MOXXI Measurements & Observations in the 21st Century

Working Group - International Association of Hydrological Sciences

Innovation in Hydrometry – From Ideas to Operation
IAHS MOXXI and WMO HydroHub Joint Meeting 2017 December 4-5 2017

Flood Monitoring with Social Media and Citizen Observatory through Wireless Sensor Network and Machine Learning in Urban Catchments under Change

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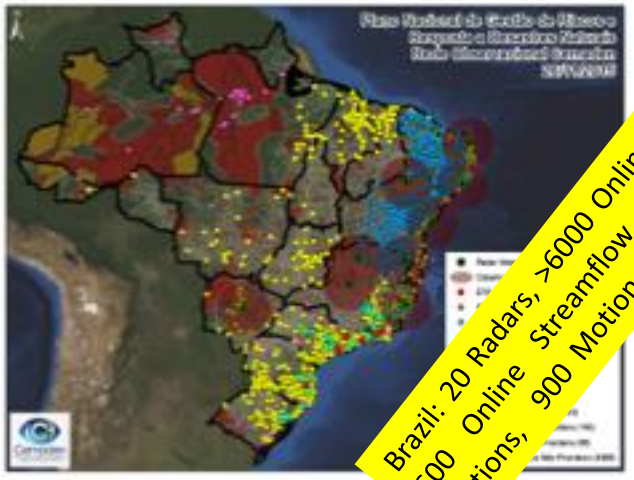
Water-Adaptive Design & Innovation



Brazil: 20 Radars, >6000 Online Rainfall Stations; 600 Online Streamflow Stations; 10* Robotic Stations, 900 Motion Sensors, 685 Soil Moisture Sts

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Bridging the gap between decision-making and emerging big data sources: An application of a model-based framework to disaster management in Brazil

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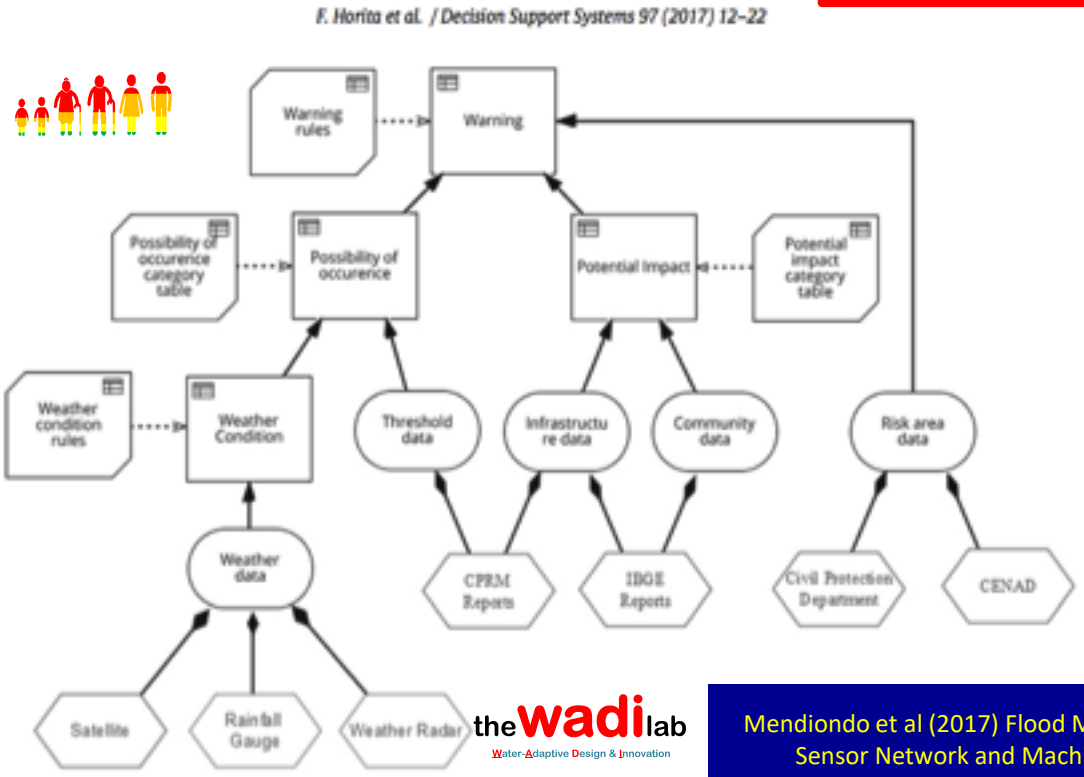

