

# LTE-M VS. 4G: ENSURING RELIABLE DATA TRANSMISSION

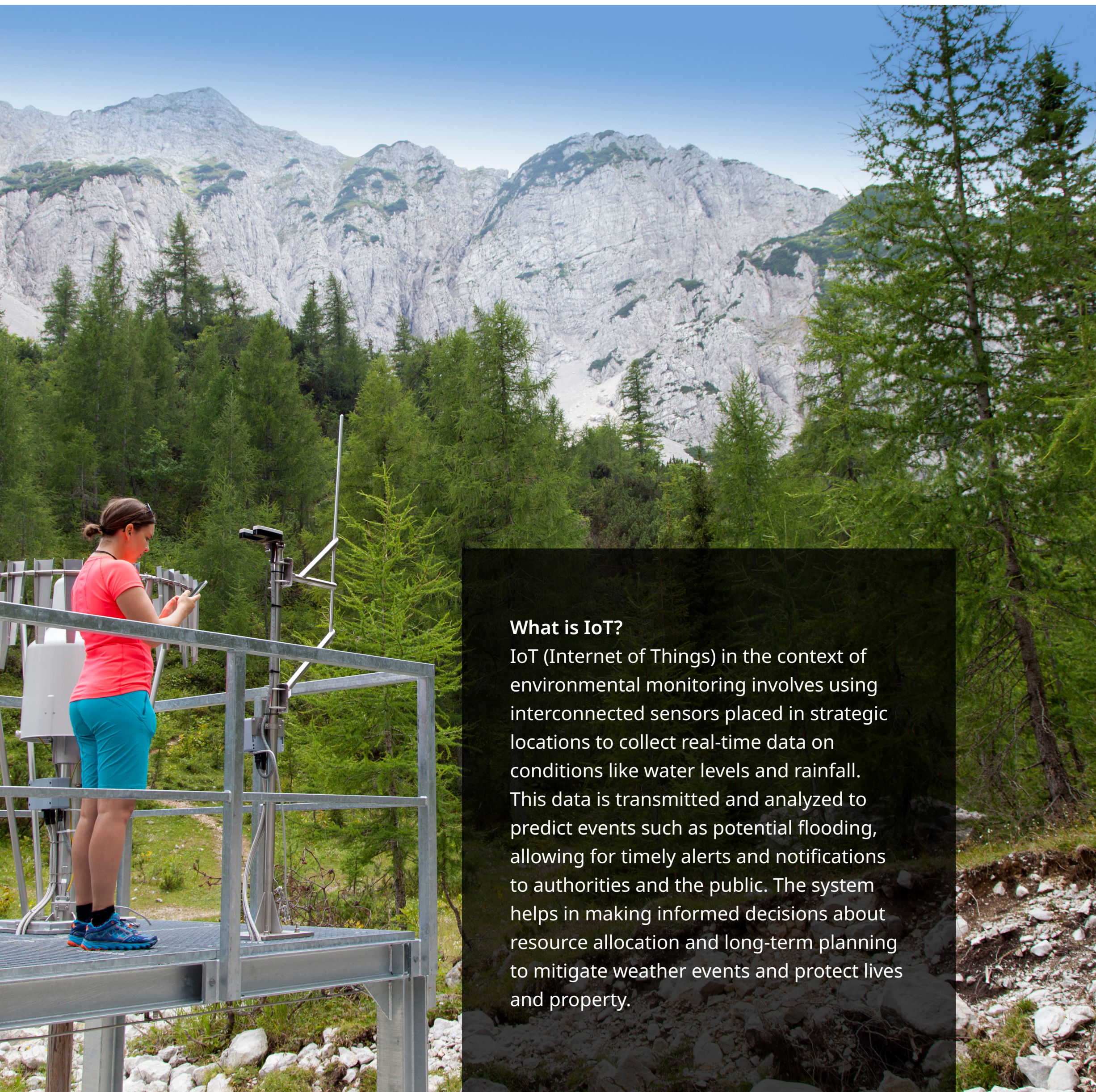
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 WHITE PAPER

## Introduction

The evolution of cellular technology has brought about various standards and categories, each tailored to specific use cases. Among these, LTE-M (also known as Cat M1) and standard 4G LTE stand out for their unique applications in telemetry and IoT (Internet of Things). This whitepaper explores the fundamental differences between LTE-M/Cat M1 and standard 4G LTE, highlighting their respective advantages and application use.





