Cataloguing Lightning as Natural Hazard: the view of WMO

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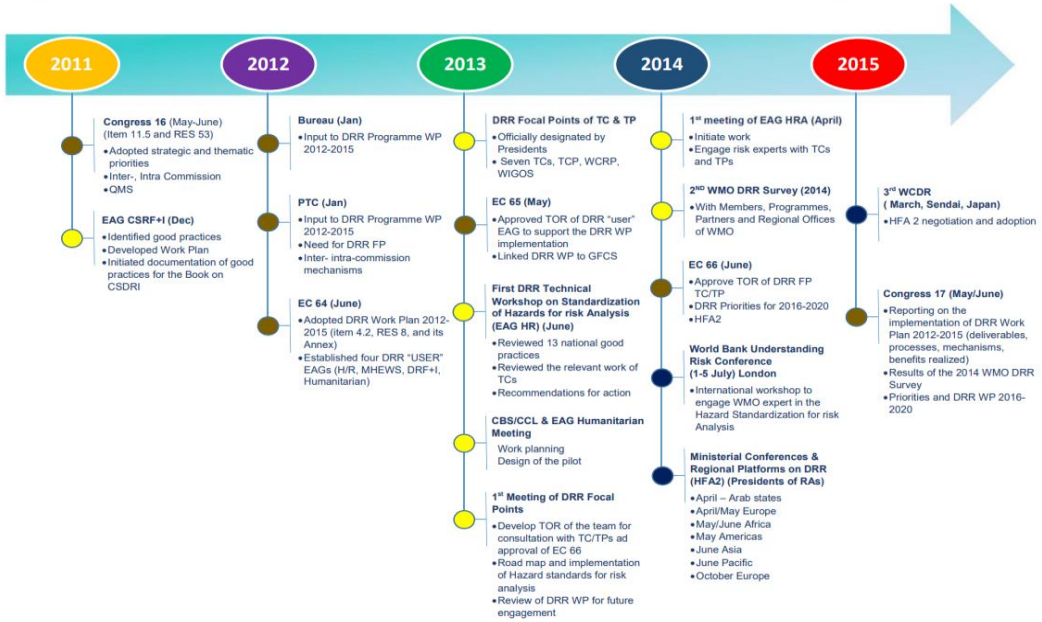
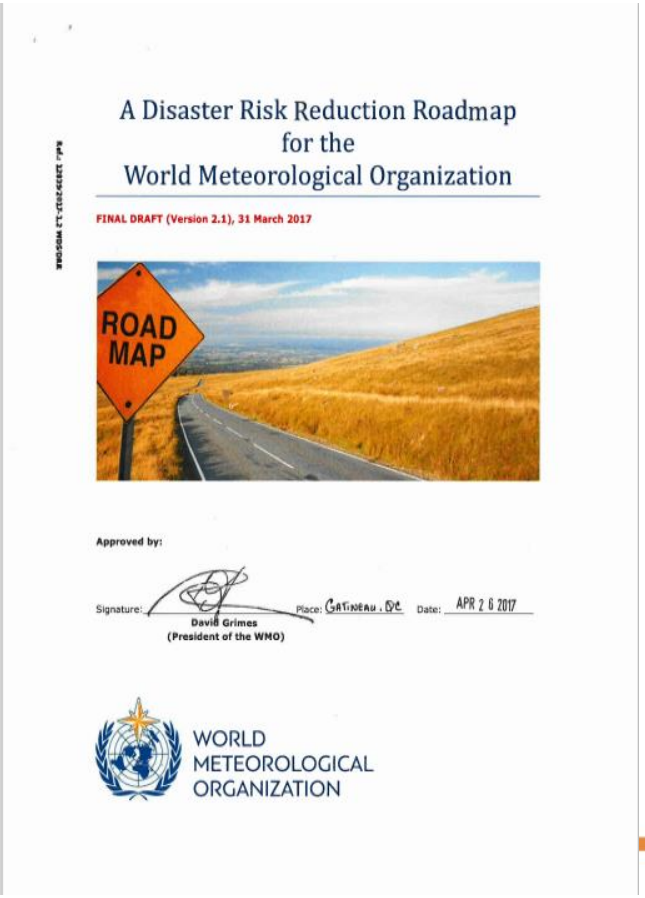
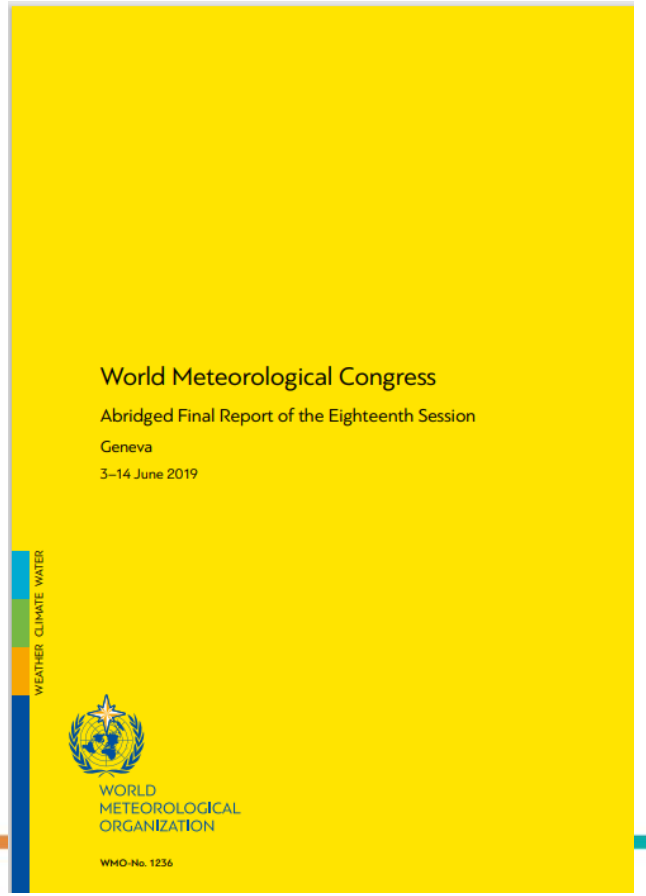
DRR at WMO: past and present