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Poor gauged basins without monitoring in flood disasters

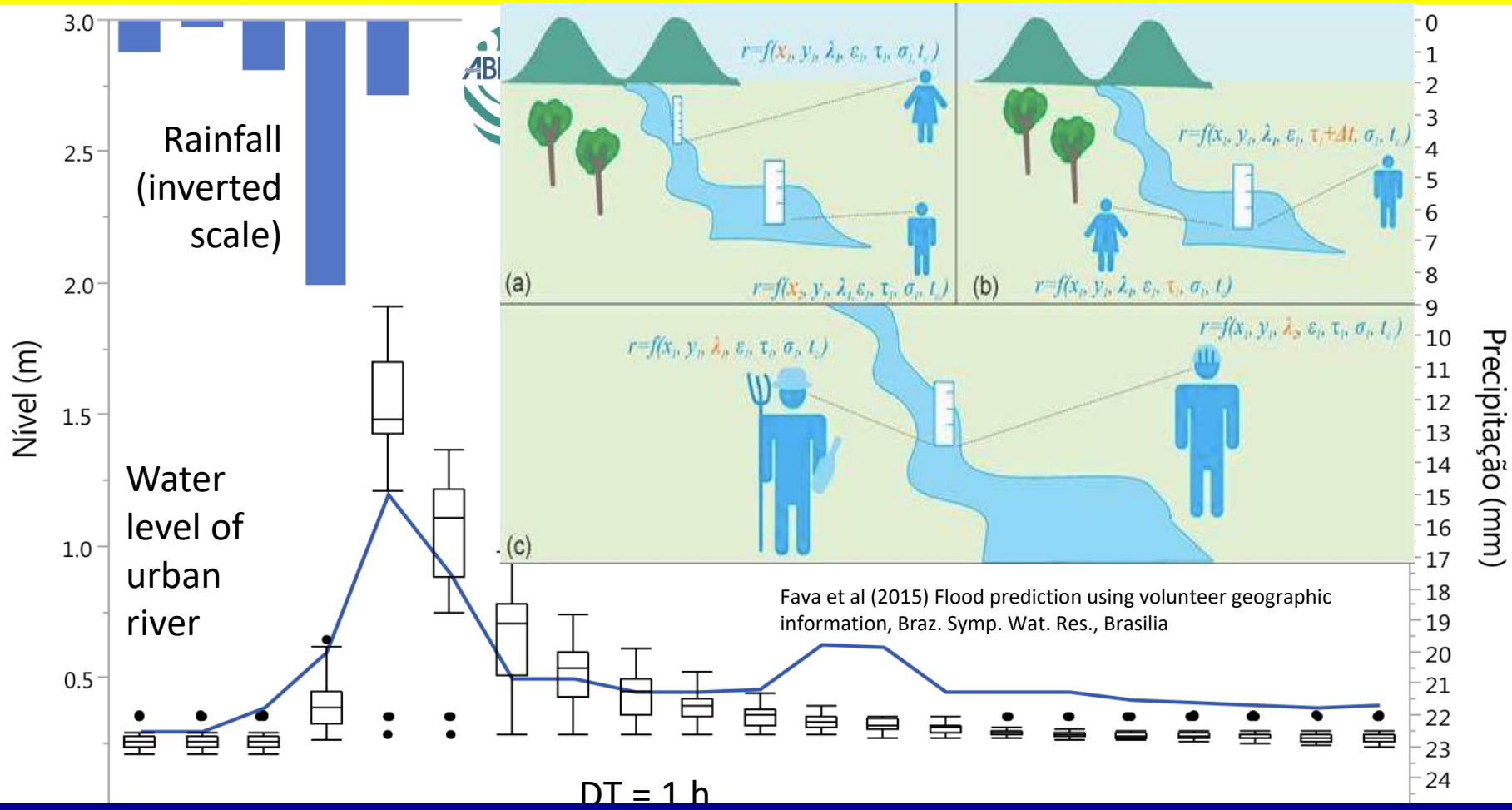
Brazil: 40,000 risk prone areas affected by ungauged catchments.

