

COUNTRY HYDROMET DIAGNOSTICS

Informing policy and investment decisions for high-quality weather forecasts, early warning systems, and climate information in developing countries.



10 July 2024

Suriname Peer Review Report

Reviewing Agency: KNMI



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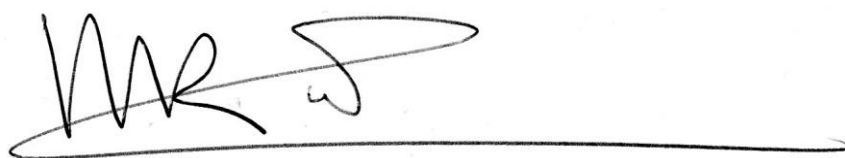
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The findings, interpretations and conclusions expressed are those of the named authors alone and do not necessarily reflect those of the agencies involved.

Authorisation for release of this report has been received from the Peer Reviewing Agency and the Country NMHS as of 10th of July 2024.

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Disclaimer

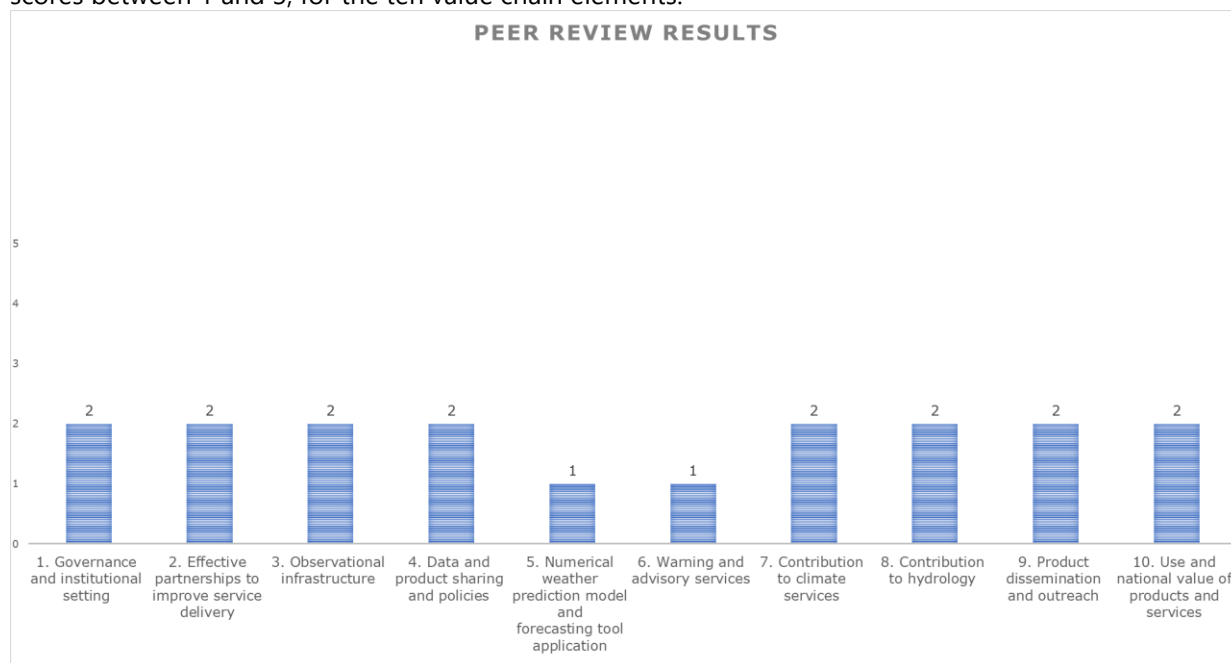
This report has been prepared based on information and analysis provided by KNMI in close consultation with MDS and stakeholders. While reasonable care has been taken in preparing this report, no representation or warranty, expressed or implied, is made as to the accuracy, completeness, or suitability of the information and assumptions relied upon, and we do not accept any liability whatsoever for any direct or consequential loss arising from any use of this report or its contents.

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Executive Summary

A bar graph and overview summarizing the peer-review scores for Suriname is shown below. The element scoring criteria, defined in the CHD guidelines and provided by WMO were used to jointly assess the maturity levels by the peer-advisor and beneficiary. Suriname obtains currently Maturity Level scores between 1 and 3, for the ten value chain elements.



Element		Maturity level score
1.	Governance and institutional setting	2
2.	Effective partnerships to improve service delivery	2
3.	Observational infrastructure	2
4.	Data and product sharing and policies	2
5.	Numerical weather prediction and forecasting tool application	1
6.	Warning and advisory services	1
7.	Contribution to climate services	2
8.	Contribution to hydrology	2
9.	Product dissemination and outreach	2
10.	Use and national value of products and services	2

Figure 1. Graph and table for the maturity level scores for Suriname, according to the CHD Methodology

Gaps, Urgent Needs and Key Recommendations

The needs, urgent issues and key recommendations are presented for the different gaps, identified for the ten elements of the Hydromet value chain of Suriname:

1: Governance and Institutional Settings

- ✓ Responsibilities:
Consider reviewing the regulations and decree(s) to better identify the role and responsibilities and increase the visibility of the organization, serving economic sectors, public and private stakeholders;
- ✓ Service level agreements:
Agreements are available for Aviation and Maritime Authority Suriname and this is in process with the Energy Authority Suriname (EAS) and Coastguard.
Consider developing more services for the public and if possible the private sector, with service level agreements, for example for radar observations data with Energy sector for Brokopondo dam and with Staatsolie Maatschappij Suriname NV;
- ✓ Human resources:
Most of the departments inside of the MDS are heavily understaffed. Moreover, since the only institute (besides the Anton De Kom University) able to provide further education and training in the different fields is to be found outside of Suriname (the Caribbean Institute for Meteorology and Hydrology (CIMH) in Barbados), it continues to be challenging for the existing staff to stay up-to-date with the developments in the worlds of meteorology and hydrology.
Need to seek for more (personal and core) budget to:
 - hire more ICT dedicated expertise (including FOSS [Free and Open-Source Software] knowledge) in data management for meteorological applications, web design, network security, including open-source software applications and computing languages.
 - train or hire new staff to efficiently ensure maintenance of the observation networks, including radar (incl. equipment repair, renewals, calibration);

2: Effective Partnerships to Improve Service delivery

- ✓ MDS under the ministry of Public Works can consider to have proactive collaboration with their partners and initiate more stakeholders meetings with governmental and also consider private partners. The partnerships need to be better formalized through agreements and MoUs. The MDS can start from the already existing partnerships, seeking to deepen and strengthen them. Then approach other governmental entities and eventually turn its attention also towards the private market.
- ✓ Continue building on partnerships with peer-advisor KNMI (Netherlands)
- ✓ Engage in medium- to long-term human Capacity Development and training trajectories for staff with WMO, selected international partners and experts.

