A Practical Guide to Seasonal Briefings

By Humanitarian Action on Climate and the Environment (HACE) & Regional Collaborators

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Executive summary | The **Regional Seasonal Briefs** are a new service providing **insights into the upcoming season and could allow more time for MSF teams for decision-making**. The product focuses on the **3 months the come** and are released **at the start** of the period covered. The briefings are generated by region and cover most if not all the countries in that region, with a particular focus on those where MSF has active projects. They are developed by HACE with the collaboration of regional partners. We provide an overview of the past seasonal performance and impacts on the region as well as the expected seasonal performance for the months to come at a regional and national level. **This guide provides comprehensive guidance on how to use and interpret HACE seasonal briefings so those can be used effectively by MSFers from various backgrounds.**

Contents

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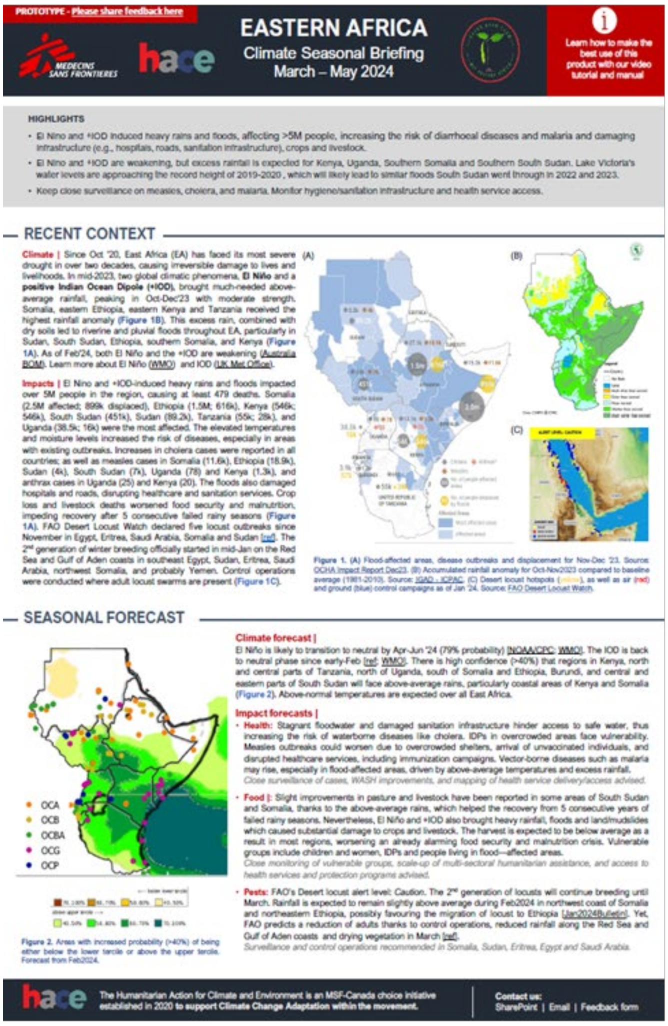
1. Regional Seasonal Briefings

1.1. What exactly can we find in them?

Regional Seasonal Briefings contain information on the performance of the past season and its impacts on health, food, and livelihoods, as well as providing the seasonal forecast and expected impacts. **Figure 1a/b** show the overall structure of the briefing and a description of the content that you can find in each section. The first page provides a regional overview, whilst the second page provides more detailed information at the country level. In the first page, we also find a section with highlights which list the major findings and point to some recommendations when applicable.



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EASTERN AFRICA
Climate Seasonal Briefing
March – May 2024

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HIGHLIGHTS

- El Nino and +IOD induced heavy rains and floods, affecting >5M people, increasing the risk of diarrhoeal diseases and malaria and damaging infrastructure (e.g., hospitals, roads, sanitation infrastructure), crops and livestock.
- El Nino and +IOD are weakening, but excess rainfall is expected for Kenya, Uganda, Southern Somalia and Southern South Sudan. Lake Victoria's water levels are approaching the record height of 2019-2020 , which will likely lead to similar floods South Sudan went through in 2022 and 2023.
- Keep close surveillance on measles, cholera, and malaria. Monitor hygiene/sanitation infrastructure and health service access.

RECENT CONTEXT

Climate | Since Oct '20, East Africa (EA) has faced its most severe drought in over two decades, causing irreversible damage to lives and livelihoods. In mid-2023, two global climatic phenomena, **El Niño** and a **positive Indian Ocean Dipole (+IOD)**, brought much-needed above-average rainfall, peaking in Oct-Dec'23 with moderate strength. Somalia, eastern Ethiopia, eastern Kenya and Tanzania received the highest rainfall anomaly (Figure 1B). This excess rain, combined with dry soils led to riverine and pluvial floods throughout EA, particularly in Sudan, South Sudan, Ethiopia, southern Somalia, and Kenya (Figure 1A). As of Feb'24, both El Niño and the +IOD are weakening (Australia BOM). Learn more about El Niño (WMO) and IOD (UK Met Office).

Impacts | El Nino and +IOD-induced heavy rains and floods impacted over 5M people in the region, causing at least 479 deaths. Somalia (2.5M affected; 899k displaced), Ethiopia (1.5M; 616k), Kenya (546k; 546k), South Sudan (451k), Sudan (89.2k), Tanzania (55k; 28k), and Uganda (38.5k; 16k) were the most affected. The elevated temperatures and moisture levels increased the risk of diseases, especially in areas with existing outbreaks. Increases in cholera cases were reported in all countries; as well as measles cases in Somalia (11.6k), Ethiopia (18.9k), Sudan (4k), South Sudan (7k), Uganda (78) and Kenya (1.3k), and anthrax cases in Uganda (25) and Kenya (20). The floods also damaged hospitals and roads, disrupting healthcare and sanitation services. Crop loss and livestock deaths worsened food security and malnutrition, impeding recovery after 5 consecutive failed rainy seasons (Figure 1A). FAO Desert Locust Watch declared five locust outbreaks since November in Egypt, Eritrea, Saudi Arabia, Somalia and Sudan [ref]. The 2nd generation of winter breeding officially started in mid-Jan on the Red Sea and Gulf of Aden coasts in southeast Egypt, Sudan, Eritrea, Saudi Arabia, northwest Somalia, and probably Yemen. Control operations were conducted where adult locust swarms are present (Figure 1C).

Figure 1. (A) Flood-affected areas, disease outbreaks and displacement for Nov-Dec '23. Source: OCHA Impact Report Dec23. (B) Accumulated rainfall anomaly for Oct-Nov2023 compared to baseline average (1981-2010). Source: IGAD - ICPAC. (C) Desert locust hotspots (yellow), as well as air (red) and ground (blue) control campaigns as of Jan '24. Source: FAO Desert Locust Watch.

SEASONAL FORECAST

Figure 2. Areas with increased probability (>40%) of being either below the lower tercile or above the upper tercile. Forecast from Feb2024.

Climate forecast |
El Niño is likely to transition to neutral by Apr-Jun '24 (79% probability) [NOAA/CPC; WMO]. The IOD is back to neutral phase since early-Feb [ref; WMO]. There is high confidence (>40%) that regions in Kenya, north and central parts of Tanzania, north of Uganda, south of Somalia and Ethiopia, Burundi, and central and eastern parts of South Sudan will face above-average rains, particularly coastal areas of Kenya and Somalia (Figure 2). Above-normal temperatures are expected over all East Africa.

Impact forecasts |

- **Health:** Stagnant floodwater and damaged sanitation infrastructure hinder access to safe water, thus increasing the risk of waterborne diseases like cholera. IDPs in overcrowded areas face vulnerability. Measles outbreaks could worsen due to overcrowded shelters, arrival of unvaccinated individuals, and disrupted healthcare services, including immunization campaigns. Vector-borne diseases such as malaria may rise, especially in flood-affected areas, driven by above-average temperatures and excess rainfall.
Close surveillance of cases, WASH improvements, and mapping of health service delivery/access advised.
- **Food |:** Slight improvements in pasture and livestock have been reported in some areas of South Sudan and Somalia, thanks to the above-average rains, which helped the recovery from 5 consecutive years of failed rainy seasons. Nevertheless, El Niño and +IOD also brought heavy rainfall, floods and land/mudslides which caused substantial damage to crops and livestock. The harvest is expected to be below average as a result in most regions, worsening an already alarming food security and malnutrition crisis. Vulnerable groups include children and women, IDPs and people living in flood—affected areas.
Close monitoring of vulnerable groups, scale-up of multi-sectoral humanitarian assistance, and access to health services and protection programs advised.
- **Pests:** FAO's Desert locust alert level: Caution. The 2nd generation of locusts will continue breeding until March. Rainfall is expected to remain slightly above average during Feb2024 in northwest coast of Somalia and northeastern Ethiopia, possibly favouring the migration of locust to Ethiopia [Jan2024Bulletin]. Yet, FAO predicts a reduction of adults thanks to control operations, reduced rainfall along the Red Sea and Gulf of Aden coasts and drying vegetation in March [ref].
Surveillance and control operations recommended in Somalia, Sudan, Eritrea, Egypt and Saudi Arabia.