Low-cost technologies help real time early warning and alert issuing for flood prone areas:

- social media (SM),
- citizen observatories(CO),
- wireless sensor networks (WSN)
- machine learning (ML) methods

Mendiondo et al (2017) Flood Monitoring with Social Media and Citizen Observatory through Wireless Sensor Network and Machine Learning in Urban Catchments under Change, In: Innovation in Hydrometry – From Ideas to Operation,IAHS MOXXI & WMO HydroHub Joint Meeting, Dec 4-5 2017

The WADI Lab **Social Media, Citizen Observatory, Wireless Sensor Network and Machine Learning CAPES ProAlertas USP-CEMADEN: USING VOLUNTEER INFORMATION SYSTEMS FOR FLOOD AWARENESS AND FORECASTING. The picture outlines a timeline comparison (1-hour interval) of observed (blue line) and estimated water levels (box-plots with uncertainty) from regression-based volunteer information systems. Source: Fava et al (2015). Next steps: SHOWS (Socio-Hydrology Observatory for Water Security)**



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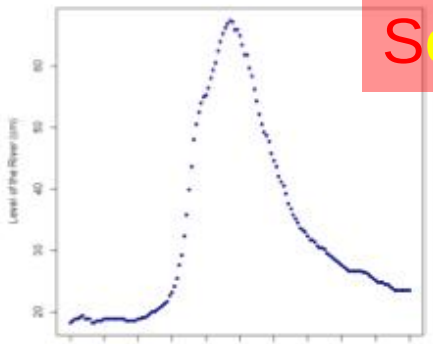
The WADI's problem-oriented Solutions Using Citizen Engagement, Machine Learning, IoT, Chaos Theory + Hydrological Monitoring/Modeling

Fig. 1. Positioning of the sensors (yellow points), base station (light blue point) and router (red point) at São Carlos, SP, Brazil.

Next Step: Socio-Hydrology Observatory for Water Security



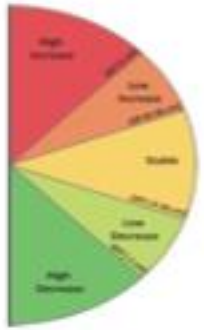


Fig. 4. Classes to forecast.

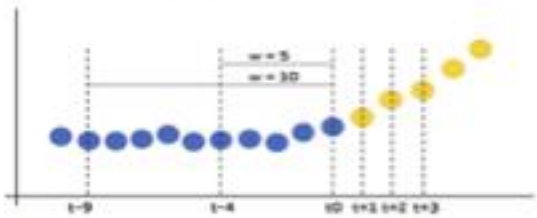


Fig. 5. Examples of the river water level time series with the window used as input for the ML techniques. Forthcoming values are calculated by sliding the window. t_0 represents the current time; t_{+1}, t_{+2} and t_{+3} are the stages in the forecasting; t_{-4} and t_{-9} shows the window size used as input for the machine learning technique.