3: Observation Infrastructure

- ✓ The maturity level could be increased by sharing more functional AWS through WIS 2.0. Additionally, further development of the current integrated system for data reception, monitoring, storage, quality control, and management of weather and climate data is required.
- ✓ Enhancing capacity for station maintenance and repair is crucial. This involves securing additional resources, manpower, and transportation for station visits. It can help MDS to work on SOP requirements in line with WMO standards.
- ✓ An adequate calibration instrument at MDS Paramaribo station, where there is already a calibration lab for the radiosondes, is needed to reach the required quality standards.
- ✓ Training for IT and technical experts is essential to implement the above recommendations.

4: Data and Product Sharing and Policies

- ✓ Currently, no station data is shared to the WMO-GTS or WIS2.0 and global community. The 3 airport stations have SYNOP/METAR data available hourly what is transmitted to the Brasilia Databank.
- ✓ Internet access should be stable and sufficient enough to download satellite images and work more efficiently.
- ✓ A Meteorological Work Station (MWS) or web-based platform (like GEOWEB) to get access to satellite imagery, forecasts and where it is possible to get full and easy access to the real-time data as well as the historical data.

5: Numerical Model and Forecasting applications

- ✓ Upgrade server infrastructure to handle diverse forecast demands for quicker data processing and timely access. A Meteorological Work Station (MWS) or web-based platform (like GEOWEB) to get access to forecasts and where it is possible to get full and easy access to the real-time data as well as the historical data.
- ✓ Establish formal data-sharing agreements with international partners to streamline access to diverse forecast data.
- ✓ Improve dissemination of meteorological information to enhance preparedness and response capabilities.
- ✓ Expand the use of probabilistic forecasts beyond aviation to benefit other sectors.
- ✓ Invest in continuous improvement to enhance the accuracy and reliability of probabilistic forecasts for marine and aviation applications.

6: Early warning and advisory services

- ✓ It is essential to upgrade the observational network, including meteorological and components, to provide real-time, accurate hourly observations. This is important for forecasting, issuing warnings, and validating post-event verification.
- ✓ Without increasing the number of forecasters, it is difficult to properly address additional hazards or provide multi-hazard advice.
- ✓ An additional dedicated person should be hired for verification and validation purposes.
- ✓ Forecasters should undergo additional capacity building and training to enhance their use of the various tools provided by the Global and Regional Centres.

7: Contribution to Climate Services

- ✓ The climatological department should adopt a more proactive approach by initiating communication with potential long-term partners to establish formal and effective partnerships.
- ✓ The development and enhancement of a central data management system are imperative. This system must provide streamlined access for data analysts, meteorologists, and the Quality unit, and include the implementation of data homogenization.
- ✓ Digitizing the entire data archive, covering all parameters, is essential and should be integrated into the central data management system.
- ✓ Relevant staff from the Climatological unit needs to receive additional training to fully utilize the benefits of this new system.
- ✓ The system should also have the capability to accommodate the AWS data archive, which should be segregated from the manual network data.
- ✓ By gradually transitioning the station network to AWS, which operates on a 24/7 hourly basis, a more comprehensive representation of Suriname's climate can be achieved, particularly for climatic parameters associated with the diurnal cycle.

8: Contribution to Hydrology

- ✓ The Hydrology Division operates as a separate department within the same directorate but more collaboration would be useful in the near future.
- ✓ The Hydrology Division is currently understaffed. Despite the recent expansion of the surface stations network using Automatic Water Level Stations (AWLs), it is crucial to recruit and retain staff to effectively manage and operate these systems.
- ✓ The service lacks experienced hydrologists, making it imperative to establish a comprehensive capacity-building and training program.
- ✓ In the future, adequate advisory support will be necessary to implement a hydrological model for all the rivers in Suriname.

9: Product dissemination and outreach

- ✓ Increase in the number of forecasters: It is crucial to increase the number of forecasters in the Meteorological Department Service (MDS) to meet the media's needs and provide timely updates, especially during critical weather events.
- ✓ Exploration of other dissemination methods: The MDS should consider using cell broadcasting to reach a wider audience and deliver real-time alerts directly to mobile phones, enhancing the overall effectiveness of the warning system.
- ✓ Support for Indigenous and Maroon Languages and Sign Language: It is essential to provide support for communication in Indigenous and Maroon languages, as well as in sign language, to ensure all communities receive and understand warnings and forecasts.
- ✓ Educational Program Initiative: Collaboration with the Ministry of Education to initiate an educational program for teachers in the interior regions aimed at incorporating disaster risk reduction (DRR) knowledge into their curricula.

10: Use of National Products and Values

- ✓ Establish Regular Survey Intervals. Implement a structured schedule for conducting user satisfaction surveys at regular intervals, such as annually or biannually. This will ensure that feedback is consistently gathered and analyzed over time.
- ✓ Utilize multiple channels to collect user feedback, including online surveys, phone interviews, focus groups, and community meetings. This approach will capture a broader range of perspectives and improve the representativeness of the feedback.
- ✓ Design comprehensive survey tools that cover various aspects of the services provided by the MDS, such as the accuracy of forecasts, timeliness of warnings, effectiveness of communication methods, and overall user satisfaction.
- ✓ Ensure that surveys reach a diverse cross-section of the population, including different geographic regions, demographic groups, and sectors (e.g., agriculture, transportation, health). This will help in understanding the unique needs and concerns of various user groups.
- ✓ Establish a systematic process for analyzing survey results and integrating the findings into service improvement plans.
- ✓ Share the survey findings with stakeholders and the public to maintain transparency and demonstrate a commitment to continuous improvement.

Chapter 1: General information

Introduction

The Republic of Suriname lies on the northeastern Atlantic coast of South America, bordering Guyana to the West, French Guyana to the East, and Brazil to the South. 50°N55°10'W It has an area of 163,820 km². The latitude for Suriname is: 3.919305 and the longitude is: -56.027783.

The country has a population of approximately 623,000 people (World Bank April 2024). Suriname, a Small Island Developing State (SIDS), is one of the most vulnerable countries in South America, due to river and coastal flooding Suriname is particularly vulnerable to the impacts of climate change.

The country's small population, major economic activities, and infrastructure are concentrated along the low-lying, heavily urbanized coastal zone. Given the expected impacts of sea level rise (1 m by 2100), temperature rise (+0.8 to 2.0 °C by 2050), and changing precipitation patterns (-22 to +14 mm/month by 2050) Suriname exists of a complex mangrove ecosystem in the coastal plain. Forests in general (including mangrove forests) cover 94.7% of the total land area of the country which is almost 0.4% of the total forests on earth. Maintaining the integrity of natural forests acting as a carbon sink is an important factor to avoid future climate change.