### What is IoT?

IoT (Internet of Things) in the context of environmental monitoring involves using interconnected sensors placed in strategic locations to collect real-time data on conditions like water levels and rainfall. This data is transmitted and analyzed to predict events such as potential flooding, allowing for timely alerts and notifications to authorities and the public. The system helps in making informed decisions about resource allocation and long-term planning to mitigate weather events and protect lives and property.

## Overview

### LTE-M/Cat M1

LTE-M, or LTE Cat M1, is a category within the LTE family designed specifically for IoT applications. It offers several key features:






- ✓ **Low Power Consumption:** LTE-M is optimized for low power usage, making it ideal for battery-operated devices (1).
- ✓ **Extended Coverage:** It provides better signal penetration and extended coverage, especially in challenging environments like basements or rural areas (1).
- ✓ **Lower Data Rates:** LTE-M supports lower data rates compared to standard 4G, which is sufficient for many IoT applications that require periodic data transmission (1).
- ✓ **Mobility and Handover:** LTE-M supports mobility and handover, allowing devices to maintain connectivity while moving (2).

### Standard 4G LTE

Standard 4G LTE, often referred to simply as LTE, is the fourth generation of mobile network technology. It is widely used for high-speed data transmission in mobile phones and other devices. Key features include:

- ✓ **High Data Rates:** Standard 4G LTE supports high data rates, making it suitable for applications requiring large amounts of data transfer, such as video streaming (2).
- ✓ **Broad Coverage:** It offers broad coverage and is widely available in urban and suburban areas (2).
- ✓ **Low Latency:** Standard 4G LTE provides low latency, which is crucial for real-time applications (2).

