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THE NEW GNIP NETWORK IN BRAZIL: AN EXAMPLE OF SOUND INSTITUTIONAL ARRANGEMENTS

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Abstract: Despite its continental size, large volumes of fresh water and overall importance regarding world climate patterns, Brazil has been lacking precipitation isotope data for the last three decades. Despite some individual efforts to keep monitoring sites operational, such as in Belo Horizonte (CDTN), in Rio Claro (UNESP) and Sao Paulo (USP), a homogenized country-scale implementation of the GNIP network did not exist since the 90's. In 2018, as an institutional benchmark, a national task force for the installation of GNIP stations was formed through a partnership between ANA and CPRM, supported by IAEA. Within this year, 10 GNIP stations were installed and are already operational.

1. INTRODUCTION

The rationales behind continuous long-term precipitation isotope observations are well known. During the active period of the Brazilian GNIP network (1960s to 1990s) isotope techniques were intensively applied and proliferated. Relevant doubts concerning the causes of groundwater salinization in the semi-arid Northeast, the understanding of the precipitation patterns in the Amazon and the groundwater dynamics in the Paraná Basin in the Southeast region of the country were addressed with isotope assessments (Kirchheim et al, 2017). The decline of the precipitation sampling network was paralleled by a substantial slowdown on the use of isotope techniques within Brazil and several analytical facilities, which had been active during the 80's and 90's, terminated their services. The only GNIP stations still operational were kept enthusiastically by researchers from the Nuclear Technology Development Center (CDTN), the State University of São Paulo (UNESP) and the University of São Paulo (USP), despite the lack of a national strategy. 2018 represents a milestone since a national approach for isotope monitoring was developed and implemented. The partnership between ANA and CPRM, with technical support by the IAEA allowed the installation of 10 stations within 2018. Results achieved so far provide evidence of sound institutional arrangements. Another 12 stations are already planned to be installed in the next 2 years. Figure 1 shows the actual operational sites and the planned ones.

2. METHODS

In order to secure the desired long-term sustainability of the isotope network, some strategic approaches were considered: (i) The selection of the monitoring sites took into account previously monitored sites; (ii) Eligible sites needed be located in areas considered to be safe against vandalism, close to maintenance and technical staff; (iii) Sites needed to be located close to rain gauges already officially registered in the National Hydrometeorological Network; (iv) Site selection also considered on-going projects of CPRM-ANA and their demand for basic isotopic data, and finally; (v) As part of every site's installation, local staff benefitted from a short seminar related to isotope activities; (vi) Monitoring stations being operated by research institutions, such as CDTN, UNESP and USP are considered to be part of the national network leading to an enhancement of partnership relationship between participants.

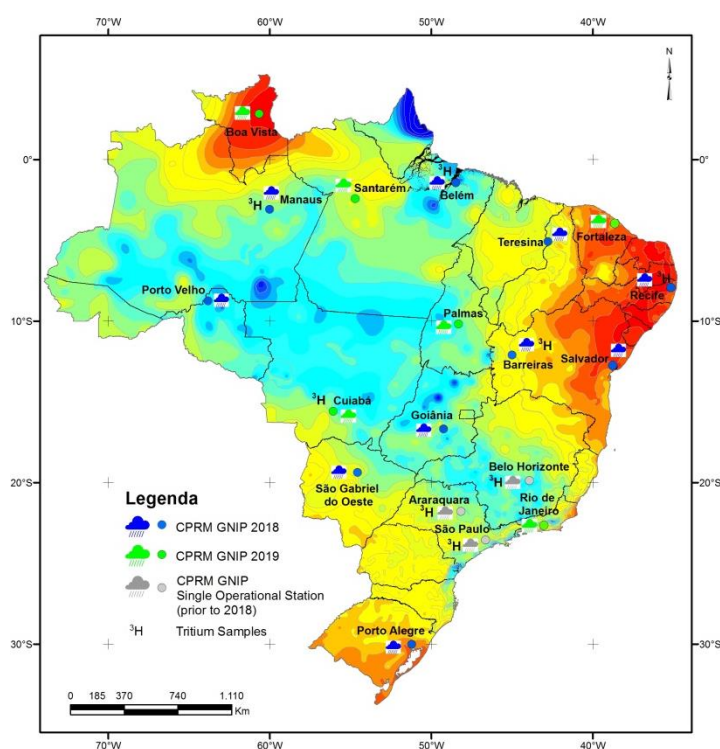


Figure 1. Rain sampling stations in Brazil. Station in Araraquara-SP operated by CEA/UNESP, Station in Belo Horizonte-MG operated by CDTN and Station in São Paulo-SP operated by USP

3. RESULTS

Achievements of the installation campaign are tabulated in Table 1. Besides stable isotopes assessment ($\delta^{18}\text{O}$ and $\delta^2\text{H}$), monthly samples for ^3H are going to be taken and analyzed in 5 GNIP sites.

Table 1. Synthesis of the actual scenario of the GNIP network in Brazil

Station Site	Stable Isotopes	^3H	$\Sigma\text{ppt/m (mm), T (}^\circ\text{C)}$ and $\text{P}_{\text{air}}(\%)$	Start Date
Araraquara-SP	✓	✓	✓	10/13
São Paulo-SP	✓	✓	✓	10/16

Belo Horizonte-MG	✓	✓	✓	10/06
Porto Alegre-RS	✓		✓	07/17
São Gabriel do Oeste-MS	✓		✓	07/17
Manaus-AM	✓	✓	✓	08/18
Recife-PE	✓	✓	✓	09/18
Salvador-BA	✓		✓	09/18
Belém-PA	✓	✓	✓	11/18
Porto Velho-RO	✓		✓	11/18
Teresina-PI	✓		✓	12/18
Goiânia-GO	✓		✓	12/18
Barreiras-BA	✓	✓	✓	12/18
Fortaleza-CE	✓		✓	02/19
Cuiabá-MT	✓	✓	✓	02/19
Santarém-PA	✓		✓	03/19
Boa Vista-RR	✓		✓	03/19
Palmas-TO	✓		✓	04/19
Rio de Janeiro-RJ	✓		✓	04/19

4. CONCLUSIONS

At each one of the monitoring stations, monthly samples for $\delta^{18}\text{O}$, $\delta^2\text{H}$ and ^3H are being collected, complemented by monthly mean precipitation, temperature and humidity data, compliant with the IAEA GNIP guidelines. Results are going to be available at the IAEA GNIP database (IAEA/WMO -2018) and at national level through the portal HidroWeb, a tool of the National Water Resources Information System (SNIRH). In doing so, ANA and CPRM at the national, and the IAEA at the international level, are accomplishing their missions in generating baseline isotope data and promoting the proliferation of water isotope applications. The strategy applied in Brazil is robust and can serve as an example for other countries.

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