Major Decisions of WMO Governing Bodies and Milestones of DRR Programme







VII Regional Platform for Disaster Risk Reduction in the Americas and the Caribbean (RP21)
Building Resilient Economies in the Americas and the Caribbean
1 to 4 November 2021, Virtual Event

UNDRR
UN Office for Disaster Risk Reduction

CDEMA
CARIBBEAN DISASTER EMERGENCY MANAGEMENT AGENCY
Resilient States - Safer Lives

WMO DRR Roadmap - linked with Sendai Framework

Core NMHS functions / operations and capacities	Thematic areas of the DRR Programme		Sendai Framework Priorities for Action
	Normal stage	**Disaster phase**	
Observations, monitoring, data assessment, data management and exchange, data processing, modelling and forecasting (and where possible seamless prediction from nowcasting to decadal projections)	**1)** Long-term **risk assessment** (hazard and risk identification, analysis and evaluation) for different scenarios	**1)** Real-time **risk assessment** (hazard and risk identification, analysis and evaluation) for different scenarios	**Understanding disaster risk (Priority 1)**
	2) Prevention and mitigation to reduce risks in sectors through structural and non-structural measures	**2) Prevention and mitigation** through (temporary) structural and non-structural measures	**Investing in DRR for resilience (Priority 3)**
	5) Disaster risk financing and transfer		
	3) Preparedness for effective response and recovery through **MHEWS*** (impact-based early warning for slow-onset hazards)	**3) Preparedness** for effective response and recovery through **MHEWS*** (impact-based early warning for rapid-onset hazards	**Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction (Priority 4)**
	4) Assistance to **humanitarian planning** (preparedness and **recovery**)	**4)** Assistance to **humanitarian response** (during emergencies)	
Enablers such as regulatory work (standards, manuals, guidelines, quality management, etc.), **capacity development** (demonstration projects, training, etc.), **partnerships / cooperation** and **coordination**	**6)** Engagement of NMHSs and WMO in **DRR governance** at different levels		**Strengthening disaster risk governance to manage disaster risk (Priority 2)**

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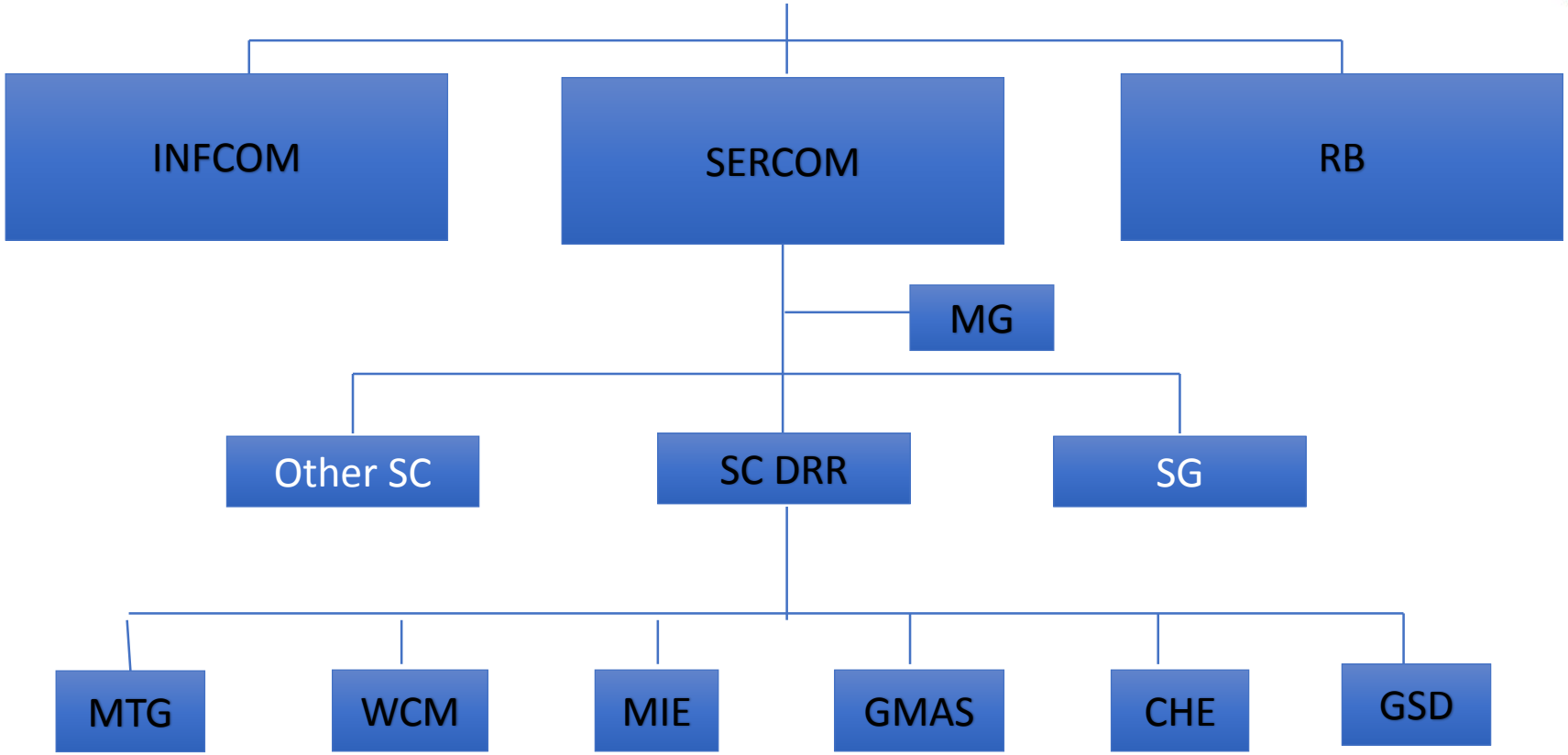
Technical Comission Governance