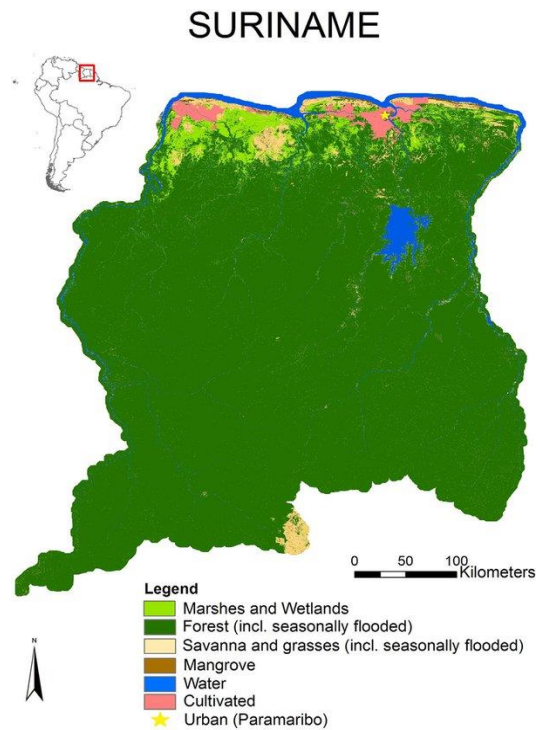


Figure 2. Landscape of Suriname

Geological overview

Suriname is geographically divided into two distinct regions: a southern rainforest-covered interior, which accounts for nearly 80% of the country's surface area, and a northern coastal plain that constitutes the remaining portion. The vast rainforest interior forms part of the Guiana Shield, an ancient geological formation.

The northern coastal plain is further subdivided into three regions: the Savannah Belt, the Old Coastal Plain, and the Young Coastal Plain. The Savannah Belt features a gently sloping, north-facing hilly landscape, with elevations ranging from 10 to 50 meters above sea level. The Old Coastal Plain, located at elevations between 4 to 11 meters above sea level, lies further south. Beyond this, the terrain transitions into dense forests and higher ground, marking the beginning of the interior rainforest region.

Overview of Weather and Climate of Suriname:

In the humid tropical zone near the equator, the convergence of trade winds typically forms a discontinuous band of deep convection known as the Intertropical Convergence Zone (ITCZ). The ITCZ's position shifts north and south with the seasons in response to the sun's movement and the associated changes in the subtropical high-pressure belt. However, its mean position is approximately 5° north of the geographical equator over the oceans. Over continents, the convergence line becomes distorted as the land surface warms during summer, causing the ITCZ to become less defined. The characteristic layer of cloud in the ITCZ results from convection, which dissipates within hours in regions where convection is absent.

Migration:

Rainfall on Earth is most intense in the Intertropical Convergence Zone (ITCZ), a narrow belt of clouds typically centred around six degrees north of the Equator. The ITCZ's mean position north of the Equator is primarily due to the Atlantic Ocean's northward energy transport across the Equator, which warms the Northern Hemisphere more than the Southern Hemisphere. On seasonal and longer timescales, the ITCZ migrates, usually towards the warming hemisphere, though exceptions occur during El Niño or La Niña events. The ITCZ's position varies predictably throughout the year, generally staying near the equator but moving farther north or south over land compared to the oceans due to its attraction to the warmest surface temperatures.

In Suriname, the rainy season, characterized by cloudy conditions and frequent rainfall, occurs when the ITCZ is overhead, typically from December to January and April to August. During these periods, surface winds are weak. Conversely, during the short dry season (February to March) and the long dry season (September to November), the ITCZ is positioned respectively south and north of Suriname. In the short dry season, the northeast trade winds predominantly influence Suriname, while the southeast trade winds prevail during the long dry season.

