

Summary: Cumulated rainfall is calculated for 1h, 24h and 96h based on rainfall data from rain gauges and radar. Depending on whether the cumulated rainfall values exceed certain combinations of empirical thresholds, four levels of warnings (low to very high) are issued. Information is generated at least daily, it is reported to the municipal operations centre, and it is publicly available on the web.

Types of landslides

Rainfall-induced landslides on natural and artificial slopes

Monitoring

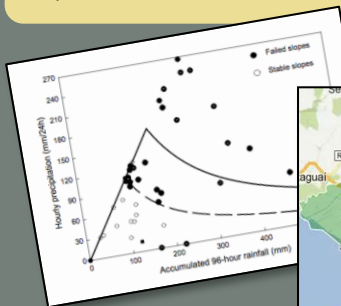
Rainfall data from 33 automated stations (every 5 minutes) and 2 radars (every 2 minutes)

Forecast

Numerical weather forecasts twice a day

Types of assessment

Empirical rainfall thresholds



Formulation

Cumulated rainfall thresholds for 1, 24 and 96 hours: exceedance of thresholds and a series of either/or rules



Spatial discretization

Areas of influence of rain gauges (33) and catchments (4)

Human consultation before issuing a warning?

Yes (CO-Rio for high, very high)

Warning zones

Rio de Janeiro municipality divided in four catchments

Warning levels

4 warning levels (low, medium, high, very high) related to landslide abundance (none, sporadic, diffuse, widespread)

Warning time

Updates in function of warning: daily (low), 6 hours (medium), real-time (high, very high)

Information type

- Web, Social media, Apps

Major improvements in 2010, 2018 and 2019:

- management moved to multi-purpose municipal operations centre "CO-Rio"
- internal protocols revised
- team of meteorologists expanded
- two weather radars operational
- creation of a protocol to close some urban roads
- local version of NASA's LHASA model used as information during human consultation

Landslide data:
originally 65 landslides (1996),
updated with 3.000 landslides (2010-2016)