Purpose (ToR from SERCOM to SC-DRR)

- ✓ **Development and maintenance of WMO normative material** and recommended good practices related to the delivery of services to the general public and government authorities to support informed decision-making related to disaster risk reduction, the protection of life, livelihood, property and environment as well as welfare and well-being of the population as specified in WMO Technical Regulations.
- ✓ **Assistance to Members** in enhancing their service delivery capabilities and enabling effective implementation and compliance, including through the development of cooperative and supportive frameworks such as the Global Multi-hazard Alert System (GMAS), the WMO Coordination Mechanism (WCM) to better support humanitarian action which will also provide them more visibility and recognition for their contributions in the global agendas;
- ✓ **Contribution to the science-infrastructure-service value chain** by integration of innovation and progress made by science, including social science, and the application of frontier technologies into enhanced service design and delivery, especially from developing countries - and the integration of this perspective in various WMO Programmes, while also identifying and gathering user requirements possibly needing targeted research and infrastructure development.
- ✓ **Cooperation and partnerships with external partners** as needed to support Members, in close collaboration with Regional Associations;

Expected Outcomes from Cg-18

14 outcomes were defined and approved by SERCOM at its April2020 session (five are listed below)

- ✓ **Guide(s) on the Support of National Meteorological and Hydrological Services to their National Multi-hazard Early Warning Procedures, Coordination Mechanisms, Systems and Services - Resolution 16 (Cg-18)**
- ✓ **Implementation plan for the WMO-CHE, Resolution 12, (Cg-18)**
- ✓ **GMAS framework implementation strategy and plan, Resolution 13 (Cg-18)**
- ✓ **Strengthening multi-hazard early warning services in areas prone to all flooding types and severe weather - (Resolution 15 (Cg-18)**
- ✓ **Develop WMO Coordination Mechanism (Resolution 14 (Cg-18))**

Cataloguing of Hazardous weather, climate, water and space weather events

- **The importance of a common and updated terminology on disaster risk reduction was highlighted in The Sendai Framework for Disaster Risk Reduction 2015-2030:**

- *"to support the implementation, follow-up and review of the this framework through …leading, in close coordination with States, the update of 2009 Terminology on Disaster Risk Reduction in line with the agreed terminology by States;…"* (paragraph 48 c) and *"…recommends that the Working Group* [comprising experts nominated by Member States] *considers the recommendations of the Scientific and Technical Advisory Group on the update of the 2009 UNISDR Terminology on Disaster Risk Reduction by December 2016,…"* (Sendai Framework, paragraph 50).