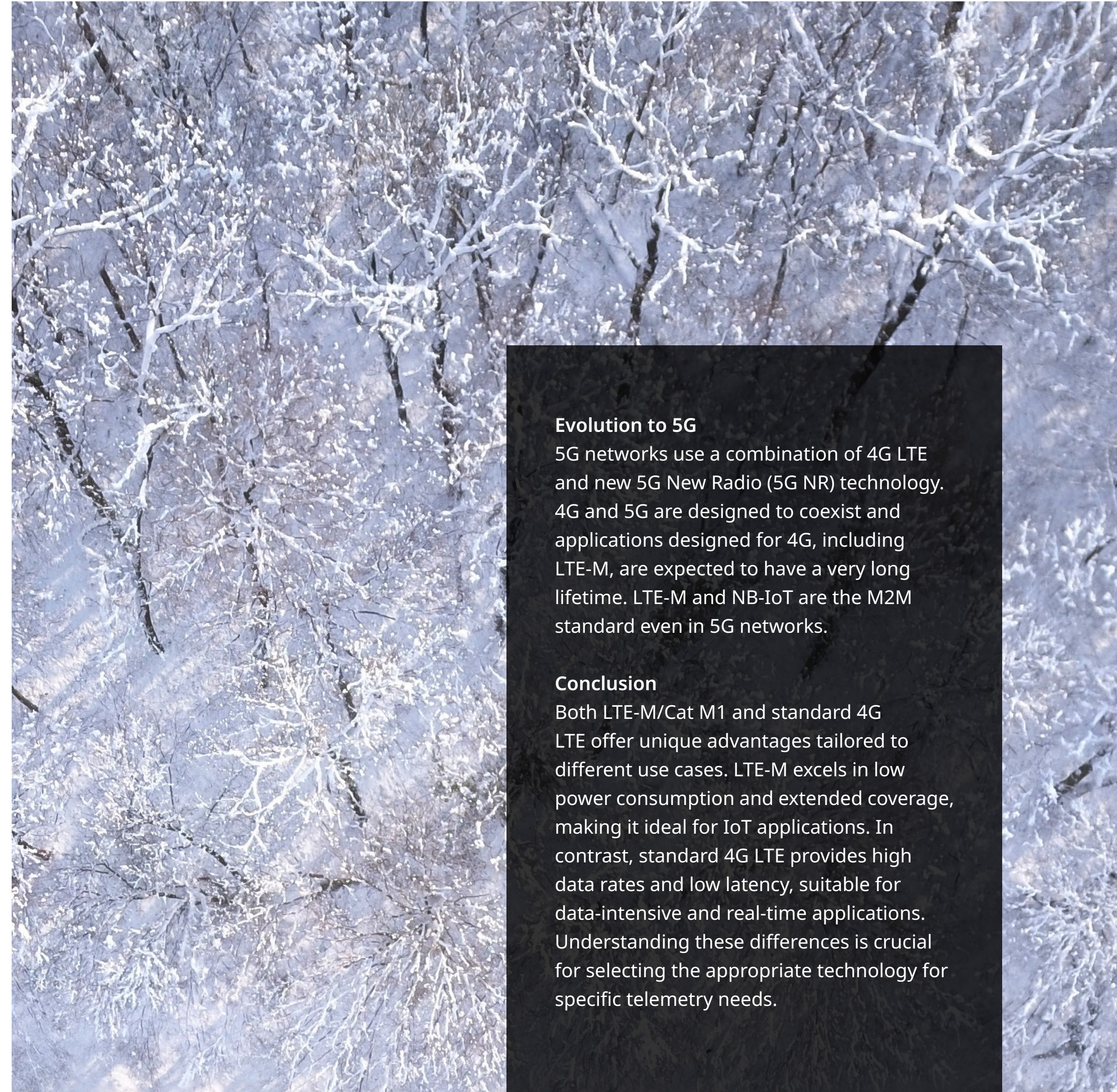
## LTE-M/Cat M1 vs. 4G LTE

	LTE-M/Cat M1	4G LTE
 Data Rates and Bandwidth	Supports lower data rates (up to 1 Mbps), which is adequate for most IoT applications (3).	Supports higher data rates (up to 1 Gbps), suitable for data-intensive applications (3).
 Power Consumption	Designed for low power consumption, extending the battery life of IoT devices (1).	Higher power consumption due to its high data rate capabilities (2).
 Coverage and Signal Penetration	Better signal penetration and extended coverage, especially in remote or indoor locations (1).	Broad coverage but may struggle in areas with poor signal penetration (2).
 Latency	Higher latency compared to standard 4G LTE, but sufficient for most IoT applications (3).	Low latency, essential for real-time applications (2).
 Mobility	Supports mobility and handover, making it suitable for mobile IoT applications (2).	Also supports mobility but is primarily optimized for high-speed data transfer (2).



# Application Uses for LTE-M/Cat M1 & 4G LTE

	LTE-M/Cat M1	4G LTE
Hydrology	Ideal for remote hydrological monitoring stations that require long battery life and can operate with lower data rates. These stations can transmit periodic data on water levels, flow rates, and precipitation.	Suitable for real-time data transmission in urban hydrology projects where high data rates are needed for detailed analysis and immediate response. Especially offers advantages for transmitting IP-Cam images.
Flood Warning	Effective for deploying a network of sensors in flood-prone areas. These sensors can provide regular updates on water levels and environmental conditions, ensuring timely warnings with minimal power consumption. for most IoT applications (3).	Useful for centralized flood monitoring systems that require high-speed data transfer to process and disseminate real-time alerts to authorities and the public. Especially offers advantages for transmitting IP-Cam images.
Environmental Monitoring	Perfect for long-term environmental monitoring devices that track parameters like air quality, soil moisture, and temperature. The low power consumption and extended coverage make it suitable for remote and rural areas.	Best for applications that need high-frequency data collection and immediate analysis, such as urban air quality monitoring stations that provide real-time data to city management systems.



## Evolution to 5G

5G networks use a combination of 4G LTE and new 5G New Radio (5G NR) technology. 4G and 5G are designed to coexist and applications designed for 4G, including LTE-M, are expected to have a very long lifetime. LTE-M and NB-IoT are the M2M standard even in 5G networks.

## Conclusion

Both LTE-M/Cat M1 and standard 4G LTE offer unique advantages tailored to different use cases. LTE-M excels in low power consumption and extended coverage, making it ideal for IoT applications. In contrast, standard 4G LTE provides high data rates and low latency, suitable for data-intensive and real-time applications. Understanding these differences is crucial for selecting the appropriate technology for specific telemetry needs.