The Humanitarian Action for Climate and Environment is an MSF-Canada choice initiative established in 2020 to support Climate Change Adaptation within the movement.

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Title section: States the region and period under review, the logos of the MSF groups involved in its development, and an information box linking the user to this 'Practical Guide' and a video tutorial.

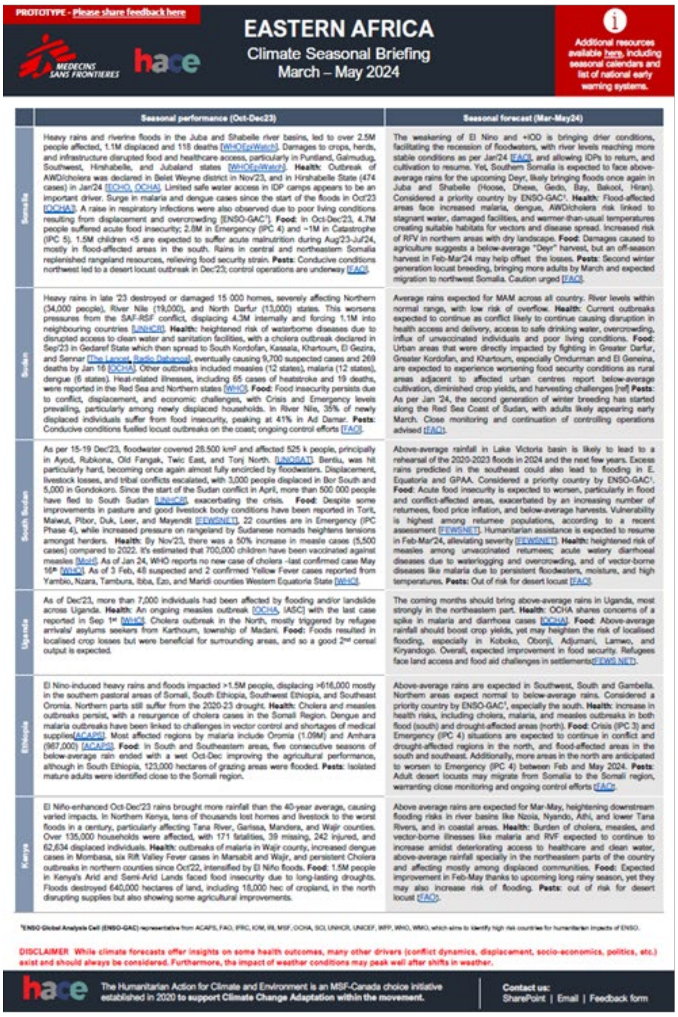
Highlights: Summarizes the main impacts observed (performance) and expected (forecasts) for the region and gives general guidance on possible actions.

Recent context: Reviews the past season performance relative to what was expected for that season/region and the impacts observed including physical (e.g., flooding, infrastructure), human (e.g. displacement, diseases, injuries) and agropastoral (e.g., pests, loss of livestock and crops). . Impact data obtained from updates from MSF teams (via direct communication or SOUK) and other actors including, albeit not limited to, WHO, OCHA, IFRC, WFP, and FAO.

Seasonal forecast: Summarizes the forecasted weather conditions for the period/region, mostly focusing on temperature and rainfall. It also provides and overview of expected impacts on health, food and pests. Impact data obtained from other actors including, albeit not limited to WHO, OCHA, IFRC, WFP, and FAO.

Contact section: List of available platforms to contact us for feedback, questions or requests. It includes link to a *feedback form* which we encourage all users to fill in. See section on 'Importance of feedback loops'

Figure 1a. Diagram explaining sections of page 1 of the Regional Seasonal Briefing.



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EASTERN AFRICA
Climate Seasonal Briefing
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Additional resources available here, including seasonal calendars and list of national early warning systems.