Lightning and Wildfires from the DRR Perspective

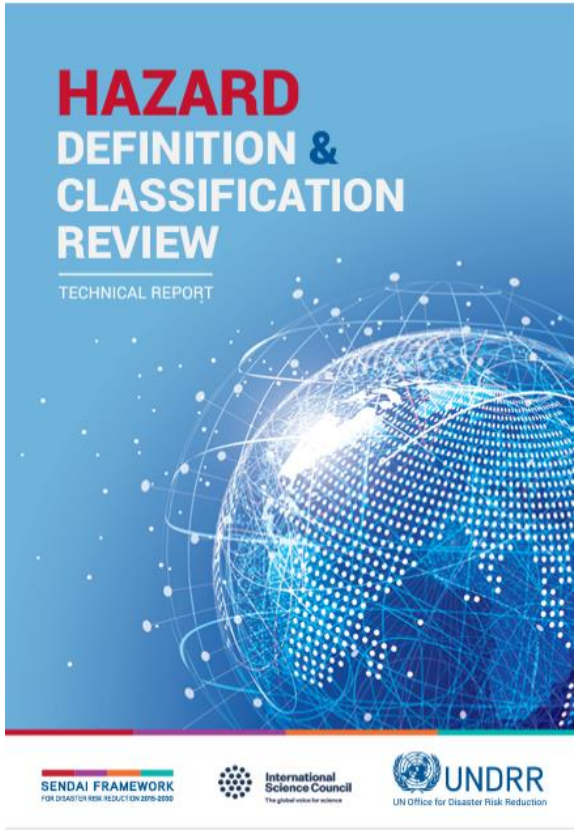
Disaster and Disaster Risk

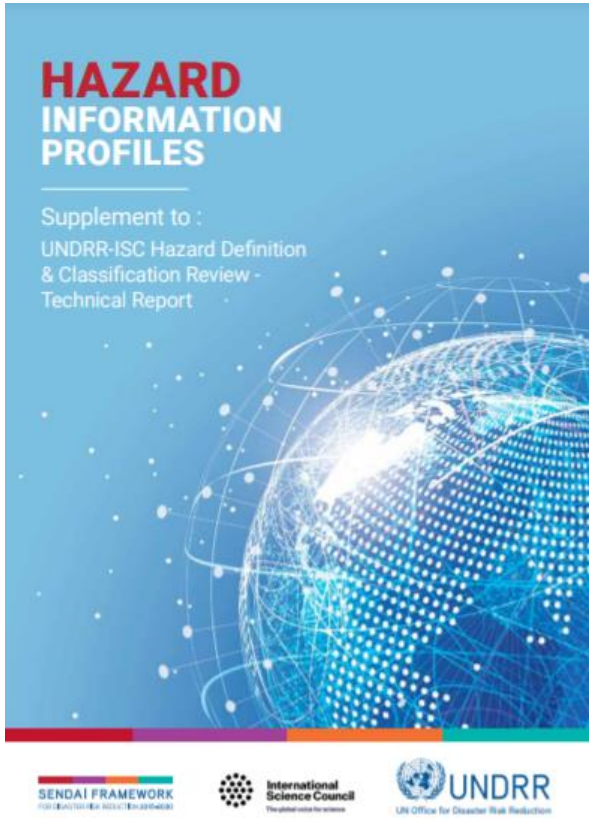
Disaster → **Impact**

Hazard

Disaster Risk → **Probability**

LIGHTNING AS A HAZARD





Hazard Information Profiles - Supplement to UNDRR-ISC Hazard Definition & Classification Review - September 2021

MH0002 / METEOROLOGICAL AND HYDROLOGICAL / Convective-Related

Lightning (Electrical Storm)

Definition

Lightning is the luminous manifestation accompanying a sudden electrical discharge which takes place from or inside a cloud or, less often, from high structures on the ground or from mountains (WMO, 2017).

Reference

WMO, 2017: International Cloud Atlas: Lightening. World Meteorological Organization (WMO). https://cloudatlas.wmo.int/lightning.html Accessed 26 November 2019.

Annotations

Synonyms

Bolt, Thunderbolt, Bolt-from-the-blue, Fireball, Thunderstroke, Thunderball.

Additional scientific description

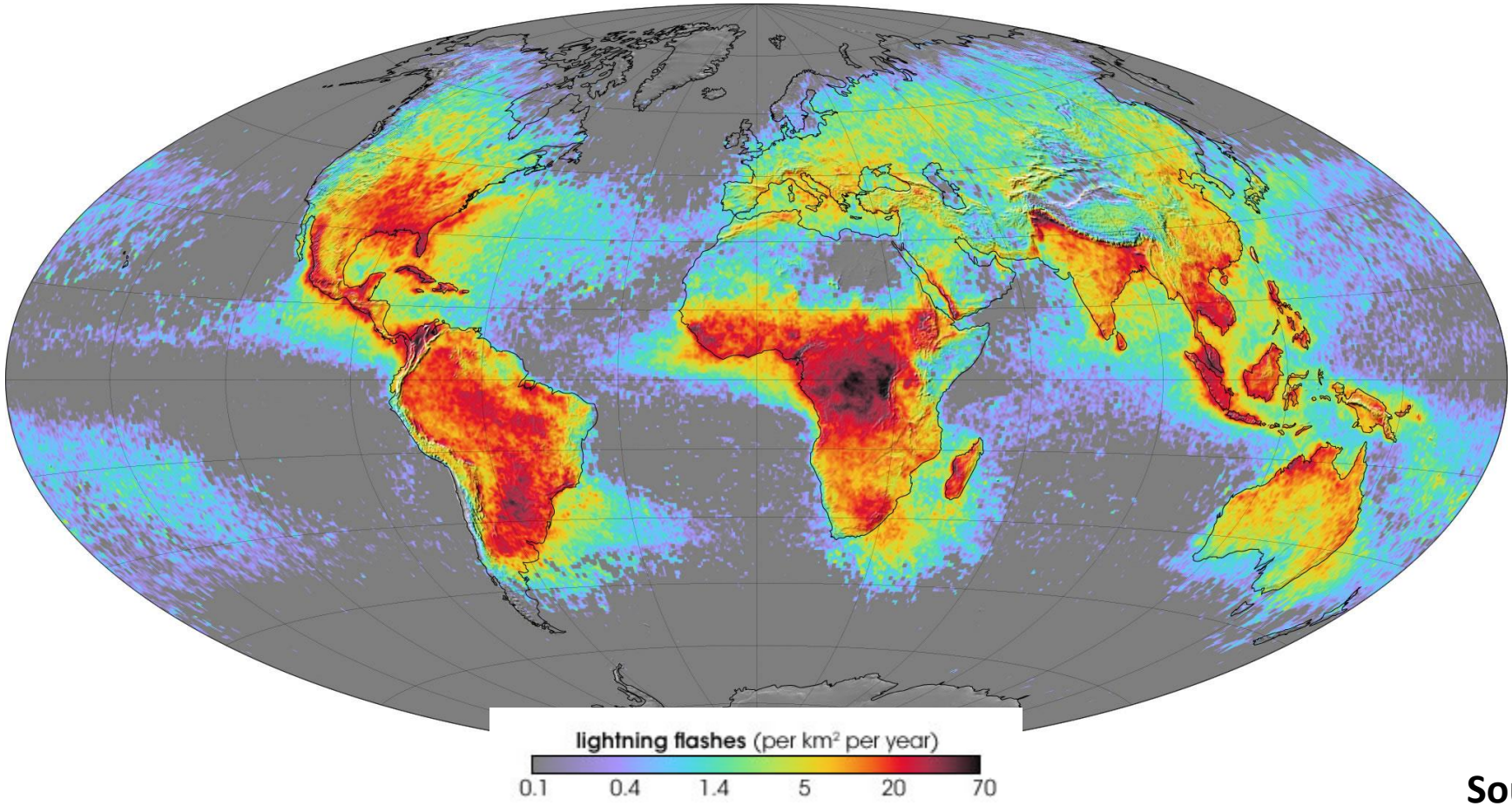
Lightning is a transient, high-current electric discharge with pathlengths measured in kilometres. The most common source of lightning is the electric charge separated in ordinary thunderstorm clouds. Well over half of all lightning discharges occur within the thunderstorm cloud and are called intracloud discharges (AMS, 2012).

