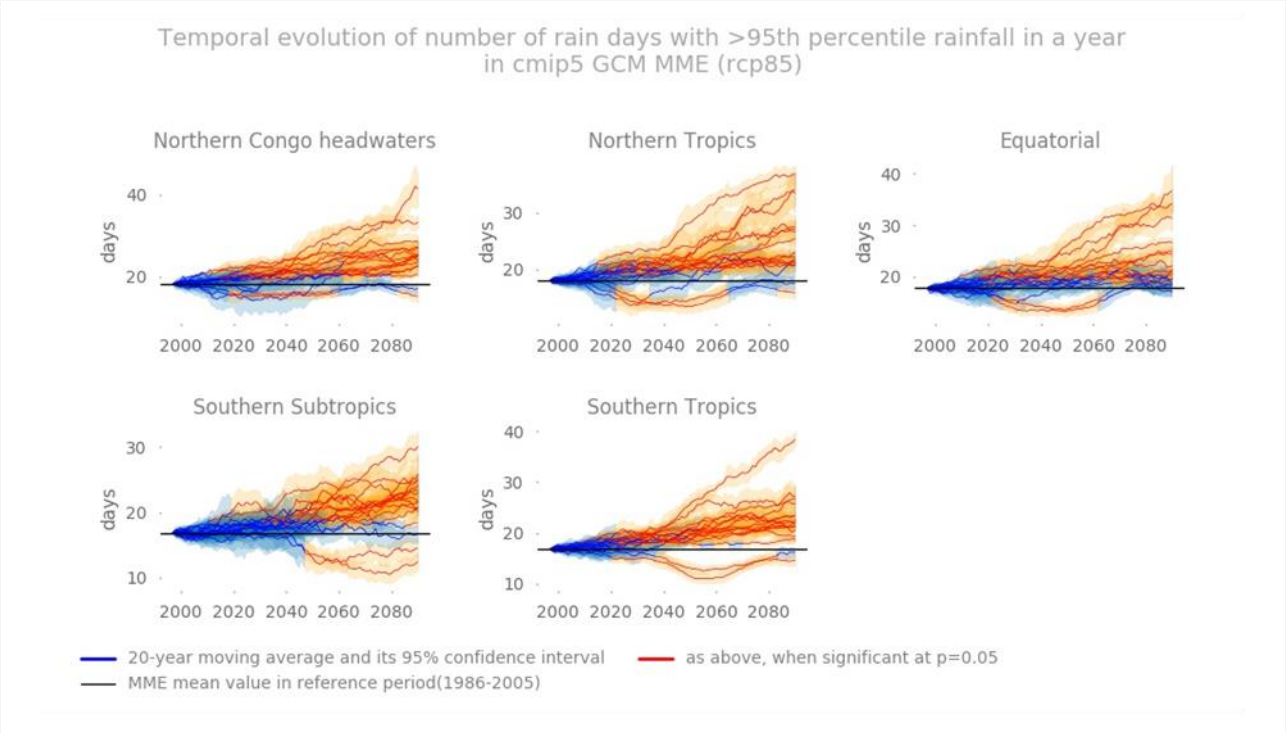


Figure A-7: Projected changes and emergence of changes in number of very heavy rainfall days (greater than 95th percentile) per year

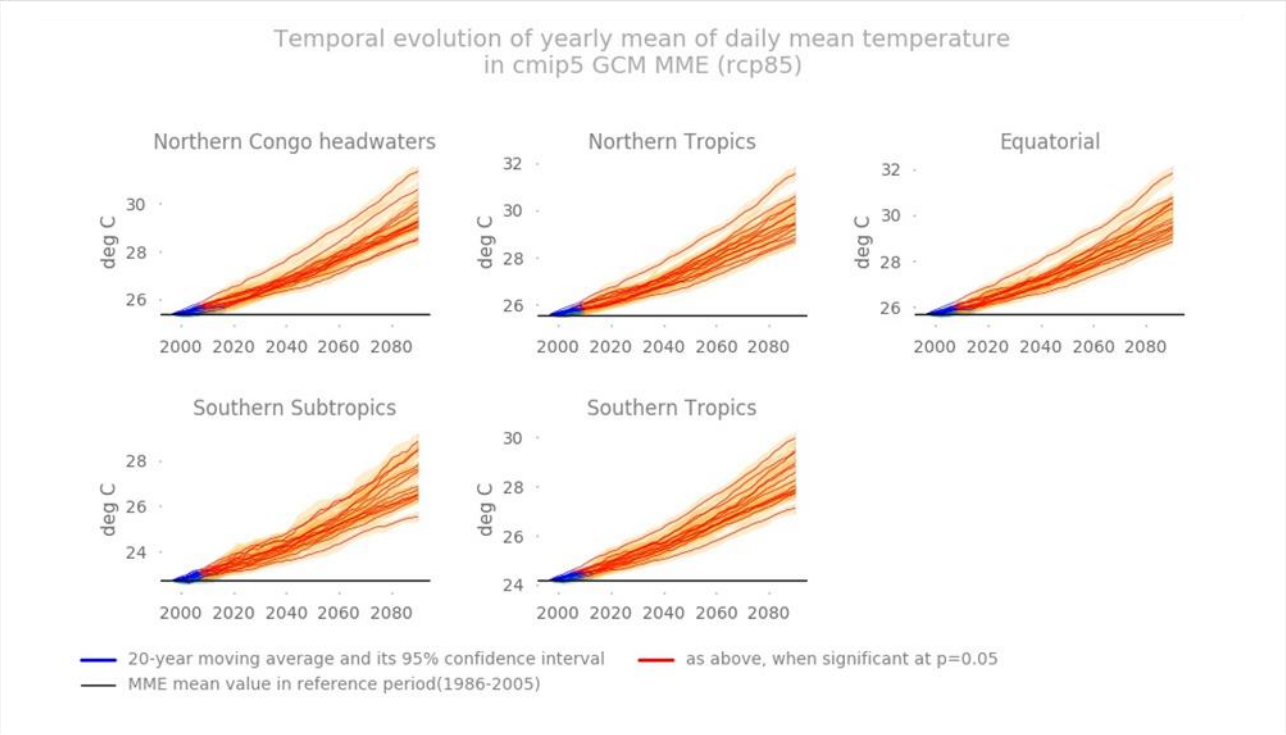


Figure A-8: Projected changes and emergence of changes in annual mean daily mean temperatures

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