# LTE-M Global Coverage

## Europe

LTE-M coverage in Europe is quite extensive. According to the GSMA, LTE-M networks have been fully deployed across Europe since the end of 2020 (4). This means that most European countries have widespread LTE-M coverage, supporting various IoT applications.

## USA

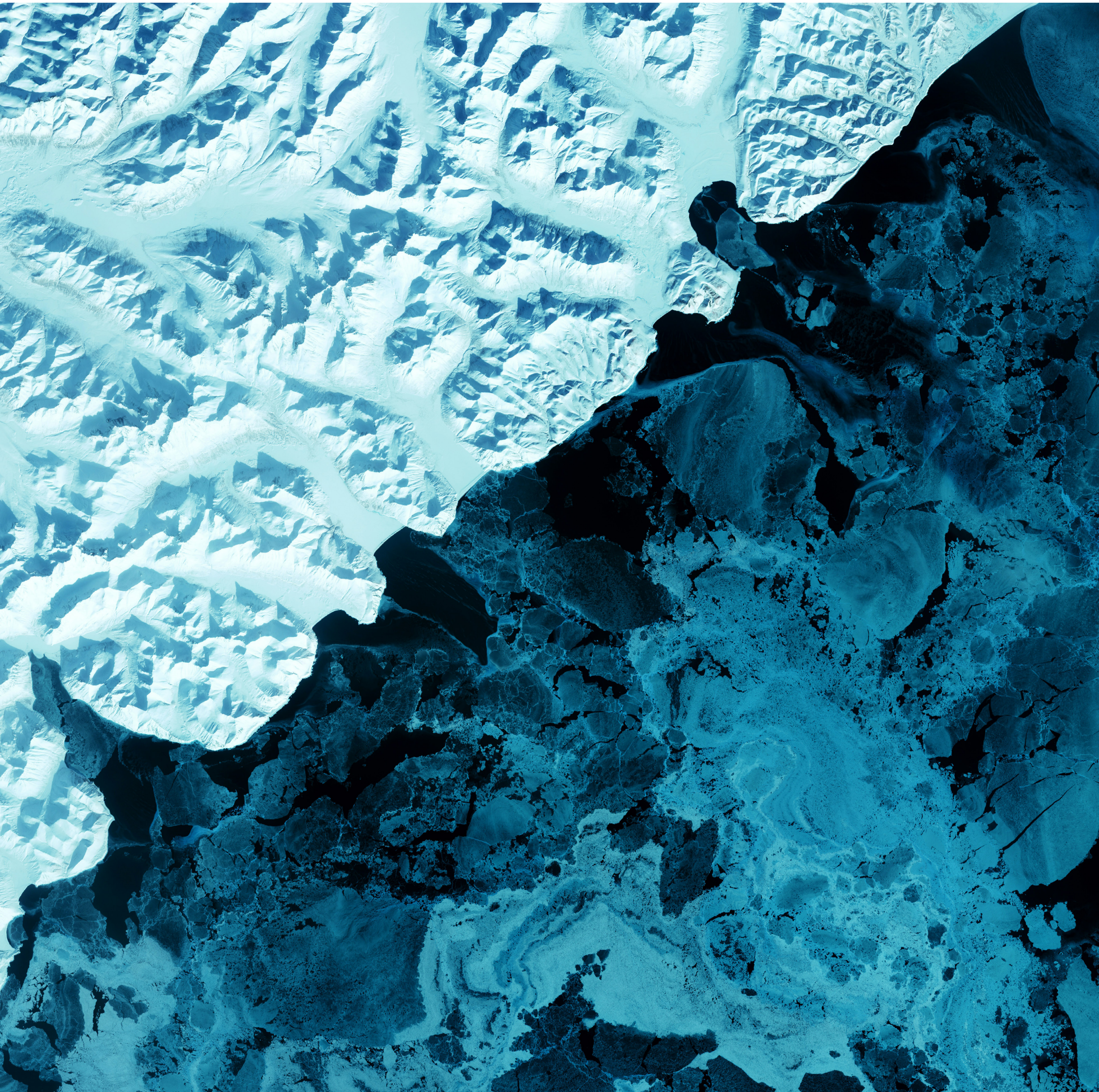
LTE-M (Cat M-1) coverage in the USA is robust and widespread, thanks to major carriers like AT&T and Verizon. Both companies have rolled out nationwide LTE-M networks, ensuring extensive coverage across urban, suburban, and many rural areas (5).