Lightning is a large electrical discharge caused by a thundercloud. It can occur within a cloud as intracloud lightning, between clouds as intercloud lightning, or between the cloud and the earth as cloud-to-ground lightning. A lightning discharge consists of pulses of electric current carried by electrons. The current is driven by a high voltage between the cloud's charge centres or between them and the earth. During the development of a thundercloud, negative charge is accumulated in the hail-forming region at the central part of the cloud, and positive charge in the top region which consists of ice crystals (Finnish Meteorological Institute, 2019).

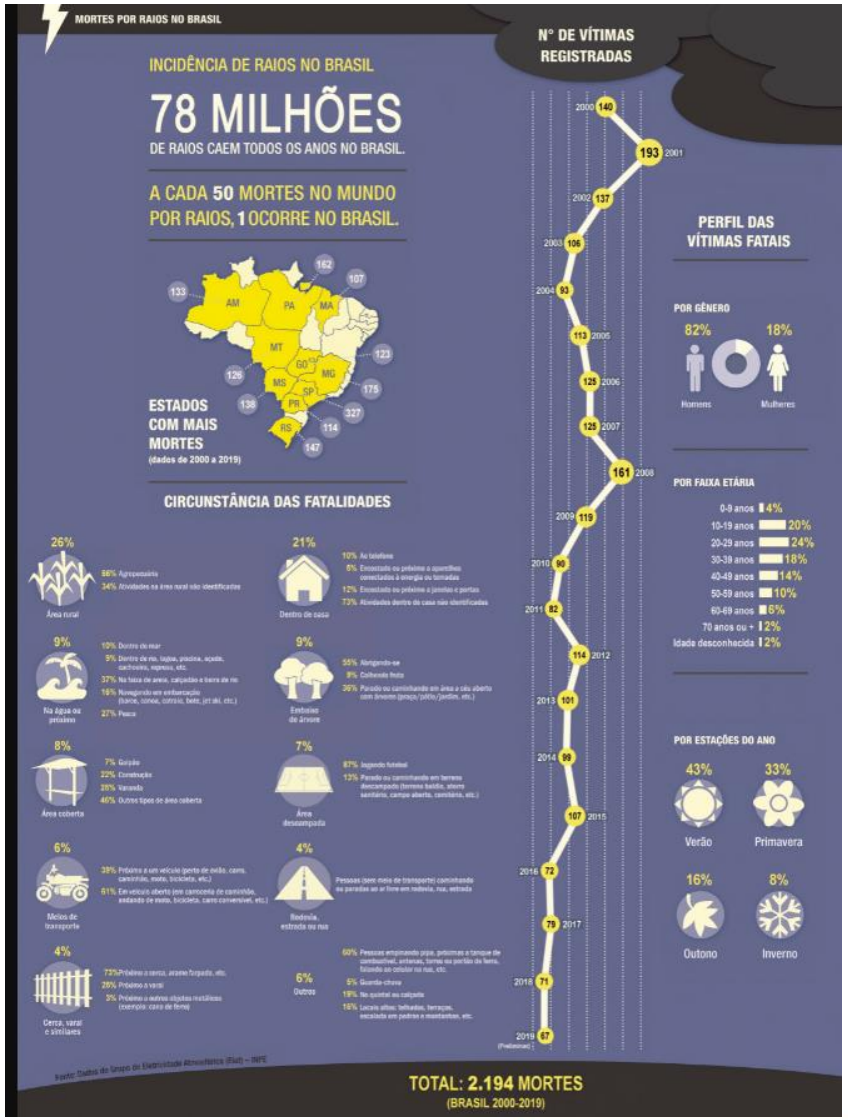
Lightning strikes are classified into different types according to their own characteristics. The two most common types are cloud-to-ground lightning and cloud-to-cloud lightning (WMO, 2017).

- *Cloud-to-ground lightning* is lightning discharge between a cumulonimbus cloud and the ground. Of all types of lightning, cloud-to-ground lightning poses the greatest threat to people and facilities on the ground (WMO, 2017). The usual cloud-to-ground lightning has been studied more extensively than other lightning forms because of its practical interest (i.e., as a cause of injury and death, disturbances in power and communication systems, and ignition of forest fires) and because lightning channels below cloud level are more easily photographed and studied with optical instruments (AMS, 2012). Cloud-to-ground lightning can occur as either positively or negatively charged bolts. Positively charged bolts are considerably more rare, more powerful (e.g., by an order of magnitude or more) and often can strike miles beyond the parent anvil of the thunderstorm (e.g., these positive strikes are referred to as a 'bolt out of the blue') (NOAA, 2019).
- *Cloud-to-cloud lightning* and cloud-to-air discharges are less common than intracloud or cloud-to-ground lightning. All discharges other than cloud-to-ground are often lumped together and called cloud discharges (AMS, 2012; WMO, 2017). Cloud-to-cloud lightning is the discharge between areas of cloud without the discharge channel reaching the ground. For most of the time, it occurs between oppositely charged portions of the same cloud but sometimes it takes place between two separate clouds. Since the discharge channel of cloud-to-cloud lightning may be obscured by the cloud, it may or may not be visible to an observer on the ground. It may therefore be surprising to learn that cloud-to-cloud lightning is, in fact, the most frequently occurring type of lightning. It occurs around ten times more often than cloud-to-ground lightning. Cloud-to-cloud lightning does not pose a threat to life and property on the ground. However, this type of lightning takes place in the sky and sometimes passes through the clear air between clouds, it is therefore of great practical interest to those concerned with the safety of aircraft (WMO, 2017).