	Seasonal performance (Oct-Dec23)	Seasonal forecast (Mar-May24)
Somalia	Heavy rains and riverine floods in the Juba and Shabelle river basins, led to over 2.5M people affected, 1.1M displaced and 118 deaths [WHOEpiWatch]. Damages to crops, herds, and infrastructure disrupted food and healthcare access, particularly in Puntland, Galmudug, Southwest, Hirshabelle, and Jubaland states [WHOEpiWatch]. **Health**: Outbreak of AWD/cholera was declared in Belet Weyne district in Nov'23, and in Hirshabelle State (474 cases) in Jan'24 [ECHO, OCHA]. Limited safe water access in IDP camps appears to be an important driver. Surge in malaria and dengue cases since the start of the floods in Oct'23 [OCHA]. A raise in respiratory infections were also observed due to poor living conditions resulting from displacement and overcrowding [ENSO-GAC[1]]. **Food**: In Oct-Dec'23, 4.7M people suffered acute food insecurity; 2.8M in Emergency (IPC 4) and ~1M in Catastrophe (IPC 5). 1.5M children <5 are expected to suffer acute malnutrition during Aug'23-Jul'24, mostly in flood-affected areas in the south. Rains in central and northeastern Somalia replenished rangeland resources, relieving food security strain. **Pests**: Conducive conditions northwest led to a desert locust outbreak in Dec'23; control operations are underway [FAO].	The weakening of El Nino and +IOD is bringing drier conditions, facilitating the recession of floodwaters, with river levels reaching more stable conditions as per Jan'24 [FAO], and allowing IDPs to return, and cultivation to resume. Yet, Southern Somalia is expected to face above-average rains for the upcoming Deyr, likely bringing floods once again in Juba and Shabelle (Hoose, Dhexe, Gedo, Bay, Bakool, Hiran). Considered a priority country by ENSO-GAC[1]. **Health**: Flood-affected areas face increased malaria, dengue, AWD/cholera risk linked to stagnant water, damaged facilities, and warmer-than-usual temperatures creating suitable habitats for vectors and disease spread. Increased risk of RFV in northern areas with dry landscape. **Food**: Damages caused to agriculture suggests a below-average "Deyr" harvest, but an off-season harvest in Feb-Mar'24 may help offset the losses. **Pests**: Second winter generation locust breeding, bringing more adults by March and expected migration to northwest Somalia. Caution urged [FAO].
Sudan	Heavy rains in late '23 destroyed or damaged 15 000 homes, severely affecting Northern (34,000 people), River Nile (19,000), and North Darfur (13,000) states. This worsens pressures from the SAF-RSF conflict, displacing 4.3M internally and forcing 1.1M into neighbouring countries [UNHCR]. **Health**: heightened risk of waterborne diseases due to disrupted access to clean water and sanitation facilities, with a cholera outbreak declared in Sep'23 in Gedaref State which then spread to South Kordofan, Kassala, Khartoum, El Gezira, and Sennar [The Lancet, Radio Dabanga], eventually causing 9,700 suspected cases and 269 deaths by Jan 16 [OCHA]. Other outbreaks included measles (12 states), malaria (12 states), dengue (6 states). Heat-related illnesses, including 65 cases of heatstroke and 19 deaths, were reported in the Red Sea and Northern states [WHO]. **Food**: Food insecurity persists due to conflict, displacement, and economic challenges, with Crisis and Emergency levels prevailing, particularly among newly displaced households. In River Nile, 35% of newly displaced individuals suffer from food insecurity, peaking at 41% in Ad Damar. **Pests**: Conducive conditions fuelled locust outbreaks on the coast; ongoing control efforts [FAO].	Average rains expected for MAM across all country. River levels within normal range, with low risk of overflow. **Health**: Current outbreaks expected to continue as conflict likely to continue causing disruption in health access and delivery, access to safe drinking water., overcrowding, influx of unvaccinated individuals and poor living conditions. **Food**: Urban areas that were directly impacted by fighting in Greater Darfur, Greater Kordofan, and Khartoum, especially Omdurman and El Geneina, are expected to experience worsening food security conditions as rural areas adjacent to affected urban centres report below-average cultivation, diminished crop yields, and harvesting challenges [ref] **Pests**: As per Jan '24, the second generation of winter breeding has started along the Red Sea Coast of Sudan, with adults likely appearing early March. Close monitoring and continuation of controlling operations advised [FAO].
South Sudan	As per 15-19 Dec'23, floodwater covered 28.500 km^2 and affected 525 k people, principally in Ayod, Rubkona, Old Fangak, Twic East, and Tonj North. [UNOSAT]. Bentiu, was hit particularly hard, becoming once again almost fully encircled by floodwaters. Displacement, livestock losses, and tribal conflicts escalated, with 3,000 people displaced in Bor South and 5,000 in Gondokoro. Since the start of the Sudan conflict in April, more than 500 000 people have fled to South Sudan [UNHCR], exacerbating the crisis. **Food**: Despite some improvements in pasture and good livestock body conditions have been reported in Torit, Maiwut, Pibor, Duk, Leer, and Mayendit [FEWSNET], 22 counties are in Emergency (IPC Phase 4), while increased pressure on rangeland by Sudanese nomads heightens tensions amongst herders. **Health**: By Nov'23, there was a 50% increase in measle cases (5,500 cases) compared to 2022. It's estimated that 700,000 children have been vaccinated against measles [MoH]. As of Jan 24, WHO reports no new case of cholera –last confirmed case May 16th [WHO]. As of 3 Feb, 48 suspected and 2 confirmed Yellow Fever cases reported from Yambio, Nzara, Tambura, Ibba, Ezo, and Maridi counties Western Equatoria State [WHO].	Above-average rainfall in Lake Victoria basin is likely to lead to a rehearsal of the 2020-2023 floods in 2024 and the next few years. Excess rains predicted in the southeast could also lead to flooding in E. Equatoria and GPAA. Considered a priority country by ENSO-GAC[1]. **Food**: Acute food insecurity is expected to worsen, particularly in flood and conflict-affected areas, exacerbated by an increasing number of returnees, food price inflation, and below-average harvests. Vulnerability is highest among returnee populations, according to a recent assessment [FEWSNET]. Humanitarian assistance is expected to resume in Feb-Mar'24, alleviating severity [FEWSNET]. **Health**: heightened risk of measles among unvaccinated returnees; acute watery diarrhoeal diseases due to waterlogging and overcrowding, and of vector-borne diseases like malaria due to persistent floodwaters, moisture, and high temperatures. **Pests**: Out of risk for desert locust [FAO].
Uganda	As of Dec'23, more than 7,000 individuals had been affected by flooding and/or landslide across Uganda. **Health**: An ongoing measles outbreak [OCHA, IASC] with the last case reported in Sep 1st [WHO]. Cholera outbreak in the North, mostly triggered by refugee arrivals/ asylums seekers from Karthoum, township of Madani. **Food**: Foods resulted in localised crop losses but were beneficial for surrounding areas, and so a good 2nd cereal output is expected.	The coming months should bring above-average rains in Uganda, most strongly in the northeastern part. **Health**: OCHA shares concerns of a spike in malaria and diarrhoea cases [OCHA]. **Food**: Above-average rainfall should boost crop yields, yet may heighten the risk of localised flooding, especially in Koboko, Obongi, Adjumani, Lamwo, and Kiryandogo. Overall, expected improvement in food security. Refugees face land access and food aid challenges in settlements[FEWS NET].
Ethiopia	El Nino-induced heavy rains and floods impacted >1.5M people, displacing >616,000 mostly in the southern pastoral areas of Somali, South Ethiopia, Southwest Ethiopia, and Southeast Oromia. Northern parts still suffer from the 2020-23 drought. **Health**: Cholera and measles outbreaks persist, with a resurgence of cholera cases in the Somali Region. Dengue and malaria outbreaks have been linked to challenges in vector control and shortages of medical supplies[ACAPS]. Most affected regions by malaria include Oromia (1.09M) and Amhara (987,000) [ACAPS]. **Food**: In South and Southeastern areas, five consecutive seasons of below-average rain ended with a wet Oct-Dec improving the agricultural performance, although in South Ethiopia, 123,000 hectares of grazing areas were flooded. **Pests**: Isolated mature adults were identified close to the Somali region.	Above-average rains are expected in Southwest, South and Gambella. Northern areas expect normal to below-average rains. Considered a priority country by ENSO-GAC[1], especially the south. **Health**: increase in health risks, including cholera, malaria, and measles outbreaks in both flood (south) and drought-affected areas (north). **Food**: Crisis (IPC 3) and Emergency (IPC 4) situations are expected to continue in conflict and drought-affected regions in the north, and flood-affected areas in the south and southeast. Additionally, more areas in the north are anticipated to worsen to Emergency (IPC 4) between Feb and May 2024. **Pests**: Adult desert locusts may migrate from Somalia to the Somali region, warranting close monitoring and ongoing control efforts [FAO].
Kenya	El Niño-enhanced Oct-Dec'23 rains brought more rainfall than the 40-year average, causing varied impacts. In Northern Kenya, tens of thousands lost homes and livestock to the worst floods in a century, particularly affecting Tana River, Garissa, Mandera, and Wajir counties. Over 135,000 households were affected, with 171 fatalities, 39 missing, 242 injured, and 62,634 displaced individuals. **Health**: outbreaks of malaria in Wajir county, increased dengue cases in Mombasa, six Rift Valley Fever cases in Marsabit and Wajir., and persistent Cholera outbreaks in northern counties since Oct'22, intensified by El Niño floods. **Food**: 1.5M people in Kenya's Arid and Semi-Arid Lands faced food insecurity due to long-lasting droughts. Floods destroyed 640,000 hectares of land, including 18,000 hec of cropland, in the north disrupting supplies but also showing some agricultural improvements.	Above average rains are expected for Mar-May, heightening downstream flooding risks in river basins like Nzoia, Nyando, Athi, and lower Tana Rivers, and in coastal areas. **Health**: Burden of cholera, measles, and vector-borne illnesses like malaria and RVF expected to continue to increase amidst deteriorating access to healthcare and clean water, above-average rainfall specially in the northeastern parts of the country and affecting mostly among displaced communities. **Food**: Expected improvement in Feb-May thanks to upcoming long rainy season, yet they may also increase risk of flooding. **Pests**: out of risk for desert locust [FAO].

[1]ENSO Global Analysis Cell (ENSO-GAC) representative from ACAPS, FAO, IFRC, IOM, IRI, MSF, OCHA, SCI, UNHCR, UNICEF, WFP, WHO, WMO, which aims to identify high risk countries for humanitarian impacts of ENSO.

DISCLAIMER While climate forecasts offer insights on some health outcomes, many other drivers (conflict dynamics, displacement, socio-economics, politics, etc.) exist and should always be considered. Furthermore, the impact of weather conditions may peak well after shifts in weather.

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Country analysis: Reviews the past season performance (first column) and the forecast (second column) for each country in the region – *countries where MSF has missions have been prioritized if not enough space.*

Contact section: List of available platforms to contact us for feedback, questions or requests. It includes link to a *feedback form* which we encourage all users to fill in. See section on 'Importance of feedback loops'

Figure 1b. Diagram explaining sections of page 2 of the Regional Seasonal Briefing.

The **past season performance section** collects at the regional and national level information on how the observed rainfall and temperature compared with the average conditions for that region and season. The past weather conditions are then linked to impact on infrastructure, population health, livelihood and agricultural performance. HACE collects information on impacts from MSF teams directly through bespoken exchanges and operational updates, complemented by analyses published by other NGOs, governments and UN agencies. In addition, HACE sits on several international meetings on climate and health with other humanitarian actors. Information shared during these meetings is also fed into our briefs.