- **Nationwide Coverage:** T-Mobile, AT&T and Verizon have deployed LTE-M networks across the entire country since 2017, providing reliable connectivity for IoT devices (13).
- **Urban and Rural Areas:** The coverage is not limited to cities; it extends to many rural areas, making it suitable for a wide range of applications, from smart cities to agriculture.
- **IoT Applications:** LTE-M supports various IoT applications, including smart meters, asset tracking, and wearables, due to its low power consumption and extended range.

## Brazil

LTE-M coverage in Brazil is generally good, especially in urban areas. The major mobile operators, such as Vivo, Claro, TIM, and Oi, have been expanding their LTE-M networks to support IoT applications (6) (7).

- **Vivo:** Leading in terms of population coverage, Vivo offers LTE connections to a significant number of municipalities (8).
- **Claro:** Also has extensive coverage, reaching many urban and suburban areas (8).
- **TIM and Oi:** Both provide LTE-M services, though their coverage might be slightly less extensive compared to Vivo and Claro (8).



## Advantages of IoT SIM cards

IoT SIM cards are designed to offer flexibility and extensive coverage by not being tied to a single network provider. Here's how it works:

### Carrier-Agnostic Connectivity

- **Multiple Networks:** IoT SIM cards can connect to multiple cellular networks within a country. This means that if one network is unavailable or has poor coverage, the SIM can automatically switch to another network (10).
- **Global Reach:** These SIM cards provide access to over 540 cellular networks in more than 180 countries (10). This is particularly beneficial for devices that need to operate internationally without the hassle of negotiating with different local carriers.
- **Multi-IMSI Technology:** Multi-IMSI (International Mobile Subscriber Identity) technology, allowing a single SIM card to store multiple network profiles. This enables seamless switching between networks to ensure the best possible connectivity (11).

### Benefits of Carrier-Agnostic IoT SIMs

- **Enhanced Reliability:** By not being bound to a single provider, IoT devices can maintain connectivity even in areas where one network might be down or have weak signal strength.
- **Cost Efficiency:** Users can avoid high roaming charges and benefit from a single tariff plan for global use (10).
- **Simplified Management:** There's no need to manage multiple contracts with different network providers. One SIM card can handle connectivity across various regions and networks (12).

# OTT HydroMet Product Selection Guide



**OTT SensorLink 1000 & OTT ecoLog 1000**



**Sutron Xlink 100/500**



**OTT netDL 500/1000**

## Available Modems

Cellular 4G/2G (EU-MEA)  
 Cellular 4G Cat-M1 (USA)  
 Cellular LTE-M (Cat-M1; Global)

Cellular 4G/2G  
 Cellular LTE-M (Cat-M1; Global)

Internal:

- 2G - GSM/GPRS
- 3G - GSM/GPRS/UMTS

External:

- 4G/3G/2G
- IoT LTE-M (CAT-M1)

## Recommendation

In general, applications using the OTT SensorLink 1000 or ecoLog 1000 do not require high-speed data transfer. It is more important to have low power usage, better signal penetration, and extended coverage.