Average yearly counts of lightning per square kilometer



Source: NASA Lightning team

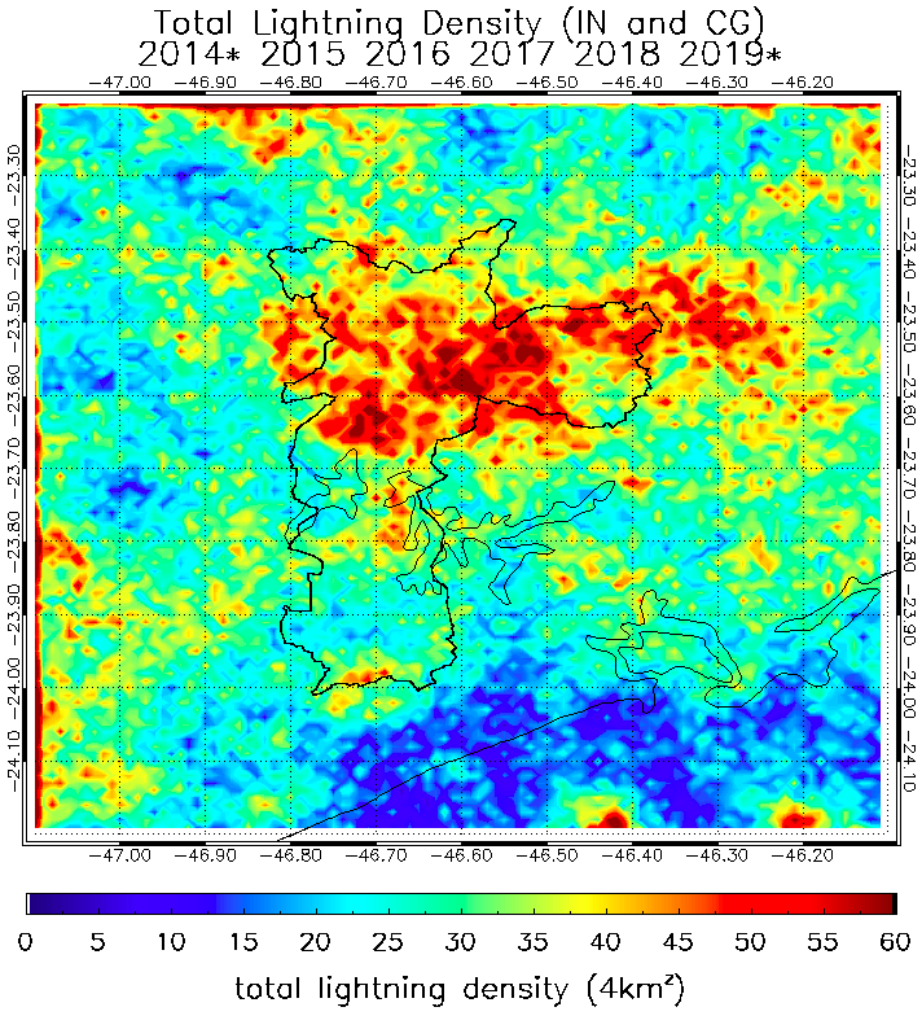


Impacts

Deaths due to lightning/year in Brazil

Source: ELAT/INPE

Contribution from the heat island



Lightning over the São Paulo metropolitan area (black poligon).

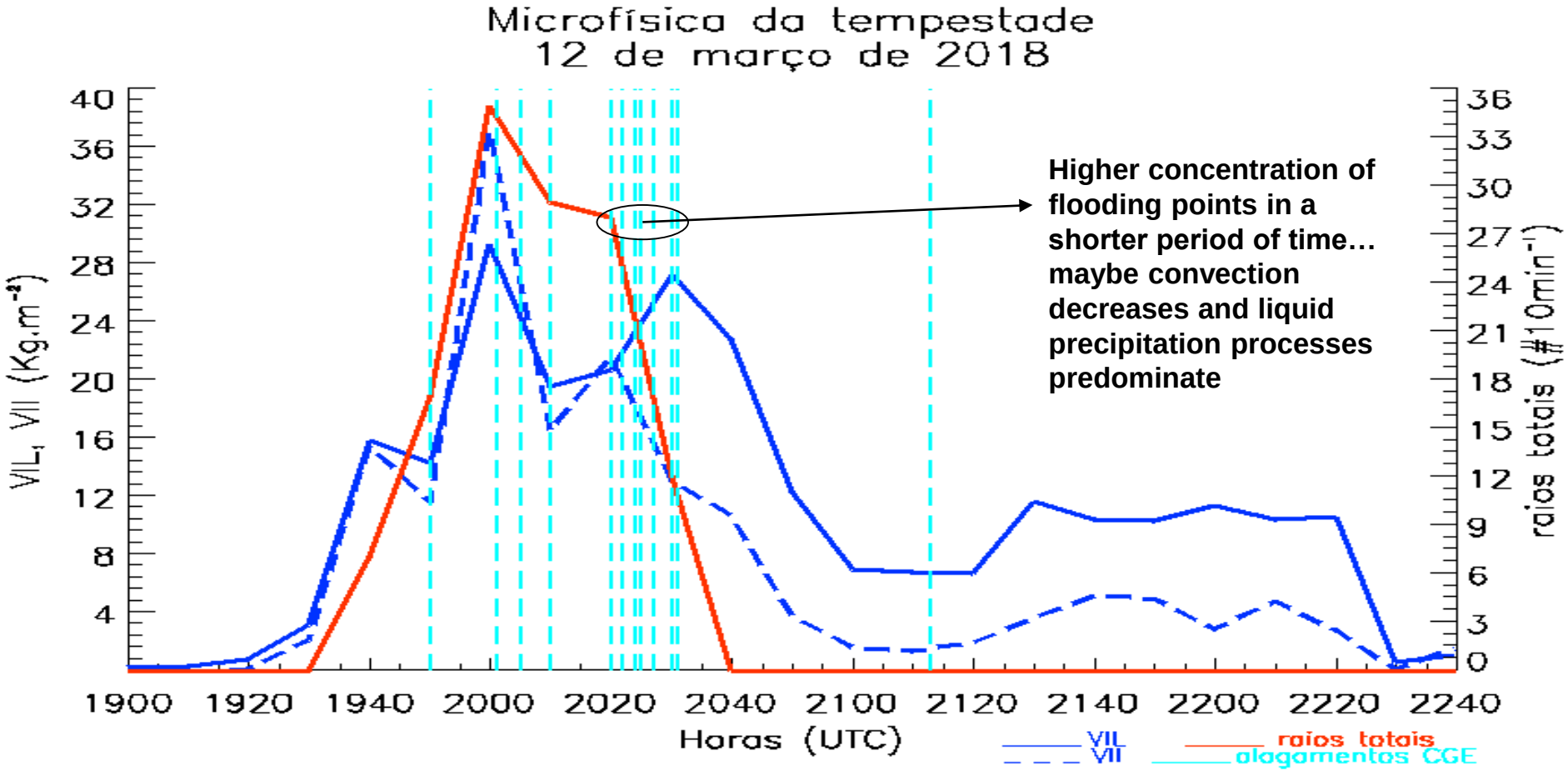
Maximums are over the urban area of the city.