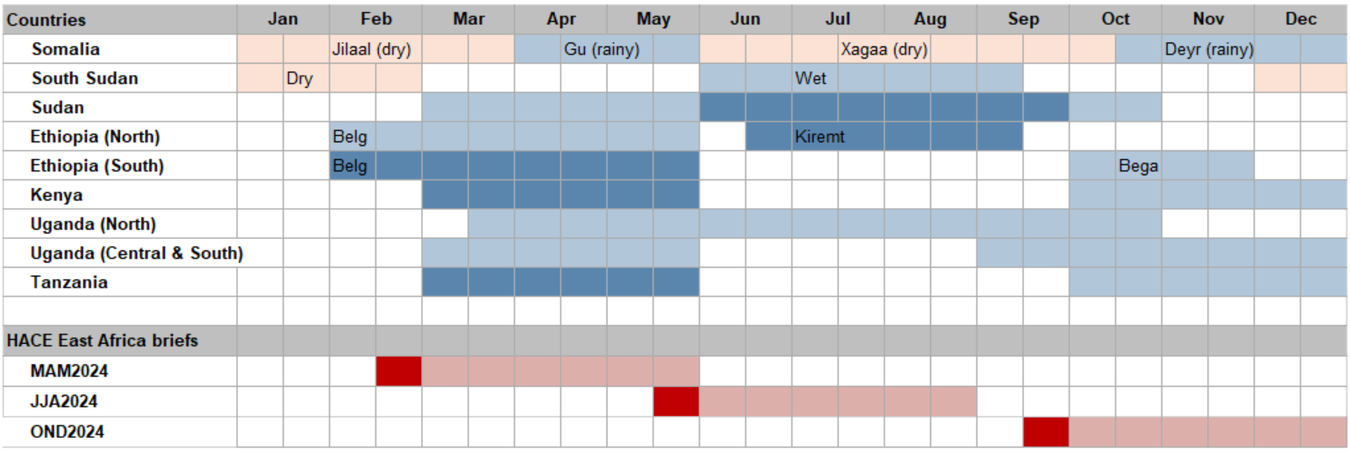
For **the outlook of the coming months**, we provide detailed information on the likelihood of experiencing wetter or drier (precipitation), warmer, or colder (temperature) conditions than what we would usually expect for that season and region, the so-called climatological average. This information is obtained from **seasonal forecasts** which are generated by reference international agencies such as the World Meteorological Organization (WMO), Copernicus (EU), or the International Research Institute for Climate and Society (IRI). HACE analyses the products provided by these various organizations egularly to communicate the most trustworthy seasonal forecast. To learn more about what seasonal forecasts are, how are they generated, available products and how HACE uses them, refer to Section **2. Seasonal Forecasts.** In addition to climate information, we provide a broad analysis of expected humanitarian impacts. This is a combination of MSF staff prior experience and knowledge, evidence from the literature linking certain weather patterns and the likelihood of disease outbreaks or impacts on wellbeing, existing analyses by other humanitarian actors and governments and insights from international meetings on climate and health.

Seasonal briefings rely heavily on seasonal forecasts.

1.2. When are they released?

Regional Seasonal Briefings are launched periodically, ahead of the predominant seasons of each region. See **Table 1** for a calendar of the main rainy and dry seasons for each country and the launch time and coverage of the Regional Seasonal Briefs.

Table 1. Rainy and dry seasons of countries in East Africa and timings of the East Africa Regional Seasonal Briefs



Countries	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Somalia	🟧	🟧	🟧 Jilaal (dry)	🟧	🟧	🟧	🟦	🟦 Gu (rainy)	🟦	🟦	🟧	🟧	🟧	🟧 Xagaa (dry)	🟧	🟧	🟧	🟧	🟧	🟦	🟦 Deyr (rainy)	🟦	🟦	🟦
South Sudan	🟧	🟧 Dry	🟧	🟧							🟦	🟦	🟦 Wet	🟦	🟦	🟦	🟦						🟧	🟧
Sudan					🟦	🟦	🟦	🟦	🟦	🟦	■	■	■	■	■	■	■	■	🟦	🟦				
Ethiopia (North)			🟦 Belg	🟦	🟦	🟦	🟦	🟦	🟦	🟦		■	■ Kiremt	■	■	■	■							
Ethiopia (South)			🟦 Belg	■	■	■	■	■	■	■									🟦	🟦 Bega	🟦	🟦		
Kenya					■	■	■	■	■	■									🟦	🟦	🟦	🟦	🟦	🟦
Uganda (North)						🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦				
Uganda (Central & South)					🟦	🟦	🟦	🟦	🟦	🟦							🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
Tanzania					■	■	■	■	■	■									🟦	🟦	🟦	🟦	🟦	🟦
HACE East Africa briefs																								
MAM2024				🟥	▨	▨	▨	▨	▨	▨														
JJA2024										🟥	▨	▨	▨	▨	▨	▨								
OND2024																		🟥	▨	▨	▨	▨	▨	▨

Source: World Bank Climate Change Knowledge Portal For development Practitioners and Policy Makers

1.3. Who are we?

The Regional Seasonal Briefing products were **designed by HACE but count with the valuable input regional partners,** such as the Green Bean team, in the case of the Eastern Africa Seasonal Brief.

The **Humanitarian Action for Climate and the Environment (HACE)** is an MSF-Canada choice initiative that aims to bolster Climate Change Adaptation efforts within the movement by developing tailored Climate Services and products (e.g., Regional Seasonal Briefings, ad-hoc forecasting support, etc.), fostering a community of practice, and supporting climate change adaptation research. HACE seeks to take tangible steps, engage in partnerships, maintain scientific rigor, and empower vulnerable communities to adapt to climate change effectively. Our vision, to become a dynamic hub for climate adaptation expertise at the service of MSF needs and aspirations. Our actions are rooted in four core values: *action-oriented practices, collaborative environment, scientific integrity,* and *community empowerment*. Read more about what we do and what products we offer on HACE SharePoint.

2. Seasonal forecasts: what are they and how to use them

1.1. What are seasonal forecasts?

In general, climate and weather forecasts provide information about what to expect in the future with more or less certainty, depending on how they have been generated and the complexity of the phenomena they are forecasting. With a prediction lead time (how far ahead the forecast is for) of usually 3-6 months, seasonal forecasts lie somewhere in between conventional weather forecasts (in the range of days) and climate change predictions (in the range of years to decades).

Seasonal forecasts answer the question **“how likely it is that the coming season will be wetter or drier, warmer, or colder than 'usual' for that time of year?”**. Or in other words, they tell us about the likelihood of climate anomalies, i.e. deviations from the long term (30 year) mean, for a particular month or season.

1.2. Why are seasonal forecasts possible?

Seasonal forecasting models exploit slow and predictable behaviour of some of the Earth system components, including atmospheric and oceanic circulations. The most influential component is **sea-surface temperature (SST)** which is the temperature at the water’s surface. SST alters the temperature of the air above the ocean and consequently atmospheric circulation and lobal weather systems over land are affected. The slow fluctuations of SST can be predicted up to 6 months ahead, allowing us to generate seasonal forecasts. The strongest and most well-known link between SST and seasonal weather is associated **with the El Niño Southern Oscillation (ENSO)** phenomenon, acting as the main source of predictability at the seasonal time scale. ENSO is one of the most important climate phenomena on Earth due to its ability to change the global atmospheric circulation, which in turn, influences temperature and precipitation across the globe. It is characterized by variations in sea surface temperatures (SSTs) and atmospheric pressure in the equatorial Pacific Ocean. It consists of three primary phases: El Niño (cooling of the ocean), La Niña (warming of the ocean), and neutral conditions.

Other global scale climate phenomena include **Indian Ocean Dipole (IOD)** which influences rainfall patterns in regions bordering the Indian Ocean, Southeast Asia, and eastern Africa,, the **North Atlantic Oscillation (NAO)** affecting weather patterns in Europe, North America, and North Africa, the **Pacific Decadal Oscillation (PDO)** affecting mostly the Pacific region and the **Madden-Julian Oscillation (MJO)**, characterized by the eastward drive of large regions of enhanced and suppressed tropical rainfall, affecting mostly tropical and subtropical regions.

The El Niño-Southern Oscillation (ENSO)

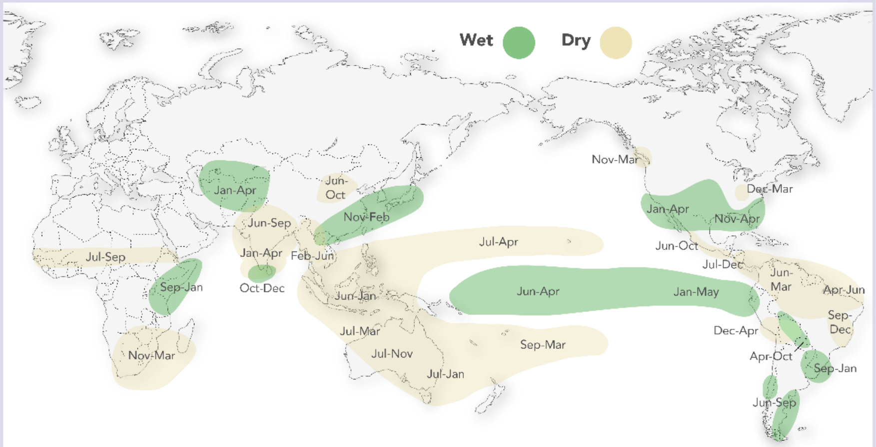
ENSO is a large-scale climatic phenomenon originating in the equatorial Pacific and affects global climate and weather patterns. The cycle is the consequence of slow feedback in the ocean-atmosphere system acting alongside the strong air-sea interaction processes in the tropics that allow the growth of small disturbances to the large-scale ocean state. El Niño events occur quasi-periodically at two- to seven-year intervals. Below a description of each phase of the ENSO phenomenon:

- **El Niño**: This phase occurs when SSTs in the central and eastern Pacific Ocean become anomalously warm. It disrupts normal weather patterns, leading to increased rainfall in some regions and droughts in others.
- **La Niña:** La Niña is the opposite phase of El Niño, characterized by cooler-than-average SSTs in the central and eastern Pacific Ocean. It often leads to enhanced rainfall in the western Pacific and drier conditions in the central and eastern Pacific, as well as affecting weather patterns around the globe.
- **Neutral Conditions**: These are periods when SSTs and atmospheric conditions in the equatorial Pacific are near their long-term averages, neither exhibiting El Niño nor La Niña characteristics.