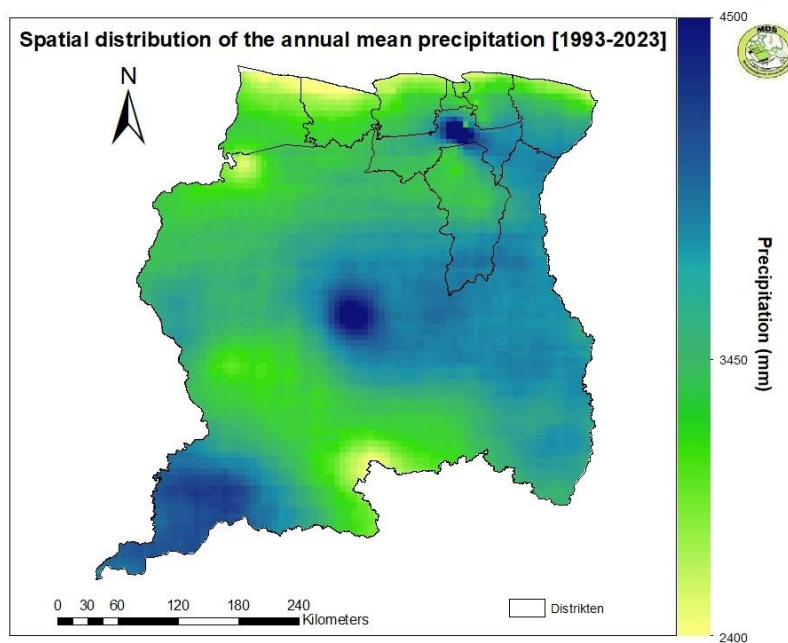


Figure 3. Annual Mean Precipitation for Suriname

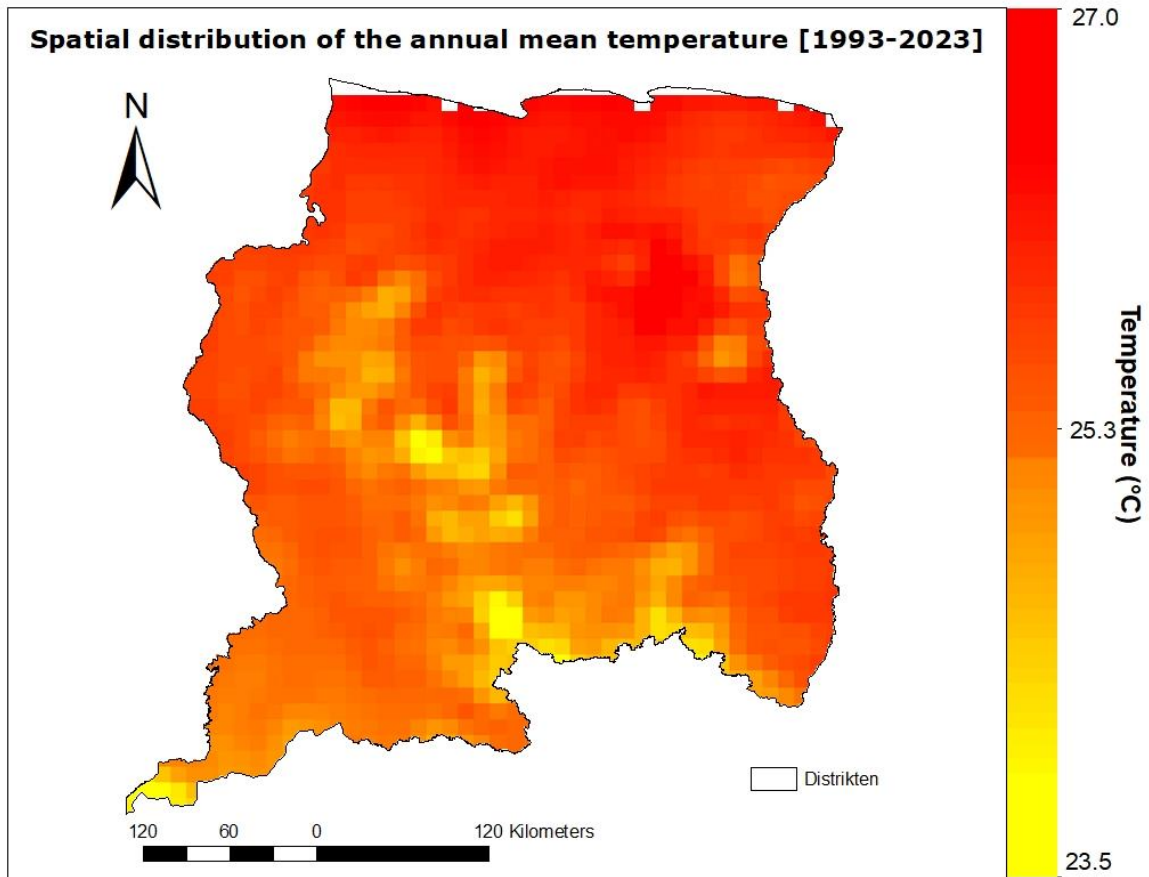


Figure 4. Annual Mean Temperature

General Weather Services, The Meteorological Department Suriname (MDS).

Meteorological Service Suriname (MDS, the NMHS of Suriname) today falls under the direct operations of The Directorate of Research and Public Services, Ministry of Public Works (OW). Responsible for investigating the causes of phenomena that affect humans, animals, and biodiversity. Using raw and collected data, information for possible events (disasters) must be provided to the government and the public, in an effective and timely manner.

Mission and Vision:

Mission

- Collecting all required information about weather and climate in the broadest sense of the word.
- Contributing to safety in the broadest sense by providing timely forecasts, warnings, and analyses of the weather and climate.

Vision

The MDS aims to be the only trusting voice to Suriname for weather and climate information, especially during bad weather conditions. Together with its Partners, work is always being done to improve the Services for the benefit of all users.

The MDS collects information on weather, climate, ozone and radiosonde data, regional seismology and atmospheric dispersal of radioactive material. The MDS provides advice and warnings to society,

shipping and aviation, among others. This service offers products and services that contribute to climate change and safety.

Status of the Operation/Management of the Surface Observing System of the National Meteorological and Hydrological Services:

Currently, the Meteorological Service Suriname (MDS) operates 5 types of stations in its observations network: 3 synoptic stations that do all the measurements on an hourly basis, where 1 operates 24/7, and 2 of them close at certain times (01.00Z -08.00Z). 4 climatological stations measure only essential parameters, 2 or 3 measurements during the climatological hours. One upper air observation system in Paramaribo, with weekly radiosonde and ozone sonde measurements. There are in total 17 AWSs and many rainfall stations that only measure precipitation. 15 of them are automated rain stations.

The Hydrological Research Division Water has 7 operational Automatic Water Level Stations (AWLS) and 18 (AWLS) that will be reactivated in the period September -December 2023.

For both services, the station density in the hinterland is low. Private and public sector decision-makers need accessible, credible, and relevant climate information.

Low density of data is also not suitable for forecasting, especially in the hinterland where extreme droughts and floods have been recorded in the past.

In response to the challenges of climate change, Suriname entered a partnership with the Global Climate Change Alliance (GCCA+), which is an initiative of the European Union (EU) aimed at strengthening vulnerable countries in their efforts to increase capacity to address the effects of climate change.

A previous GCCA+ -funded project was carried out in Suriname from 2016-2019.

The overall objective of this 2nd GCCA+ project in Suriname is to support the country in adapting to the main effects of climate change by improving the management of water resources and coastal ecosystems in ways that increase the well-being of coastal communities through gender-responsive capacity enhancement.

CHD methodology

This report has been prepared using the document CHD operational guidance for SOFF. An initial desktop review was performed, using information supplied from the Meteorological Service Suriname (MDS), World Meteorological Organization (WMO), and other partners. An in-country visit was also undertaken this visit, including meetings in the capital Paramaribo, observation sites Zanderij International Airport and Nickerie.

This document is intended to provide crucial information for the SOFF initiative implementation phase, in which Suriname's involvement is coordinated and supported by KNMI together with the United Nations Development Programme (UNDP). The assessment by KNMI has been facilitated by an on-site visit as well as various remote consultations. Following the CHD structure, this report is presented along the ten most critical elements of the hydromet value cycles with an indication of their respective maturity level and some high-level recommendations to help lift up that maturity level, and as mentioned above, with special emphasis on monitoring, forecasting, climate projection and warning systems for climate-related hazards, across timescales.

Chapter 2: Country Hydromet Diagnostics

Element 1: Governance and institutional setting

1.1 Existence of Act or Policy describing the NMHS legal mandate and its scope

The formal basis of the Meteorological Department Suriname (MDS) is signed by national decree number 12795 dated October 27, 1962, at the unification of the Meteorological Department Suriname. Its national decree came into effect on January 1, 1963. It is the authority for weather and climate information and forecast.

The MDS is responsible for gathering data related to weather, climate, ozone, radiosonde, regional seismology, and the atmospheric distribution of radioactive material, providing forecast and warnings and advice to various sectors and the society.

The Meteorological Service Department (MDS) is the official provider of meteorological information for aviation. MDS has also the responsibility to provide relevant weather information to various agencies, including:

- The National Hydrological Service
- The National Coordination Center for Disaster Relief (NCCR)
- The Maritime Authority Suriname
- The Agriculture Department
- The Energy Authority

Each of these agencies relies on the meteorological information provided by MDS for their respective operations and decision-making processes.

1.2 Existence of Strategic, Operational and Risk Management plans and their reporting as part of oversight and management.

There is a Multi-Year Development plan for 2022-2026, compiled by the Planning Bureau under the responsibility of the Vice president. The Specific Action Plan with the policy measure description is part of the Annual Government Budget. However, the budget is inadequate. Successfully operationalizing the strategic plan is contingent upon winning the tender bid to perform the work. The main priorities of the specific action plan of 2024 approved by the National Assembly of Suriname are Capacity-building focusing on upgrading forecasters and climatological personnel, and regularly maintaining the Met Instruments.

1.3 Government budget allocation consistently covers the needs of the NMHS in terms of its national, regional, and global responsibilities and based, among others, on cost-benefit analysis of the service. Evidence of sufficient staffing to cover core functions

The budget in 2024 is 5,000,000.00 SRD (around \$150,000) and about 1/3 of this budget is for staffing and about 10% is WMO contribution.

Other sources of funding of about 200% are UNDP, India-UN project and KNMI, but also GCCA+ Phase 1&2/EU and the Dutch government (Foundation and Makandra).

In reality, this recovery does not fully meet the needs of MDS in terms of national, regional and global responsibilities. MDS annual budget is around \$150,000, the main sources of funding of which come from a government subsidy. It is strongly recommended to diversify and strengthen the partnership to enable the sustainability of operations and increase the motivation to develop value-added services based on the needs of end users.

1.4 Proportion of staff (availability of in-house, seconded, contracted- out) with adequate training in relevant disciplines, including scientific, technical, and information and communication technologies (ICT). Institutional and policy arrangements in-country to support training needs of NMHS.