But….

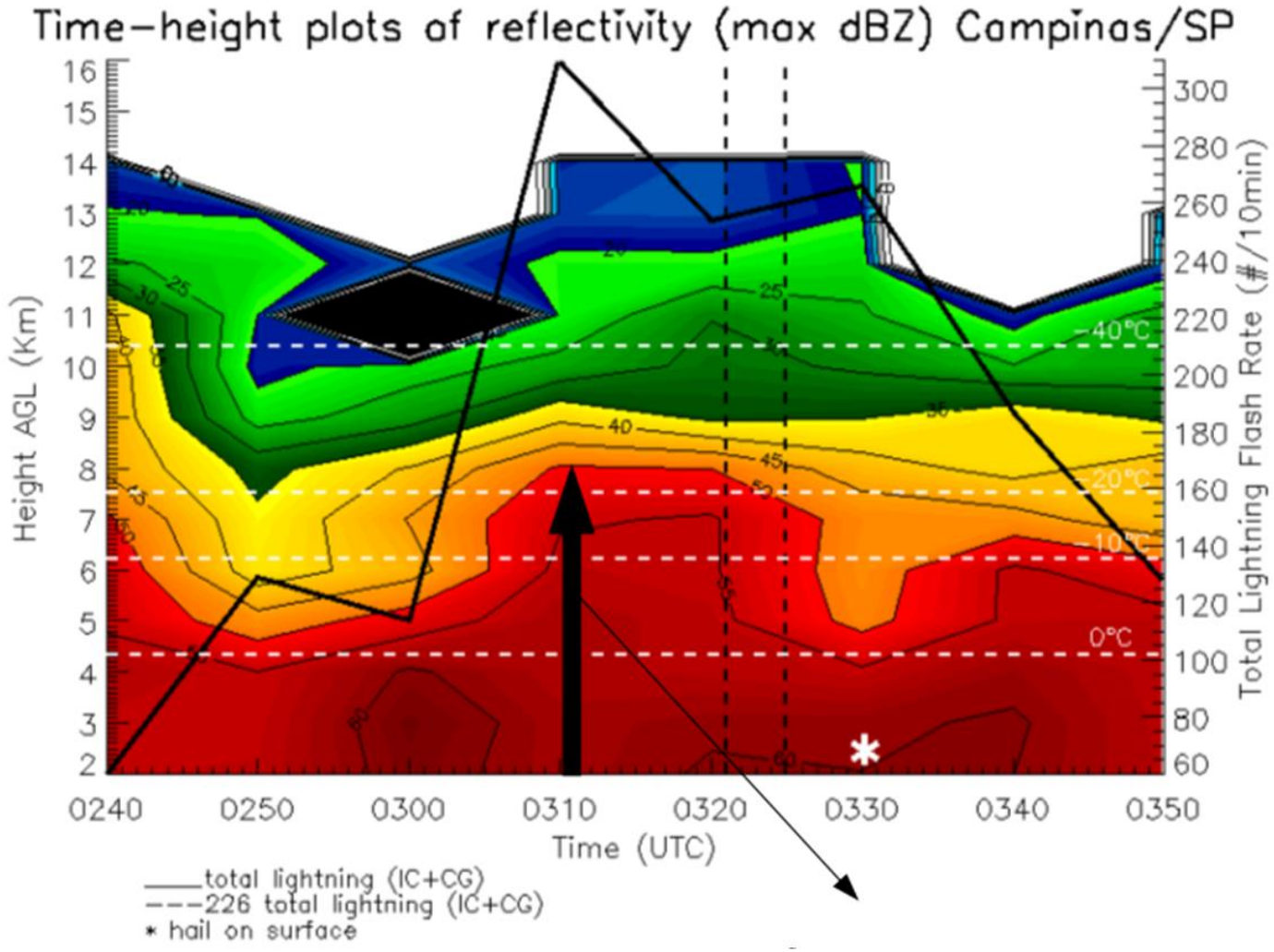
Lightning can also be used as a framework for disasters monitoring