ENSO has significant impacts on weather and climate patterns worldwide, influencing temperature, precipitation, and atmospheric circulation across multiple continents. It can affect health and livelihoods, making it a crucial focus phenomenon to monitor. The maps below show the rainfall impacts (and months) expected during an El Nino and La Nina events, respectively.

El Niño and Rainfall

El Niño conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. The regions and seasons shown on the map below indicate typical but not guaranteed impacts of La Niña. For further information, consult the probabilistic information* that the map is based on.



*http://iridl.ldeo.columbia.edu/expert/home/.lenssen/.ensoTeleconnections/
For more information on El Niño and La Niña: http://iri.columbia.edu/enso

Sources:
1. Lenssen, Goddard and Mason, 2020. Seasonal Forecast Skill of ENSO Teleconnection Maps. Weather Forecasting, 2387–2406
2. Mason and Goddard, 2001. Probabilistic precipitation anomalies associated with ENSO. Bull. Am. Meteorol. Soc. 82, 619-638

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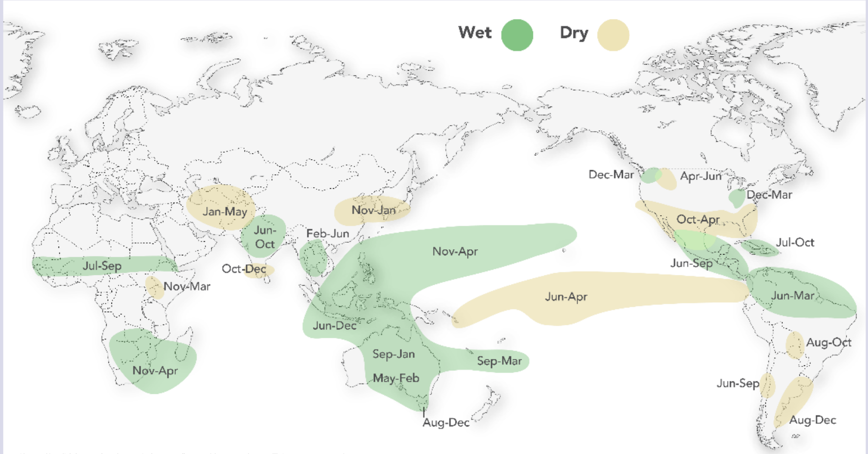
La Niña and Rainfall

La Niña conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. The regions and seasons shown on the map below indicate typical but not guaranteed impacts of La Niña. For further information, consult the probabilistic information* that the map is based on.



*http://iridl.ldeo.columbia.edu/expert/home/.lenssen/.ensoTeleconnections/
For more information on El Niño and La Niña: http://iri.columbia.edu/enso

Sources:
1. Lenssen, Goddard and Mason, 2020. Seasonal Forecast Skill of ENSO Teleconnection Maps. Weather Forecasting, 2387–2406
2. Mason and Goddard, 2001. Probabilistic precipitation anomalies associated with ENSO. Bull. Am. Meteorol. Soc. 82, 619-638

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1.3. How are seasonal forecasts generated?

Weather forecasts are generated by **computer models (or dynamical models**) that simulate the evolution of the atmosphere using mathematical equations. The equations at the heart of dynamical models are designed to mimic the natural processes at work in the atmosphere and oceans all around the globe. They are based on well-known processes that take place in the atmosphere and oceans. The models include initial conditions in the form of observational data, which can come from a wide range of sources, most commonly from satellites and weather stations. Once we have provided the model with the latest information about the status of the system, the model can start solving the equations and identifying weather patterns that are likely to occur in the future.

Since they rely on large-scale atmospheric and oceanic processes, they are often based on **coupled ocean-atmosphere integrations with a global or regional spatial catchment area and produce predictions at a relatively** coarse resolution ranging from 25 to 100km^2. The use of coarse resolution helps to minimize the computational expense of the modelling, while being able to capture broad atmospheric and oceanic processes. Regional seasonal models may have higher resolutions, reaching down to a few kilometres, depending on computational capacities and forecasting requirements**.** Local weather patterns are influenced by smaller-scale features that seasonal models are unlikely to capture due to its lower resolution. Consequently, **interpreting local values directly from such maps can be misleading.**

1.4. Sources of uncertainty

Forecast models are a simplification of a much more complex system, and as such, the equations used do not perfectly replicate all the natural processes in place. Seemingly, the initial conditions are likely to suffer from patchy coverage, measurement error and inadequate representativeness, among other limitations. Thus, small discrepancies in the initial condition and the real-world conditions can result in large errors in the predictions. This is sometimes known as the *butterfly effect,* and it arises due to the strong dependence of the model to the selected set of equations and initial conditions. This set up is affected by two types of errors: **random** and **systematic errors** which cause the model outputs to deviate from the reality.

Random errors refer to the aleatory deviation between the forecast and the observation which would not repeat if the model were to be run again. **Systematic errors**, on the other hand, arise due to the presence (or absence) of certain circumstances which cause the deviance to persist for as long as they are present in the system, such as *model initial conditions*, *external forcing*, and *model structure*. For example, measurement inaccuracies in the initial conditions will likely lead to errors in the model outputs. This error would persist if the model were to be run again. Due to the complexity of the climate system, small uncertainties in measuring initial conditions become significantly magnified in long range forecasts. *External forcing* refers to the effects of external factors that were not taken into consideration when the model is run. Seasonal forecasts models are a simplification of the reality, the extent to which key variables are missed will affect the performance of the model. Finally, the structure of the model will impact the forecast skill. A clear example is the use of grids or modelling boxes to simplify the computational expense of resolving the equations, treating the boxes as independent forecasts. This is a simplification of the reality where processes occur in a continuous manner.

1.5. Type of seasonal forecast approaches

There are two types of dynamic models: **deterministic** and **ensemble.**

The **deterministic model** is a dynamic modelling which is ran only once with a given set of initial conditions and equations, using all available computing power to generate a forecast at the highest resolution possible. The result, a singular snapshot to one of many possible futures which heavily relies on the initial conditions and equations provided. Deterministic models perform relatively well in short-range forecasts yet quickly lose reliability as we move forward in time; often showing unreliable forecasts beyond 10 days lead time.

A **probability forecast** can give a percentage of how likely a defined event is to occur, which can help users to assess the risks associated with weather events to which they are sensitive. **Ensemble models** are designed to estimate these probabilities by sampling the range of possible forecast outcomes. By doing so, they address the chaotic nature of the system and account for the multiple sources of random error in the model, to help us to understand the uncertainty in the forecast. To do so, the forecast model is run not once, but many times, using slightly different initial conditions and sometimes slightly different set of equations (**Figure 2**). The mode outputs are then summarized into a measure statistic, such as **ensemble mean or median,** and a measure of uncertainty, known as **ensemble spread or uncertainty.**

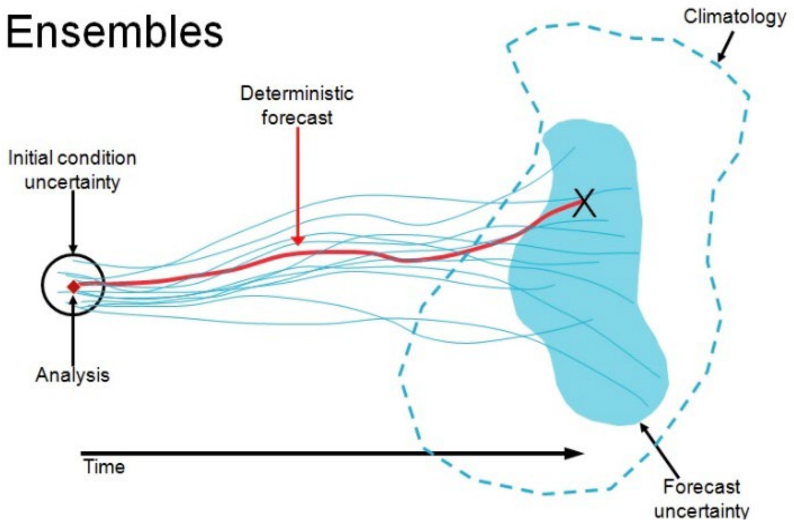

Figure 2. Diagram of the differences between deterministic and ensemble.