Total of 45 staff where 1/3 is male and 2/3 is female. In the management there is no female. 2/3 of all functions are weather observers. There is no ICT Staff or research staff available. ICT is contracted on project. Training and research is with help of the Poly Technic College and Anton de Kom University. CIMH is helpful as a training centre for example for Meteorological and Hydrological Technician, and satellite meteorology. Also KNMI supports MDS with training through projects, but not on regular basis. The need for regular trainings on WMO regulations as BIP-MT would be very sufficient.

The current budget is mainly for staff and some of the maintenance. The rest as spare parts, new AWS, radar, radiosondes etc all have to be extra funded mostly by UN organisations or the EU. The need for training to keep the staff up-to-date and have support from ICT and research personnel is essential also to support development of other operational activities, including e.g., weather and climate research and the expansion of the other functional observation networks, related to maritime, agrometeorology, climate and other e.g., MHEWS purposes.

1.5 Experience and track record in implementing internationally funded hydromet projects as well as research and development projects in general.

1. GCCA+ Phase 1 and 2 (UNDP-EU) for instruments (AWS and ARS) and data management
2. KNMI for radiosonde and Ozonesonde Measurements and data collection
3. India-UN project for ArcGis Licenses, AWS, Spare Parts, Drone
4. 5Cs for AWS

The Caribbean Community Climate Change Centre (CCCCC) established a sub-data node in Paramaribo, Suriname, to support the Regional Clearinghouse Mechanism, the single largest searchable collection of climate change information on the Caribbean. And with funding from the United States Agency for International Development Climate Change Adaptation Program (USAID CCAP).

Summary score and recommendations for Element 1:

The score can be assessed as maturity level 2: *Effort ongoing to formalize mandate, introduce improved governance, management processes and address resource challenges.*

- ✓ Responsibilities:
Consider reviewing the regulations and decree(s) to better identify the role and responsibilities and increase the visibility of the organization, serving economic sectors, public and private stakeholders;
- ✓ Service level agreements:
Level Agreements are available for Aviation and Maritime Authority Suriname and this is in process with the Energy Authority Suriname (EAS) and Coastguard.
Consider more developing services for the public and if possible the private sector, with service level agreements, for example for radar observations data with Energy sector for Brokopondo dam and with Staatsolie Maatschappij Suriname NV;
- ✓ Human resources:

most of the departments inside of the MDS are heavily understaffed. Moreover, since the only institute (besides the Anton De Kom University) able to provide further education and training in the different fields is to be found outside of Suriname (the Caribbean Institute for Meteorology and Hydrology (CIMH) in Barbados), it continues to be challenging for the existing staff to stay up-to-date with the developments in the worlds of meteorology and hydrology.

Need to seek for more (personal and core) budget to:

- hire more ICT dedicated expertise (including FOSS [Free and Open-Source Software] knowledge) in data management for meteorological applications, web design, network security, including open-source software applications and computing languages.
- train or hire new staff to efficiently ensure maintenance of the observation networks, including radar (incl. equipment repair, renewals, calibration);

Element 2: Effective partnerships to improve service delivery

2.1. Effective partnerships for service delivery in place with other government institutions.

Formal agreements have been made with the Civil Aviation Department to provide Aeronautical Forecasts and Warnings, and with the Maritime Authority Suriname to provide Weather Bulletins for Ships. Informal agreements have also been made with governmental departments to share services and products.

2.2. Effective partnerships in place at the national and international level with the private sector, research centres and academia, including joint research and innovation projects.

Partnerships are on collaboration, for example with the Anton de Kom University in Suriname and there is a letter of Intent signed by the MDS and The Royal Netherlands Meteorological Institute (KNMI) for the research on the Paramaribo station. No formal private partnerships are in place.

2.3. Effective partnerships in place with international climate and development finance partners.

International climate partnerships are in place with CIMH (Caribbean Institute for Meteorology and Hydrology) and CariCoF (Caribbean Climate Outlook Forum (CariCOF)).

2.4. New or enhanced products, services or dissemination techniques or new uses or applications of existing products and services that culminated from these relationships.

MDS does no research by itself since there are no researchers available. Research is in collaboration with KNMI, AdeK University and CariCOF. The Paramaribo station is in use for atmospheric composition research in collaboration with KNMI. Climate research is together with CariCOF on Subseasonal-to-seasonal forecasting. For hydrological forecasting this is mainly in collaboration with AdeK University.

Summary score, recommendations, and comments for Element 2

The score can be assessed as maturity level 2: Limited partnerships and mostly excluded from relevant finance opportunities.

- ✓ MDS under the ministry of Public Works can consider to have proactive collaboration with their partnerships and initiate more stakeholders meetings with governmental and also consider private partners. The partnerships need to be better formalized through agreements and MoUs. The MDS

can start from the already existing partnerships, seeking to deepen and strengthen them. Then approach other governmental entities and eventually turn its attention also towards the private market.

- ✓ Continue building on partnerships with peer-advisor KNMI (Netherlands)
- ✓ Engage in medium- to long-term human Capacity Development and training trajectories for staff with WMO, selected international partners and experts.

Element 3: Observational infrastructure

3.1. Average horizontal resolution in km of both synoptic surface and upper-air observations, including compliance with the Global Basic Observing Network (GBON) regulations.

MDS currently operates seventeen (17) AWS stations throughout the country, but none of them are GBON compliant due to the lack of data delivery by GTS/WIS. Among these stations, three (3) Synop stations provide hourly METAR information for aviation purposes. The upper air station in Paramaribo only operates twice a week, which is not sufficient for GBON compliance as it requires twice-daily observations. Additionally, the southern part of Suriname is very remote and difficult to access, resulting in a lack of observations in that area.

3.2. Additional observations used for nowcasting and specialized purposes.

Water level data for flash floods and riverine floods is received from the hydrological service in Suriname (Waterloopkundige Afdeling-WLA).

3.3. Standard Operating Practices in place for the deployment, maintenance, calibrations and quality assurance of the observational network.

The Upper Air Soundings are calibrated and have a Standard Operating Procedure (SOP) in place. However, maintenance for all Automated Weather Stations (AWS) is not always possible in remote areas due to lack of finances. Unfortunately, there is no calibration and quality assurance available for the AWS stations. Additionally, there is no national WIGOS governance mechanism, no trained staff in OSCAR, and no process in place with WDQMS. Also, there is no arrangement with the RIC in Barbados to get assistance in calibration.

3.4 Implementation of sustainable newer approaches to observations.

In Suriname there is no WIGOS implementation plan.

3.5. Percentage of the surface observations that depend on automatic techniques.

In recent years, all the stations have been automated, and AWS has been installed with the help of various projects. However, the availability of real-time data still remains an issue. At Zanderij airport, a radar has been installed, but unfortunately, no data has been available since 2020, mainly due to financial constraints.

Summary score, recommendations, and comments for Element 3

The score can be assessed as maturity level 2: Basic network, large gaps, mostly manual observations with severe challenges and data quality issues.

- ✓ The maturity level could be increased by sharing more functional AWS through WIS 2.0. Additionally, further development of the current integrated system for data reception, monitoring, storage, quality control, and management of weather and climate data is required.