Ex: Occurence of floods and flashfloods in Brazil

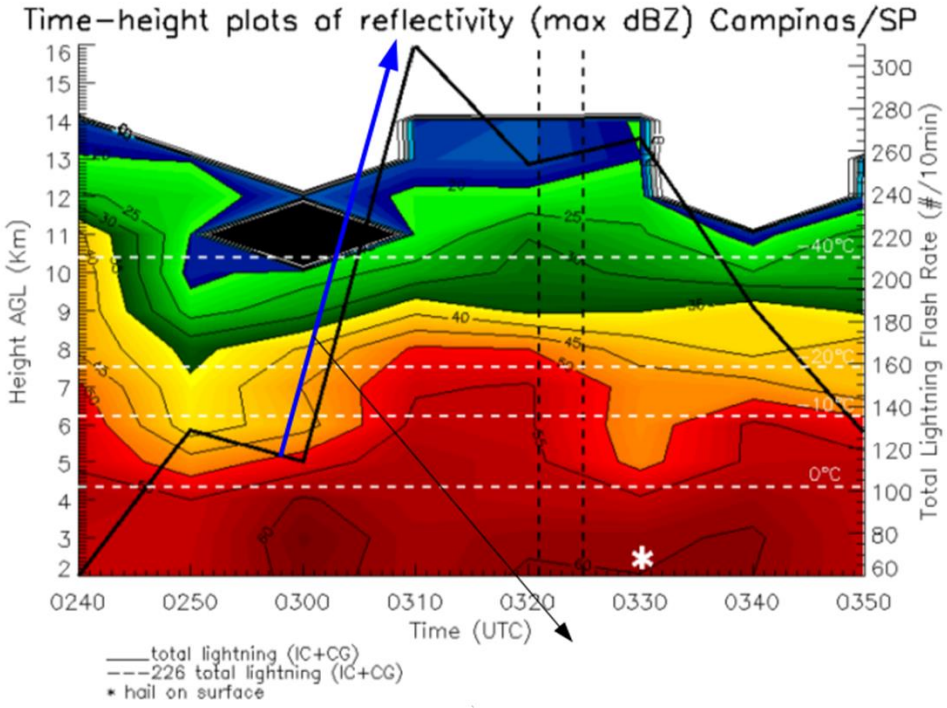
Storm Detection: 1900 UTC
Start of flood records by CGE: 1950 UTC
Lead time between initiation and flooding: **50 minutes**

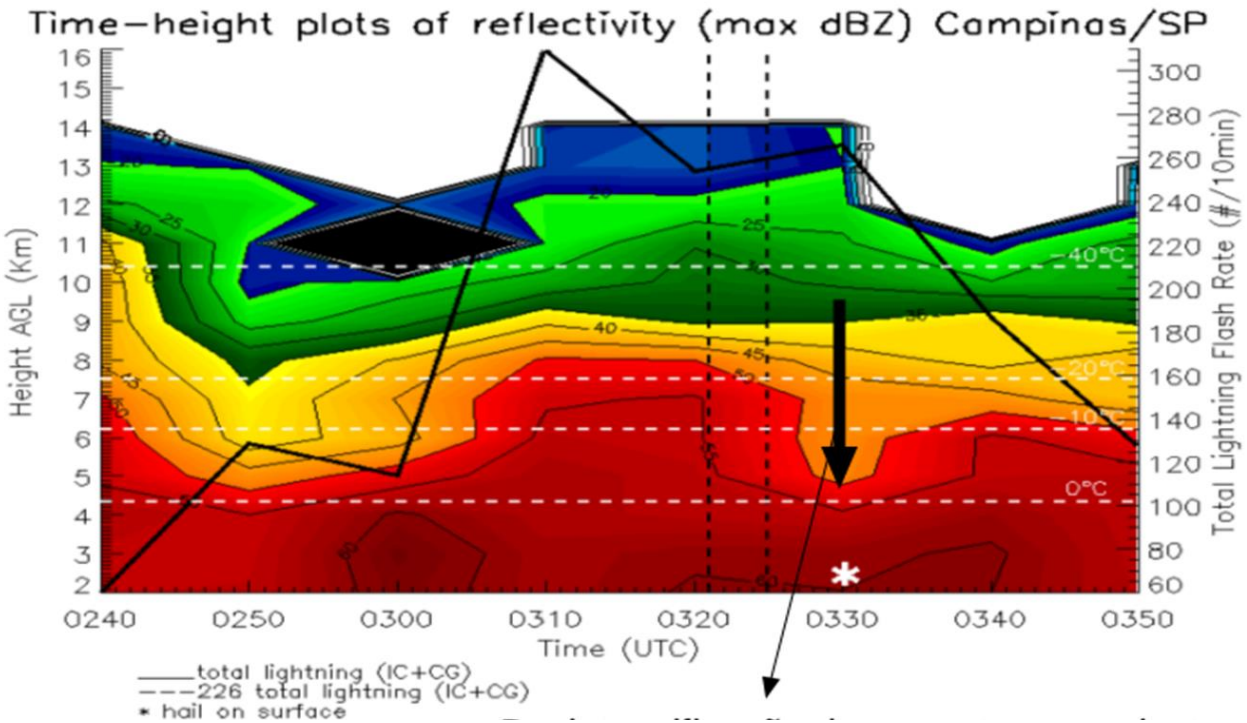


THUNDERSATORM – HAIL -



intensification of the updraft between 0300 and 0310 UTD





Jump of flash: from 110 to 310 in 10min.
jump anticipates the severe event

decrease in updraft: lesser support of hydrometeors within the cloud.

Important questions will help and guide our next steps:

- Are data on the lightning impacts useful for policy makers and managers?
- How can we effectively disseminate information, and incorporate this knowledge into policies and practices?
- What Guides should be developed for Support of National Meteorological and Hydrological Services to their National Multi-hazard Early Warning Procedures?