Running the forecast model using different sets of initial conditions and equations, leads to different *random model errors*. This allows us to quantify the **forecast certainty** linked to random errors. This is typically measured through **ensemble spreads**, which quantify the variability among individual forecasts or ensemble members. A wider spread or a substantial disagreement between ensemble members indicates higher uncertainty, whereas a narrower spread or high agreement between ensemble members implies greater agreement among forecasts.

Systematic errors, on the other hand, often persist across ensemble member models. And so, although ensembles give a useful guide of possible futures, they cannot provide a perfect representation of probability. To address this, we quantify the systematic error. This is achieved by comparing retrospective forecasts (reforecasts or **hindcasts**) with observations. The same forecast system is run for several starting points in the past in the same way as a forecast would be run (with only knowledge of the starting point), for the same length of time as an equivalent forecast. The differences between predicted and observed data, usually referred as biases, can be used to correct the real-time forecasts.

In short, ensembles (or probabilistic models) are preferred over deterministic models because they provide a more comprehensive understanding of uncertainty and variability within the data, leading to better capture of complex patterns, robustness in predictions, and improved estimation of model uncertainty.

Finally, **multi-system ensembles** combine different ensemble model outputs to predict seasonal climate patterns. These ensembles integrate forecasts generated by ensemble models from different agencies, each of which represents a distinct set of assumptions, parameterizations, and initial conditions. By combining forecasts from various ensembles, multi-system ensembles aim to capture a broader range of potential outcomes and provide more robust predictions of seasonal climate variations. The concepts of uncertainty measurement and model aggregation in multi-system ensembles mirror those found in individual ensemble models. This approach helps address uncertainties inherent in both individual models and ensembles, thereby enhancing the reliability and accuracy of seasonal climate forecasts.

At **HACE** we rely on **multi-system ensemble forecasts** for the Regional Seasonal Briefing products.

1.6. How well can we predict seasonal climate?

Forecast predictability (skill) measures how often a forecast issued in the past was correct. The skill of a forecast varies depending on the variable forecasted, season, forecast window and place over where they forecast. Temperature is relatively easier to forecasts than rain; some regions may be easier to forecast in winter than summer, short seasonal forecasts of the range of 1-3 months are often better than those forecasting the far future (5-6 months), and some locations are easier as the atmospheric signals are stronger. For example, **the strongest links between SST patterns and seasonal weather trends are found in tropical regions, and it is here that seasonal forecasting skill is highest.** **Figure 3** shows where 3-month forecasts are consistently good at predicting seasonal rainfall for at least one season of the year. This is based on the International Research Institute for Climate and Society (IRI) 3-month seasonal forecasts, but similar patterns are observed across other forecast suppliers. The strongest and most reliable signals are found in the tropics. Areas marked in red (well) and yellow (somewhat well) can confidently use seasonal forecasts; whilst areas in grey (not well) and white (unknown) should take seasonal forecasts with care and compliment it with short-range forecasts.

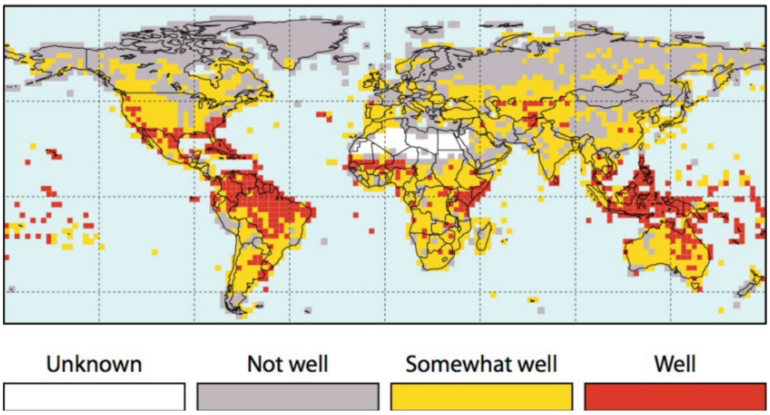

Figure 3. Map showing the model skill to predict seasonal patterns. Note: based on IRI seasonal prediction products only. Source: IRI.

1.7. What information do they provide us with and how to interpret it?

Seasonal forecasts are reported as departures from the expected weather patterns (i.e., wetter/drier, or colder/hotter) for a given are and time, what is known as **anomalies**. The advantage of using anomalies with respect to model climate for graphical products is that they are independent of observational datasets. The disadvantage is that the climate base period for anomalies cannot be chosen independently of the re-forecast period. So, **defining a baseline to derive the anomalies is an instrumental step.** The baseline periods often consider at least 20 years of data, to avoid biases from extreme isolated events and give a general idea of long-term patterns. The exact baseline used varies by provider and the decision is often based on availability and quality of historical data and consistency across their products. Refer to each data provider to see the baseline used. A baseline exists for each forecast parameter, lead time and calendar start date, resulting in 100+ hindcasts that can be used to understand the expected weather patterns at different time points.

Forecasts differ in their reporting methods for predictions, yet **anomaly maps are the most common instrument for visualizing anomalies and uncertainties**. Spatial maps are produced showing the model-predicted anomalies in seasonally averaged quantities. Each plot is labelled with the months for which it is valid or **forecast period**, often using a three-letter code composed of the first letter of each month forecasted, e.g. MAM 2024 is the three-month period March 2024 - May 20243. Information on the time when the model was released, or **base time**, is also provided to give an indication of the **lead time** of the model, i.e., the time between the forecast publication and the forecast period (**Figure 4**). For the above example, a base time of Feb 2024, indicates that the model was run in February 2024, and thus, the forecast we obtained has a lead time of 1 month.

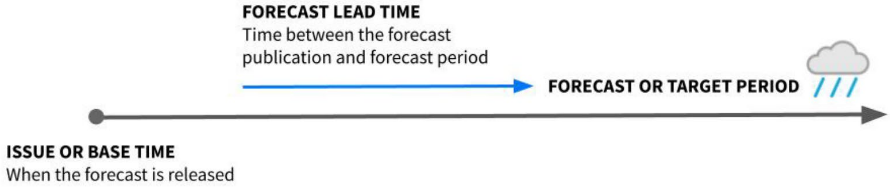

Figure 4. Diagram depicting the three key temporal labels in seasonal forecasts products. Source: OCHA

Below, we review some of the most common maps used and which agencies use them. To determine how a forecast reports its values, you can refer to the methodology report or summary provided by the data provider. These resources offer insights into the specific reporting approach used by the forecast and enable an accurate interpretation of the forecasted values.

1.7.1. Ensemble mean anomalies

The maps display the average of the ensemble mean anomalies. In other words, the average of the anomalies between each ensemble member forecast and the baseline value for that cell and time. **Produced by: Copernicus.**

1.7.2. Percentile-category probability maps

These maps indicate the probability that the seasonal variable of interest, usually rainfall or temperature, will exceed or fall under a set of categories that summarize the climatological distribution. These categories are defined from the 20+ years of baseline data (i.e., 100+ re-forecasts models specific of that forecast parameter, lead time and calendar start date). For each grid point, the distribution of values of the baseline data is analysed and divided in categories. These categories are defined as percentiles of the baseline data, and so, they represent equal probabilities of occurrence. When we analyse the forecast, we're essentially checking how many of the predicted outcomes fall above or below the thresholds delimiting the categories defined from the baseline data. Under normal circumstances, we would expect that about X% of forecasts, where X is the percentile used to define the categories, exceed the threshold without any specific external influences. However, if there are factors in the climate system that are exerting a particular influence, the probability of exceeding this threshold can deviate significantly. Depending on the percentiles used, we distinguish different probability maps.