Furquim et al (2016) Improving the accuracy of a flood forecasting: machine learning and chaos theory***Neural Computing and Applications*** 27(5): 1129–1141, DOI: 10.1007/s00521-015-1930-z; Furquim et al (2015) A Comparative Study of ML Techniques in a WSN Deployed in Brazil. In: K. Jackowski, R. Burduk, K. Walkowiak, M. Woźniak, H.Yin. (Org.). Lecture Notes in Computer Science. 937ed.: Springer International Publishing, 2015, v. , p. 485-492, DOI: 10.1007/978-3-319-24834-9_56.

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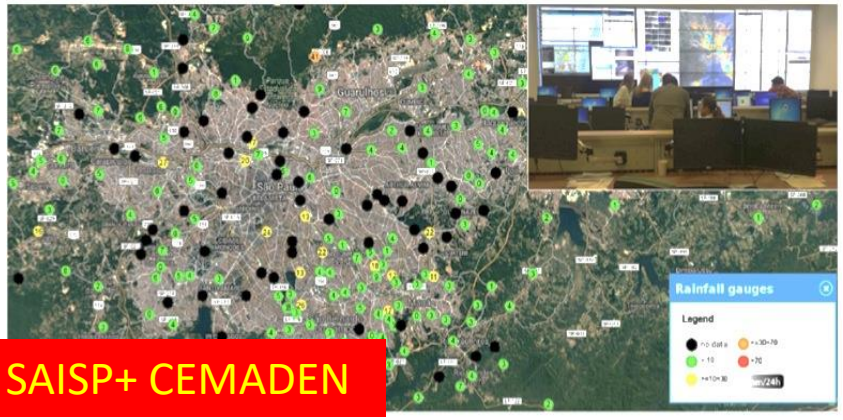
Research paper

Geo-social media as a proxy for hydrometeorological data for streamflow estimation and to improve flood monitoring

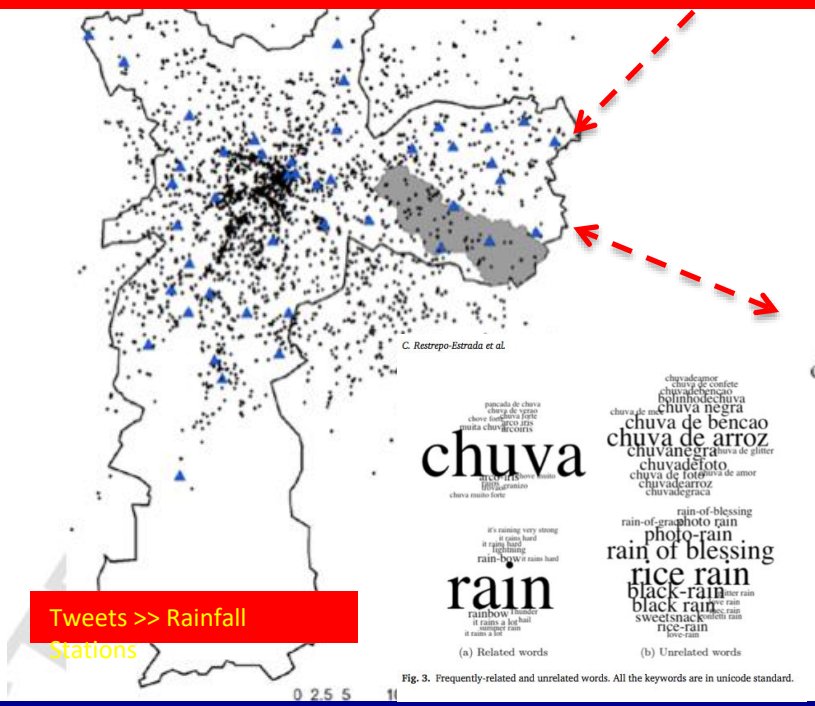
Camilo Restrepo-Estrada[a, *], Sidgley Camargo de Andrade[b, c], Narumi Abe[a], Maria Clara Fava[a], Eduardo Mario Mendiondo[a], João Porto de Albuquerque[c, d]