- ✓ Enhancing capacity for station maintenance and repair is crucial. This involves securing additional resources, manpower, and transportation for station visits. It can help MDS to work on SOP requirements in line with WMO standards.
- ✓ An adequate calibration instrument at MDS Paramaribo station, where there is already a calibration lab for the radiosondes, is needed to reach the required quality standards.
- ✓ Training for IT and technical experts is essential to implement the above recommendations.

Element 4: Data and product sharing and policies

4.1. Percentage of GBON compliance – for how many prescribed surface and upper-air stations are observations exchanged internationally. Usage of regional WIGOS centres.

In Suriname, there are currently no GBON reporting stations. This is not due to lack of observations, but rather because the data is not being transferred via GTS/WIS. The cost of GTS is too high for MDS. The Paramaribo station is a GAW station primarily funded by KNMI.

4.2. A formal policy and practice for the free and open sharing of observational data.

In Suriname, there is currently no national WIGOS partnership agreement in place for integrating and openly sharing observations from both National Meteorological Service (NMS) and non-NMS sources. The aviation section of the MDS involves observations that are quality-controlled by observers. The SYNOP stations operate continuously for either 16 or 24 hours and make observations every hour. These SYNOP messages are then written and transmitted to the Brasilia Data Bank using the Aeronautical Message Handling System (AMHS).

4.3. Main data and products received from external sources in a national, regional and global context, such as model and satellite data.

MDS utilizes satellite data to monitor thunderstorms. The satellite images are accessible through windy.com and NOAA, and they are downloaded from the internet. MDS does not have a satellite receiver station. Unfortunately, the internet availability is unstable, and currently, the download speed is less than 10 Mbps. This hinders the meteorologists' ability to efficiently obtain forecasts when they only have internet-based information.

Summary score, recommendations, and comments for Element 4

The score can be assessed as maturity level 2: A limited amount of GBON compliant data is shared internationally. The existing data sharing policies or practices or the existing infrastructure severely hamper two-way data sharing.

- ✓ Currently, no station data is shared to the WMO-GTS or WIS2.0 and global community. The 3 airport stations have SYNOP/METAR data available hourly what is transmitted to the Brasilia Databank.
- ✓ Internet access should be stable and sufficient enough to download satellite images and work more efficiently.
- ✓ A Meteorological Work Station(MWS) or web-based platform (like GEOWEB) to get access to satellite imagery, forecasts and where it is possible to get full and easy access to the real-time data as well as the historical data.

Element 5: Numerical model and forecasting tool application

5.1. Model and remote sensed products form the primary source for products across the different forecasting timescales.

The meteorologists of MDS make use of charts from different models from various sources available through the Internet. Some of the MDS is trained by WMO trainings, but due to lack of personnel this is not regularly. In general, MDS has some difficulties accessing data from WMO centres.

5.2. a) Models run internally (and sustainably), b) Data assimilation and verification performed, c) appropriateness of horizontal and vertical resolution.

Different forecasts for Suriname are generated using the NWP models available on Windy.com and NOAA/AWC. MDS does not operate its own NWP models. Unfortunately, MDS does not have access to an integrated visualization system like a Meteorological Weather Station.

5.3. Probabilistic forecasts produced and, if so, based on ensemble predictions.

The different forecasts are released by making use of the NWP models available for Suriname in Windy.com and NOAA/AWC. MDS does not run their own NWP models and also no probabilistic forecasts are available.

Summary score, recommendations, and comments for Element 5

The score can be assessed as maturity level 1: Forecasts are based on classical forecasting techniques without model guidance and only cover a limited forecast time range.

Recommendations:

- ✓ Upgrade server infrastructure to handle diverse forecast demands for quicker data processing and timely access. A Meteorological Work Station(MWS) or web-based platform (like GEOWEB) to get access to forecasts and where it is possible to get full and easy access to the real-time data as well as the historical data.
- ✓ Establish formal data-sharing agreements with international partners to streamline access to diverse forecast data.
- ✓ Improve dissemination of meteorological information to enhance preparedness and response capabilities.
- ✓ Expand the use of probabilistic forecasts beyond aviation to benefit other sectors.
- ✓ Invest in continuous improvement to enhance the accuracy and reliability of probabilistic forecasts for marine and aviation applications.

Element 6: Warning and advisory services

6.1. Warning and alert service cover 24/7.

The Meteorological Department Service (MDS) operates a limited functional warning system, primarily focused on certain meteorological hazards, which is mainly aviation related. The warnings are not generated using the CAP format and are distributed via email and the government communication unit.

The limited number of personnel presents a significant challenge. High workloads and extended shifts may lead to situations where a single forecaster on duty fails to recognize all potential hazardous scenarios. Additionally, the very limited observational network, characterized by infrequent and

delayed data collection—often only available during daytime or 12-, 06 - or 03 hourly weather data—results in a lack of immediate data crucial for issuing accurate warnings.

Another major challenge is the outreach in a country with many sparsely populated areas, not fully covered by telecommunication networks. Consequently, even when warnings are accurate and timely, they may not reach the intended audience promptly because of the language barrier.

6.2. Hydrometeorological hazards for which forecasting and warning capacity is available and whether feedback and lessons learned are included to improve warnings.

The weather parameters addressed by the abovementioned early warnings are storm surge/coastal flood, drought/dry spell, tropical storm (marine) and fog (Aviation). Also high seas/rogue waves, rain/wet spells, lightning, and potential flash floods. Unfortunately, due to a shortage of staff, these warnings are not subject to verification or validation, except for aviation warnings, which are only partially validated. Additionally, feedback from end users regarding their satisfaction with the warnings is not systematically collected; it is only gathered on an ad hoc basis per event.

Furthermore, the limited observational network prevents the collection of sufficient hydrometeorological data to verify the issued warnings.

6.3. Common alerting procedures in place based on impact-based services and scenarios taking hazard, exposure and vulnerability information into account and with registered alerting authorities.

The MDS does not have Common alerting procedures in place based on impact-based services. The warnings are being prepared and shared with government communication units and the media, but they are not yet available for public preparedness and response.

Summary score, recommendations, and comments for Element 6

The score can be assessed as maturity level 1: Warning service not operational for public preparedness and response.

Recommendations:

- ✓ It is essential to upgrade the observational network, including meteorological and components, to provide real-time, accurate hourly observations. This is important for forecasting, issuing warnings, and validating post-event verification.
- ✓ Without increasing the number of forecasters, it is difficult to properly address additional hazards or provide multi-hazard advice.
- ✓ An additional dedicated person should be hired for verification and validation purposes.
- ✓ Forecasters should undergo additional capacity building and training to enhance their use of the various tools provided by the Global and Regional Centres.

Element 7: Contribution to Climate Services

7.1. Where relevant, contribution to climate services according to the established capacity for the provision of climate services.

The current climate services provided by the Meteorological Department Service (MDS) rely exclusively on data from three manual stations, two of which operate only during daytime hours. As a result, these stations are unable to accurately capture diurnal variations. Furthermore, large areas of

the country remain poorly represented or completely unmonitored by these stations. The traditional instruments used have not been recently calibrated, and the historical data is only partially archived in paper format, with ongoing but incomplete digitization efforts limiting accessibility for immediate users.