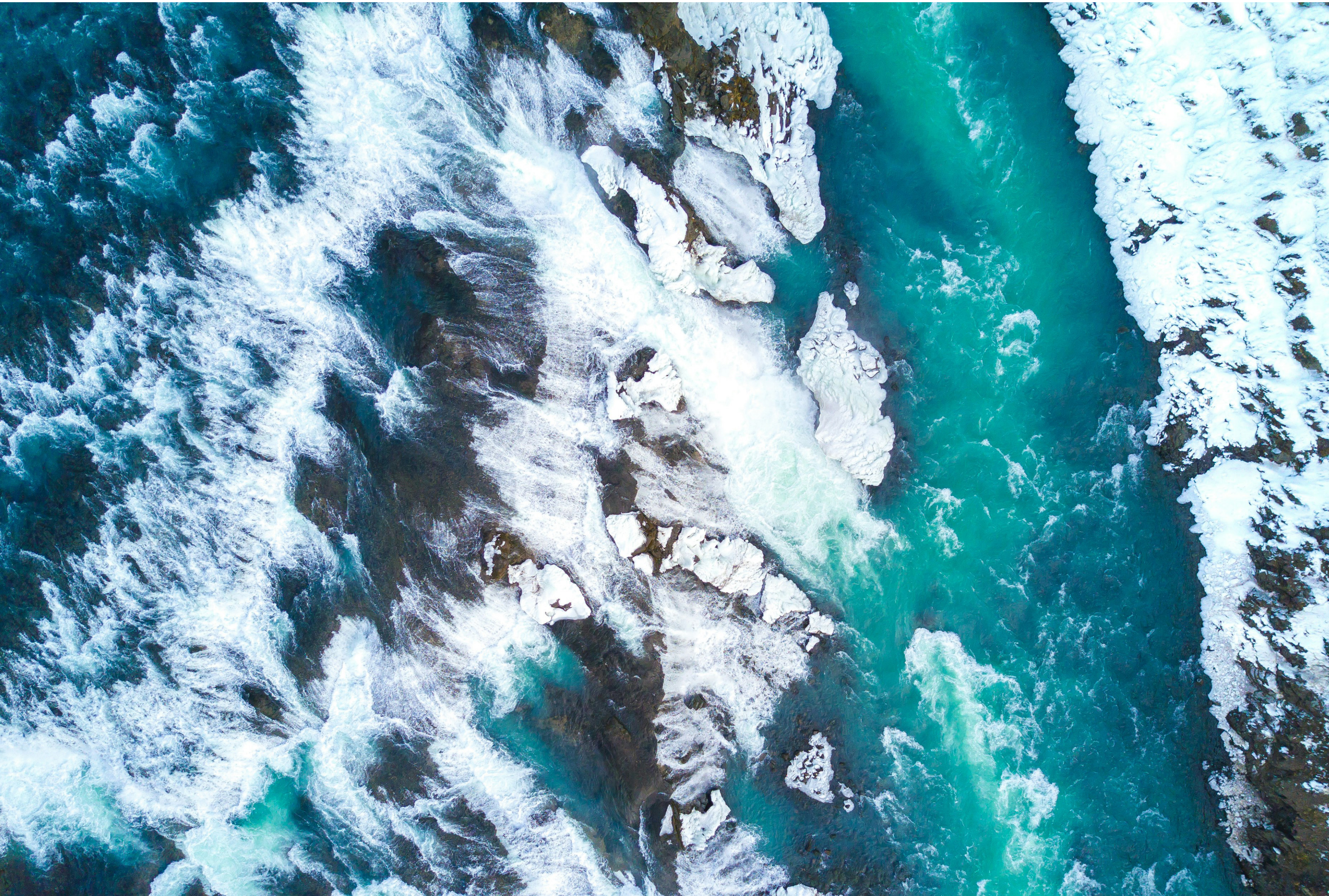
This makes the **IoT LTE-M (Cat-M1) Modem** the ideal modem for these products.

Applications requiring high data rates and reliable connectivity, such as hydrology projects, real-time flood warning systems, and detailed environmental monitoring: **4G/2G Modem**

Remote or rural environmental monitoring, long-term hydrological data collection, and flood warning systems where low power consumption and extended coverage are crucial: **IoT LTE-M (Cat M1)**

Applications requiring high data rates and reliable connectivity, such as hydrology projects, real-time flood warning systems, and detailed environmental monitoring: **3G - GSM/GPRS/UMTS Internal Modem or 4G/3G/2G External Modem**

Remote or rural environmental monitoring, long-term hydrological data collection, and flood warning systems where low power consumption and extended coverage are crucial: **2G - GSM/GPRS Internal Modem or IoT LTE-M (Cat M1) External Modem**



## References

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- (4) <https://www.i-scoop.eu/internet-of-things-iot/lpwan/lte-m-roaming/>
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