CGE + SAISP+ CEMADEN

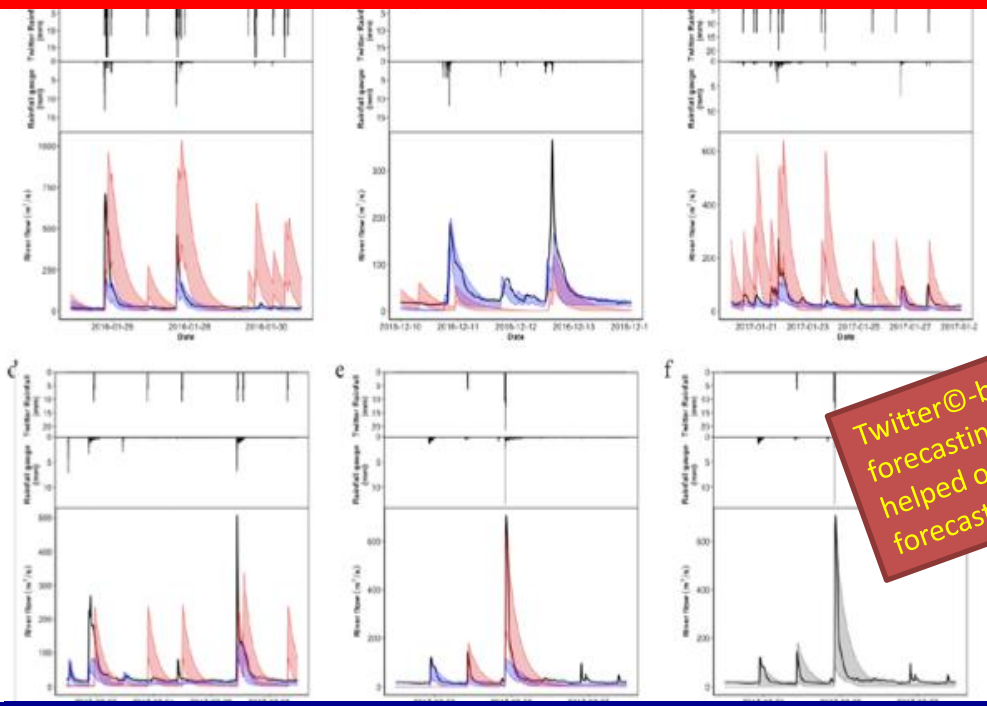
Fig. 5. Problems with authoritative data, February 2nd, 2017.

Virtual Rainfall Stations derived by Twitter© strenghtened flood risk forecasting in Sao Paulo catchments,



Tweets >> Rainfall Stations

Fig. 3. Frequently-related and unrelated words. All the keywords are in unicode standard.



Twitter©-based forecasting fi helped on flood forecasting

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“Thanks”, “Merci”, “Obrigado”, “Gracias” (emm@sc.usp.br)