The MDS produces essential climatological products, such as mapped rainfall, temperature data, wet days, wet spells, dry spells, and drought-related climate products. Additionally, institutions like the KNMI and CIMH are currently analyzing the collected data.

Regarding future climate services, the MDS has been issuing seasonal forecasts since 2023 and is preparing to produce climate predictions through an ongoing project with CARICOF/CIMH. However, the MDS's primary client, the national committee for climate change, meets infrequently and requests information from the MDS sporadically and primarily on request.

Summary score, recommendations, and comments for Element 7

The CHD Element 7 score for the "Contribution to Climate Services" assessed as Maturity Level 2 on the CHD scale, reflecting "Basic Capacity for Climate Services Provision".

Recommendations:

- ✓ The climatological department should adopt a more proactive approach by initiating communication with potential long-term partners to establish formal and effective partnerships.
- ✓ The development and enhancement of a central data management system are imperative. This system must provide streamlined access for data analysts, meteorologists, and the Quality unit, and include the implementation of data homogenization.
- ✓ Digitizing the entire data archive, covering all parameters, is essential and should be integrated into the central data management system.
- ✓ Relevant staff from the Climatological unit needs to receive additional training to fully utilize the benefits of this new system.
- ✓ The system should also have the capability to accommodate the AWS data archive, which should be segregated from the manual network data.
- ✓ By gradually transitioning the station network to AWS, which operates on a 24/7 hourly basis, a more comprehensive representation of Suriname's climate can be achieved, particularly for climatic parameters associated with the diurnal cycle.

Element 8: Contribution to hydrology

8.1. Where relevant, standard products such as quantitative precipitation estimation and forecasts are produced on a routine basis according to the requirements of the hydrological community.

The Hydrology Division operates as a separate department within the same directorate. Despite its independence, the division collaborates with Meteorological and Hydrological Services for instrument installation and maintenance. However, the Hydrology Division faces capacity challenges, including a shortage of experienced personnel. Since 2023, they have installed 25 Automatic Water Level Stations and Ecologs, along with rain gauges.

A notable positive aspect is the support provided by national and international stakeholders and organizations, which has enhanced knowledge about the country's rivers, water bodies, groundwater

aquifers, and water quality. The Water Quality Unit regularly measures water quality, significantly contributing to government policy and the well-being of the country's citizens.

8.2. SOPs in place to formalize the relation between Met Service and Hydrology Agency, showing evidence that the whole value chain is addressed.

The Standard Operating Procedures (SOPs) for both services are still under development. As previously mentioned, the Hydrology Unit is experiencing a shortage of personnel. Additionally, this unit lacks hydrological forecasters, which hinders its ability to produce flood forecasts.

8.3. Data sharing agreements (between local and national agencies and across international borders as required) on hydrological data in place or under development.

An agreement is being pursued for data exchange among the countries sharing the Amazonas basin, particularly with Brazil, which has a more advanced hydro-meteorological network. Another agreement covers hydrological information over the watershed on the eastern border of Suriname, known as Bio-plateau. Currently, there is no proper database in place. However, efforts are underway to develop a data management system in collaboration with the Meteorological service, with the assistance of a data analyst from CIMH. It also appears that some other entities or consultancy companies in Suriname conduct measurements, although not continuously. There is no official agreement for data exchange with these entities, but it may occur occasionally due to personal and informal contacts.

8.4 Joint projects/initiatives with hydrological community designed to build hydrometeorological cooperation.

The Hydrological Services have collaborated with the Water Authority Directorate under the Ministry of Natural Resources, the Water Forum platform, and the National Water Company. There are also projects or consultancy bureaus that have installed instruments. The installation, operation, and maintenance are under the supervision of the Hydrological Service. Suriname has a National Integrated Water Commission, which is intended to be responsible for establishing hydrometeorological cooperation. However, further discussions are needed to fully define its role and responsibilities.

Summary score, recommendations, and comments for Element 8

The CHD Element 8 score for the "Contribution to Hydrology" assessed as level two (2): Meteorological input in hydrology and water resource management happens on an ad hoc basis and or during times of disaster.

Recommendations:

- ✓ The Hydrology Division operates as a separate department within the same directorate but more collaboration would be useful in the near future.
- ✓ The Hydrology Division is currently understaffed. Despite the recent expansion of the surface stations network using Automatic Water Level Stations (AWLs), it is crucial to recruit and retain staff to effectively manage and operate these systems.
- ✓ The service lacks experienced hydrologists, making it imperative to establish a comprehensive capacity-building and training program.
- ✓ In the future, adequate advisory support will be necessary to implement a hydrological model for all the rivers in Suriname.

Element 9: Product dissemination and outreach

9.1. Channels used for user-centred communication and ability to support those channels (for example, does the NMHS operate its own television, video or audio production facilities? Does it effectively use cutting-edge techniques?).

The Meteorological and Geophysical Service (MDS) disseminates its services and warnings to the public and other end-users through the Government Information Service, Facebook, and various media outlets. In addition, the public can obtain the latest weather updates by contacting the MDS via phone. It is important to note that the MDS does not possess its own radio/TV production facility, but it does distribute forecasts and warnings through its social media channels.

Owing to a limited number of forecasters, scheduling regular appearances on media broadcasts poses a challenge, resulting in a restricted availability of MDS personnel for such engagements.

Significantly, a substantial portion of the country experiences only partial to severely limited access to internet, TV, radio, and basic cellular networks. To mitigate this issue, the MDS relies on word-of-mouth, localized radio transmissions, local information agents, and similar methods. Consequently, the delivery of critical information often encounters substantial delays, potentially impeding timely access for the relevant public or end-users.

9.2. Education and awareness initiatives in place.

The UNDP, in collaboration with other organizations and institutions, has worked to improve community understanding of early warnings related to drought and excessive rainfall, which can lead to floods. Education and awareness initiatives are usually carried out on an ad-hoc basis. Community engagement sessions were conducted during the installation of AWSs and AWLs, with various villages and communities in both coastal and hinterland areas.

9.3. Special measures in place to reach marginalized communities and indigenous people.

The Directorate of Research and Service has an oral agreement with tribal communities in Suriname. In collaboration with the UNDP, community engagement sessions are conducted in areas where automatic weather and water stations are installed. Each village has a designated a focal point responsible for sharing weather and water level information with the Directorate or the Hydrological and Meteorological Services.

One of the significant challenges is the linguistic diversity among the various communities, including indigenous and Marron communities. The presence of multiple languages complicates communication and the dissemination of information. Ensuring that weather and water level information is accurately

conveyed to all community members requires translating and interpreting data into the local languages. This process is vital for effective early warning systems and community preparedness but adds a layer of complexity to the engagement and information-sharing efforts. Addressing these linguistic barriers is essential for building trust and ensuring that critical information reaches everyone, thereby enhancing the resilience of these communities to hydrometeorological hazards.