Tertile summary maps divide the distribution in three equal-sized categories or tertiles, each representing 33.3% changes of occurrence. The lower tercile is the value below which the outcome occurs in 1 out of 3 cases in the baseline data, and the upper tercile is the value which is exceeded in 1 out of 3 cases. When we analyse the forecast, we're essentially checking how many of the predicted outcomes fall in each category. For example, if 60% of ensemble members predict above-normal precipitation for a specific location, the probability of above-normal precipitation in that area would be 60%. Similarly, the probabilities for below-normal and near-normal categories are determined based on the proportion of ensemble members falling into those categories. For mapping purposes, 40% is often used as a threshold to represent substantially strong signals above and below, yet it may vary between products. **Produced by: IRI, Copernicus and WMO.**

Outer-quintile category probability maps are useful tools to identify areas where the distribution of likely outcomes is shifted substantially from the climatological average, indicating the possibility of extreme conditions. For that, instead of using tertiles which are too broad of a category, larger percentiles are used, most often quintiles. For the quintiles, the baseline is categorized in five equal-sized categories, each representing a 20% chance of occurrence. In this case, the focus is on the extreme conditions, that is the upper and lower 20th percentiles. The probabilities of exceeding or being below the upper or lower 20th percentile is calculated based on the proportion of ensemble member models falling in each category (like the tertile summary maps). The results are mapped separately for the upper and lower 20th percentile, each coloured based on the probability of occurrence. **Produced by: Copernicus.**

1.7.3. Flexible seasonal forecasts

Flexible seasonal forecasts are probability maps that allow the user to manually define the percentiles. In a traditional tertile or outer-quintile probability maps, the data providers define the categories, and so the user is constricted to that information. For example, in tertile summary maps, we obtain information on the likelihood that temperature or rainfall will be above, near-normal or below the third of the historical climatological distribution. Yet, we do not get any hint on how far above or below that rainfall or temperature will be. Flexible seasonal forecasts aim to address that limitation by giving the user the possibility to explore the likelihood of different percentiles. For example, we may be interested only in very extreme temperature events. In this case, we could explore the likelihood of temperature exceeding the 80th or 90th percentile of the climatological average. In addition, there is also the possibility to set the categories not in percentiles but in absolute quantities. Using the example from above, we may be interested in knowing how likely it is that the temperature in the next three months exceeds 35⁰C as we may have identified this temperature as being a threat to population wellbeing. **Produced by: IRI.**

Percentile category maps and mean anomaly maps provide complementary information. Whilst percentile category maps provide information relative to the certainty in the predictions of exceeding or being below a certain normality expected for that time and period; ensemble mean anomaly maps give information on what the model is predicting in absolute terms, deviations in ⁰C for temperature and mm for rainfall, for example.

1.8. Different seasonal forecast products available

Seasonal forecasts are produced by several agencies. Here, we focus on multi-system ensembles which are freely available as either charts/maps or digital data. Among the most well used ones we want to highlight: the **Copernicus Climate Change Service (C3S) ensemble**, the **International Research Institute (IRI) North American Multi-Model Ensemble Project (NMME)**, and the **World Meteorological Organization (WMO) Probabilistic Multi-Model Ensemble (MME).** See **Table 2** for details.

Table 2. Widely used multi-system ensemble models and information on their products.

Model	Source	Ensemble members	Products
North American Multi-Model Ensemble Project (NMME) -- multi-system ensemble	International Research Institute (IRI) for Climate and Society; Columbia Climate School	• NOAA NCEP CFSv1 (retired Oct 2012) • NOAA NCEP CFSv2 • IRI ECHAMA and ECHAMF (retired Aug 2012) • NASA Goddard Space Flight Center (GSFC) GEOS5 • NCAR/University of Miami CCSM3.0 • GFDL CM2.1 • GFDL CM2.5 [FLORa06;FLORb01] (joined Mar 2014) • Environment Canada CanCM3 and CanCM4 (joined Sep 2012)	Available maps include: • Tertile summary maps • Flexible seasonal maps • Verification plots Available here.
Copernicus Climate Change Service (C3S) – Multi-system ensemble	Copernicus	• European Centre Medium-Range Weather Forecasts (ECMWF) • The Met Office UK • Météo-France • German Weather Service (*Deutscher Wetterdienst*, DWD) • Euro-Mediterranean Center on Climate Change (*Centro Euro-Mediterraneo sui Cambiamenti Climatici*, CMCC) • US National Weather Service's, National Centers for Environmental Prediction (NCEP) • Japan Meteorological Agency (JMA) • Environment and Climate Change Canada (ECCC)	Available maps include: • Ensemble mean anomaly maps • Tertile summary maps • Extreme 20th percentile maps • Verification plots Maps available here. Individual systems raw data available here. Verification plots available from here.
Probabilistic Multi-Model Ensemble (MME) – Multi-system ensemble	World Meteorological Organization (WMO) Centre for Long-Range Forecast Multi-Model Ensemble	• Beijing • CMCC • CPTEC • ECMWF • Exeter • Melbourne • Montreal • Moscow • Offenbach • Pune • Seoul • Tokyo • Toulouse • Washington	Available maps include: • Tertile summary maps Available here.

3. How to go from seasonal forecasts to seasonal planning

2.1. What is Seasonal planning?

Seasonal planning is a strategic process aimed at improving performance and outcomes for specific seasons. **For MSF, this could translate into planning that aims to ensure that we deliver high-quality, effective, and successful interventions considering expected conditions for a specific season.** It involves the development and implementation of plans and activities tailored to capitalize on seasonal opportunities and mitigate associated risks. Seasonal planning may involve various aspects such as resource allocation, scheduling, and operational adjustments. Seasonal forecasts are fundamental to seasonal planning as they provide a snapshot of expected weather conditions differing from the expected for the season and region. By leveraging the information from seasonal forecasts and other relevant variables, seasonal planning can be a useful tool for MSF to better prepare for, respond to, and potentially benefit from on seasonal changes and trends.

2.2. What do we need to do seasonal planning?

Depending on the specific risks being addressed, you will need a different combination of data sources to inform your strategies. A useful way to approach this is using the **determinants of risk model** (**Figure 4**). According to this model, risk is expressed as the likelihood of loss of life, injury, destruction, or damage of some sort on a group of people from a disaster. It is a result of the interaction between the likelihood of the **hazard** or disaster occurring, and the characteristics of the group and/or place of interest, including their **vulnerability** and **exposure**. When investigating the risk, it is important to consider each of these elements. The better the information and data we can obtain to describe each of these elements, the better we will be able to assess the risk.

For instance, when assessing the threat of flooding, a fundamental component is the hazards. We can obtain this information from seasonal forecasts. However, to assess the risk of this being impactful to MSF missions and communities where we work, we need to consider vulnerability and exposure indicators. For exposure, we may want to assess whether communities have flood-resilient buildings or whether the harvest period is over to understand potential impact on crops. For vulnerability, we may want to include factors such as fluctuations in food prices or local health indicators. Examining food price fluctuations provides clues about potential food security challenges arising from flood-induced crop failures or shortages. Soil moisture data offers critical information regarding agricultural productivity and water availability, crucial for informing irrigation practices and crop management strategies. Additionally, local health data can highlight vulnerabilities and health risks exacerbated by drought conditions, facilitating targeted interventions and healthcare resource allocation.

By integrating information from various sources, you can have more robust and adaptive strategies to mitigate the impacts of a given hazard and ensure preparedness and readiness of your teams and activities.

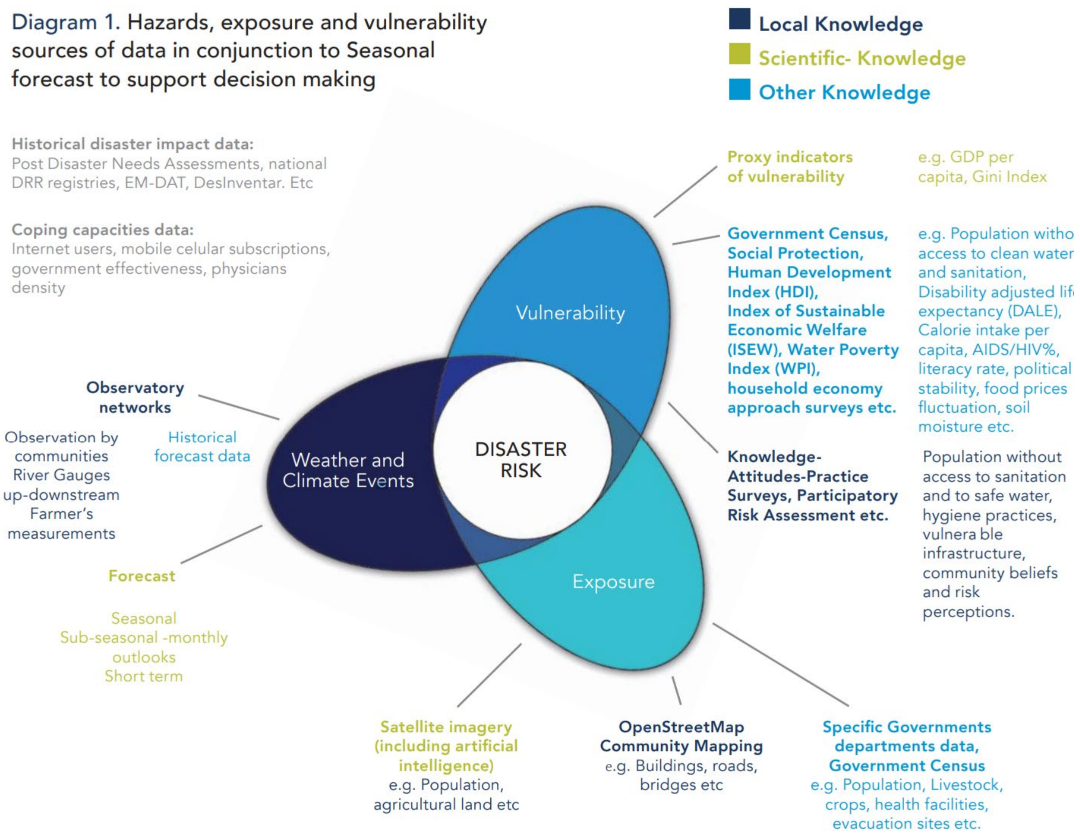

Figure 4. Diagram of the determinants of risk model with its three components: vulnerability, exposure, and weather/climate events, as well as examples of data to consider for each component. Source: IFRC.