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- *Horita, F, Albuquerque, J P, Marchezini, V, Mendiondo, E M, (2017) Bridging the gap between decision-making & emerging big data sources: Application of model-based framework to disaster management in Brazil, **Decision Support Systems**, DOI: 10.1016/j.dss.2017.03.001*
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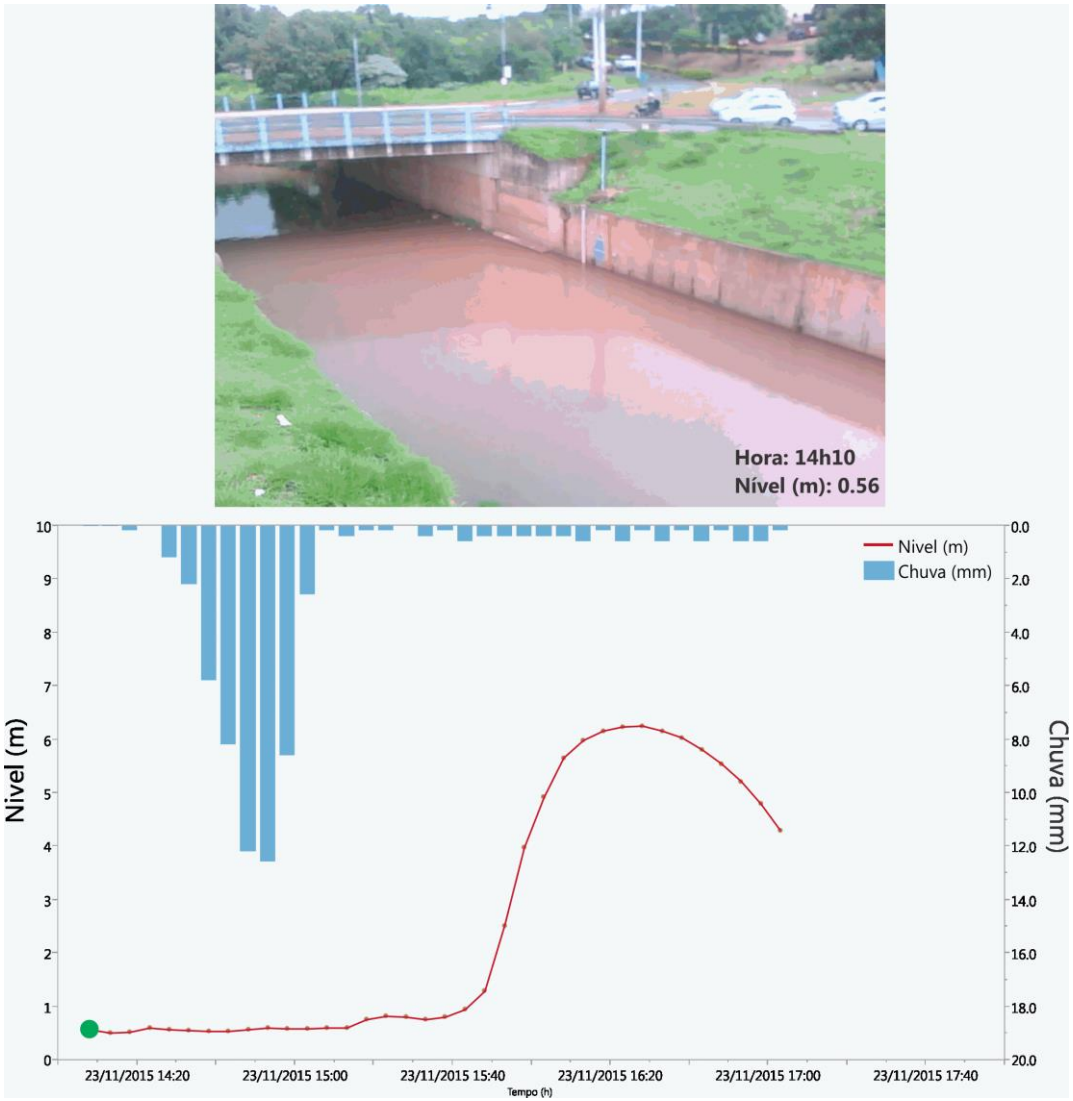
EPSRC Engineering and Physical Sciences Research Council
CNPq Conselho Nacional de Desenvolvimento Científico e Tecnológico
FINEP
CAPES
FAPESP-IVA Assessment of Impacts and Vulnerability to Climate Change in Brazil and Strategies for Adaptation Options

Subtropical Urban Flood (Drainage Area=77km^2)
São Carlos City, Sao Paulo State, Brazil, 23 Nov., 2015.



Source:
CAPES ProAlertas/USP/EESC-CEMADEN/MCTIC
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