Summary score, recommendations, and comments for Element 9

The CHD Element 9 score for the “Product Dissemination and Outreach” assessed as Maturity Level 2: Traditional communication channels and a basic dedicated website is used to disseminate forecasts and basic information.

Recommendations

- ✓ Increase in the number of forecasters: It is crucial to increase the number of forecasters in the Meteorological Department Service (MDS) to meet the media's needs and provide timely updates, especially during critical weather events.
- ✓ Exploration of other dissemination methods: The MDS should consider using cell broadcasting to reach a wider audience and deliver real-time alerts directly to mobile phones, enhancing the overall effectiveness of the warning system.
- ✓ Support for Indigenous and Maroon Languages and Sign Language: It is essential to provide support for communication in Indigenous and Maroon languages, as well as in sign language, to ensure all communities receive and understand warnings and forecasts.
- ✓ Educational Program Initiative: Collaboration with the Ministry of Education to initiate an educational program for teachers in the interior regions aimed at incorporating disaster risk reduction (DRR) knowledge into their curricula.

Element 10: Use and national value of products and services

10.1. Formalized platform to engage with users in order to co-design improved services.

The MDS is a member of a national committee responsible for coordinating Disaster Risk Reduction (DRR) activities. However, the committee's primary activation occurs only during and after major events, with limited emphasis on preventive measures and ongoing preparedness activities. This reactive approach hinders the committee's effectiveness in mitigating risks and enhancing community resilience before disasters occur.

Furthermore, aside from this committee, there are no formalized platforms for systematic user engagement. Presently, user engagement is carried out on an ad-hoc basis through personal contacts, social media interactions, and sporadic meetings with various entities. The absence of formalized and regular engagement channels leads to inconsistent communication and collaboration with stakeholders, thus impeding the ability to effectively address and respond to the diverse needs of the community.

10.2. Independent user satisfaction surveys are conducted, and the results used to inform service improvement.

Independent user satisfaction surveys are occasionally conducted to gather feedback on the services provided by the MDS. The insights gained from these surveys are utilized to inform and guide service improvements. However, in Suriname, these surveys are not conducted on a regular basis. This irregularity limits the ability of the MDS to consistently monitor user satisfaction and identify areas for continuous improvement.

10.3. Quality management processes that satisfy key user needs and support continuous improvement.

The Meteorological Department Service (MDS) has successfully implemented a Quality Management System (QMS) specifically for aeronautical meteorology, in conformity with the ISO 9001:2008 standard. This certification, obtained in 2015, reflects the commitment of the MDS to ensuring the highest standards of quality and reliability in providing meteorological services to the aviation sector. However, it is important to note that the QMS has not been extended to other fields or applied organization-wide. While the aeronautical meteorology segment benefits from this quality assurance framework, other areas of the MDS's operations remain without formalized quality management systems. This discrepancy highlights a potential gap in ensuring consistent quality across all services offered by the MDS.

Furthermore, the recertification process, originally scheduled for 2018, was not carried out due to financial constraints. This lapse raises concerns about the ongoing effectiveness and sustainability of the QMS for aeronautical meteorology. Without recertification, there is a risk of complacency or degradation in the quality of services provided to the aviation sector.

Summary score, recommendations, and comments for Element 10

The CHD Element 10 score for the “Use and National Value of Products and Services” assessed as Maturity Level 2 on the CHD scale, reflecting, “Service development draws on informal stakeholder input and feedback”.

Recommendations:

- ✓ Establish Regular Survey Intervals. Implement a structured schedule for conducting user satisfaction surveys at regular intervals, such as annually or biannually. This will ensure that feedback is consistently gathered and analyzed over time.
- ✓ Utilize multiple channels to collect user feedback, including online surveys, phone interviews, focus groups, and community meetings. This approach will capture a broader range of perspectives and improve the representativeness of the feedback.
- ✓ Design comprehensive survey tools that cover various aspects of the services provided by the MDS, such as the accuracy of forecasts, timeliness of warnings, effectiveness of communication methods, and overall user satisfaction.
- ✓ Ensure that surveys reach a diverse cross-section of the population, including different geographic regions, demographic groups, and sectors (e.g., agriculture, transportation, health). This will help in understanding the unique needs and concerns of various user groups.
- ✓ Establish a systematic process for analyzing survey results and integrating the findings into service improvement plans.
- ✓ Share the survey findings with stakeholders and the public to maintain transparency and demonstrate a commitment to continuous improvement.

Annex 1 Consultations (including experts and stakeholder consultations)

List major consultations and other activities during the CHD process:

- Kadosoe S. Director/O&W
- Bhaggoe D. ODOI/OW
- Warsodikromo T. Adviseur/OW
- Nurmohamed R Minister of Public Works
- Samuel D. MDS/OW
- Kasmani L. MDS/OW
- Bardan C. MDS/OW
- Djojebesari C. MDS/OW
- Koole E. KNMI
- Fortuin P. KNMI
- Moestadja S. Adviseur/OW
- Alcantra M. MPU/OW
- Ramautar Deepak MPU/OW
- Pawiroredjo P. EAS (Energy Authority Suriname)
- Owen S. WLA/OW
- Atwaroe K. LVD (Civil Aviation)
- Wongsopawiro T. LVD (Civil Aviation)
- Hoeseni S. LVD (Civil Aviation)
- Pieka A. MAS (Maritime Authority Suriname)
- Warmoen C. MAS (Maritime Authority Suriname)
- Coulor R. MAS (Maritime Authority Suriname)
- Babb G. UNDP
- Drakenstein B. UNDP
- Kuldipsingh S. NH (Natural Resources)
- Kheda D. CTW/OW
- Komproe G. NCCR (National Coordinator Centre Disaster Relief)
- Soerjbalie Staatsolie Maarschappij Suriname
- Daan J. Staatsolie Maarschappij Suriname
- Outron S. OGR/OW
- Kishoen Misier S. Anton de Kom University
- Ori B. OW
- Anand Kalpoe EAS (Energy Authority Suriname)
- Wijngaarde, G. Het Surinaamse Rode Kruis (Red Cross Suriname)

Annex 2 Urgent needs reported

The summary of the CHD is:

- A comprehensive law for the activities of MDS.
- Human capacity in the whole MDS, like maintenance, calibration, ICT, meteorology, climate, data visualization.
- Upgrading weather stations and providing hourly quality observations and use of real time data by MDS.
- Need of Meteorological Work Station to have NWP forecasts, satellite images and real time data sufficient available.
- More collaboration with the hydrological division would be useful in the near future.
- Effective partnerships in all sectors, governmental, private sector and international.

Annex 3 Information supplied through WMO

Peer adviser KNMI acknowledges the numerous lists of references provided by SOFF in templates and guiding material throughout the Readiness phase, including information and guidance given in the CHD data inventory and review sheet for Suriname.

Annex 4 List of materials used

The peer adviser KNMI utilised the following materials:

- Materials and documents but also reflections and input provided by the Meteorological Service Suriname (MDS) and the ministry of Public Works (OW).
- Online material included as references to this document.
- Web pages of the Government of MDS (<https://hydromet.sr/mds/>).
- Interview data, in person contributions and personal communication and reflections provided during the drafting of this report.