4. Support for seasonal planning

5.2. Regional Climate outlook forums (RCOFs)

The Regional Climate Outlook Forums (RCOFs) convene key stakeholders, including National Meteorological Services and various sectors, to generate consensus seasonal forecasts for significant regional seasons worldwide. Combining diverse forecast methods—local statistical analyses, analogue year comparisons, global dynamical forecasts, and local expertise—participants develop consensus outlooks for temperature and rainfall conditions, expressed as probability distributions across tercile categories. RCOFs serve as vital platforms for disseminating seasonal climate information. However, caution is advised in utilizing forecasts that lack assessed skill. Despite potential indications from dynamical forecasts, RCOFs often lean towards forecasting normal conditions rather than bold probabilities for deviations. Additionally, RCOFs typically offer forecasts for all rainy seasons in a region without considering varying predictability levels. For instance, in East Africa, higher predictability during the October–December season may foster greater trust in forecasts compared to other periods. A map and accompanying list of all RCOFs can be found in **Figure 5** and **Table 3**.

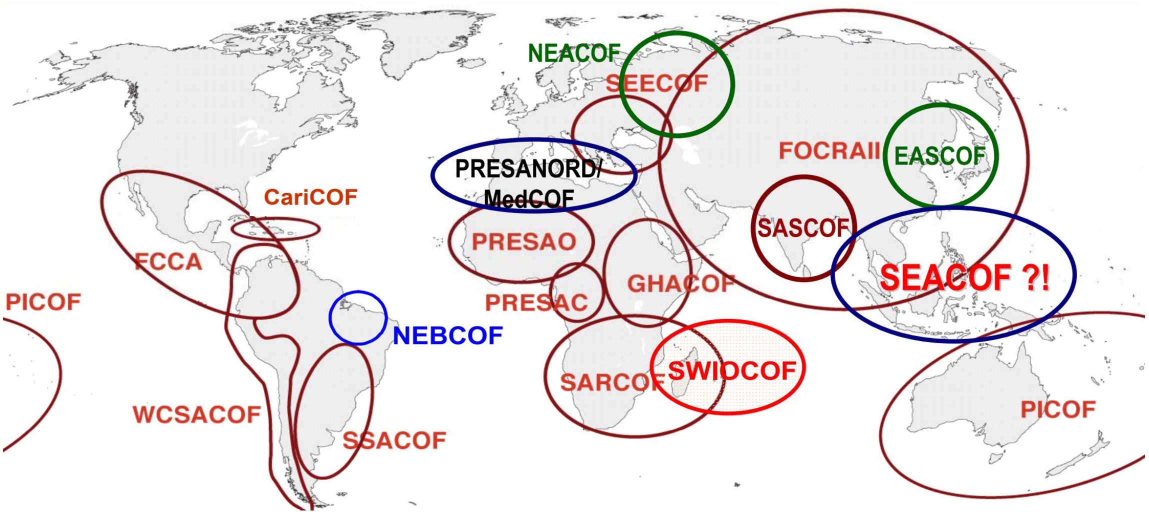

Figure 5. Map of the location of the World Meteorological Organization (WMO) Regional Climate Outlook Forums (RCOFs). Source: WMO2013

Table 3. Full name of the World Meteorological Organization (WMO) Regional Climate Outlook Forums (RCOFs). Source: WMO2013

Association of Southeast Asian Nations Climate Outlook Forum (ASEANCOF)	Polar Arctic Regional Climate Outlook Forum (PARCOF)	South Asian Climate Outlook Forum (SASCOF)
Central American Climate Outlook Forum (CACOF)	Pacific Islands online Climate Outlook Forum (PICOF)	Southeastern Europe Climate Outlook Forum (SEECOF)
Caribbean Climate Outlook Forum (CariCOF)	PRÉvisions climatiques Saisonnières en Afrique centrale (PRESAC)	Southeast of South America Climate Outlook Forum (SSACOF)
East Asia winter Climate Outlook Forum (EASCOF)	PRÉvisions climatiques Saisonnières en Afrique, pays du Golfe de Guinée (PRESAGG)	Southwest Indian Ocean Countries Climate Outlook Forum (SWIOCOF)
Forum on Regional Climate Monitoring, Assessment and Prediction for Regional Association II (FOCRAII)	PRÉvisions climatiques Saisonnières en Afrique du Nord (PRESANORD)	Western Coast of South America Climate Outlook Forum (WCSACOF)
Greater Horn of Africa Climate Outlook Forum (GHACOF)	PRÉvisions climatiques Saisonnières en Afrique Soudano-Sahélienne (PRESASS)	Southern African Regional Climate Outlook Forum (SARCOF)
Mediterranean Climate Outlook Forum (MedCOF)	Pacific Islands online Climate Outlook Forum (PICOF)	North Eurasian Climate Outlook Forum (NEACOF)

5. The importance of feedback loops

Feedback loops are essential in seasonal forecasting as they ensure that (i) our work remains relevant to the needs of our users; (ii) information is communicated in an accessible, understandable, and inclusive manner; (iii) the communication strategy including timescale and platform are adequate; and that (iv) the information provided allows users to act. Finally, it is also an opportunity to assess how users perceive the forecast's accuracy as well as how they were impacted by the weather and the actions they did or did not take. **This is all incredibly valuable information to continue improving the product together.**

HACE has several platforms available to ensure feedback is collected and integrated to our products. We encourage our users to submit any concerns/comments/requests using either of the below:

>**SharePoint:** Contact us
>**Emails:** leo.tremblay@toronto.msf.org ; aina.roca.barcelo@london.msf.org
>**Survey:** Seasonal Briefs Form

6. Glossary

Lead time	The duration between the time a forecast is made and the time for which the forecast is predicting. It represents the advance period over which future values are estimated.
Temporal coverage	The period of time for which a forecast is providing predictions.
Spatial coverage	The geographical area for which a forecast is providing predictions.
Uncertainty	Refers to the inherent variability and unpredictability associated with predicting weather patterns, climatic conditions, and other seasonal phenomena over extended periods, typically spanning several months, associated to random or systematic errors, among others.
Weather	Atmospheric condition of a particular place over a short period
Climate	Average weather condition over a long period of at least 30 years.
Forecast predictability (skill)	Measure of the agreement between the forecast and the observed reality. It gives a sense of accuracy or skill of the forecast to predict a given variable. It uses past forecasts and compares them with past observed data to generate indicators of accuracy.
Forecast certainty	Level of agreement between members of a forecast model ensemble. It gives a sense on how certain we are that the forecast is likely to occur. If many members agree, then we are relatively certain about that the forecast; if many members disagree, the forecast is uncertain.

7. Useful links

General concepts and knowledge:

Different types of seasonal forecasts and their interpretation:

https://iri.columbia.edu/news/flexible-forecasts-for-decision-makers/

MetOffice information on seasonal forecasts:

https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/business/international/wiser/video_script_final.pdf

IFRC practical guide to seasonal forecasts:

https://www.anticipation-hub.org/Documents/Manuals_and_Guidelines/A_practical_guide_for_seasonal_forecasts_SHEAR.pdf

Scientific publication on seasonal forecasts:

https://www.sciencedirect.com/science/article/pii/S1878029610000071

Seasonal forecasts documentation by C3S platform

https://confluence.ecmwf.int/display/CKB/Seasonal+forecasts+and+the+Copernicus+Climate+Change+Service

OCHA Climate Guidance on Precipitation Forecasts

https://centre.humdata.org/our-new-climate-guidance-series/

Validation of models:

How well can we predict seasonal climate?

https://iridl.ldeo.columbia.edu/maproom/IFRC/FIC/seasonalforecastskill.html

IRIs Seasonal Forecasts Verifications page

https://iri.columbia.edu/our-expertise/climate/forecasts/verification/

C3S Seasonal Forecasts Verifications page

https://confluence.ecmwf.int/display/CKB/C3S+seasonal+forecasts+verification+plots