Kick-Off Workshop of the international cooperation project “Brazil East Africa Peru India Climate Capacities – B-EPICCs

I.N.P.E., Sao Jose dos Campos-SP, Brazil, 23 August, 2022

“Climate Services and Water Disaster Resilience: Feasible Pathways for Natural Capital and Society”

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How Can Applied Solutions on Water Security from Climate Services Help Reimagine Habitats, Restore Landscapes, Revive Risk Management and Recreate Job Market for Vulnerable Communities?
Management of Disaster Risk and Societal Resilience
"how to contextualize the concepts about resilience"?

Stationary System State ('static' resilience)
Stationary System’s Thresholds

Non-Stationary System State ('dynamic' resilience):
Non-stationary hazards
Non-stationary System’s vulnerability thresholds

Thanks to partners & donors

#GenerationRestoration

Waters for Our World!

#OnlyOneEarth

#OneDropOfScience

#OneDoseOfResilience

#ScienceForPeace

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Popularização Científica - Academia - Comunidade

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PROSFE – Panta Rhei Open Science for a Future Earth – Envisioning a Post Pandemic Resilient Society

#UmaGotaDeCiencia
#UmaDoseDeResiliencia

Organização das Nações Unidas para a Educação, a Ciência e a Cultura
Cátedra UNESCO
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Figure 9. (a) Maximum (blue line) and minimum (red line) annual water level of Rio Negro at Manaus (1903–2021). Years corresponding to extreme flood with water level surpassing 29 m are indicated in blue, and years in red refer to severe hydrological droughts with minimum water level under 15.8 m. The annual water level amplitude (maximum minus minimum) is indicated by a black line (calendar years indicate extreme values with annual amplitudes >13 m) (adapted from Schöngart and Junk (2020));39 (b) duration of the emergency in Manaus (water level ≥29.0 m). All data obtained from the platform Hidroweb, available on the National Water Resources Information System (SNIRH) operated by the Brazilian National Water and Sanitation Agency (ANA) and the Geological Survey of Brazil (CPRM). Source: Adapted from Espinoza et al. (2022).
Figure 21. Overview of LAC climate policy priorities and capacities for climate services and early warning systems. Note to Figure 21(d): the results are representative of ten SIDSs that provided data. M&E: Monitoring and Evaluation of socioeconomic benefits. Note to Figure 21(e): the results are representative of seven SIDSs that provided data. Grey represents WMO Members indicating no EWS in place. Note to Figure 21(f): Member capacities are categorized as Inadequate (0%–33%), Basic/Essential (34%–66%) and Full/Advanced (67%–100%), according to the estimated percentage of the at-risk population that receive EW. For each hazard, the Inadequate category includes Members (providing data) reporting that no end-to-end EWS for the hazard is in place, as well as those whose end-to-end EWSs do not reach more than 33% of the at-risk population. The results are representative of seven SIDSs that provided data.
El episodio de sequía extrema de 2019-2021 en la Cuenca del Plata

Un informe conjunto del IRC de la Comisión Europea, el CEMADEN, el SISSA y la OIMM

Gráfico 12. Series temporales del SPI-12 y del SPI-24 calculadas a partir de la precipitación estimada por el Centro Mundial de Climatología de las Precipitaciones (GPCC) para la cuenca del río Paraná entre 1900 y 2021. (Fuente: CEMADEN).
The challenge of unprecedented floods and droughts in risk management

Heidi Kreibich, Anne F. Van Loon, ... Giuliano Di Baldassarre

Nature 608, 80–86 (2022) | Cite this article

17k Accesses | 350 Altmetric | Metrics

https://www.nature.com/articles/s41586-022-04917-5
Panta Rhei benchmark dataset: socio-hydrological data of paired events of floods and droughts


https://doi.org/10.5880/GFZ.4.4.2022.009
Extended Data Fig. 4 The theoretical framework used in this study (adapted from IPCC). This theoretical risk framework considers impact as a result of the risk components or drivers: hazard, exposure and vulnerability, which in turn are modified by management.

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Fig. 3 | Relationship between change in hazard and change in impacts. Categories are: lower hazard and lower impact, ten cases; higher hazard and higher impact, 11 cases; lower hazard and higher impact, one case; higher hazard and lower impact, two cases. Circles and triangles indicate drought and flood paired events, respectively; their colours indicate change in vulnerability. Green circle highlights success stories (n = 2) of reduced impact (-1) despite a small increase in hazard (+1). Purple ellipse indicates paired events (n = 7) with large increase in hazard (+2) - that is, events that were subjectively unprecedented and probably not previously experienced by local residents.
Suggested topics of Applied Solutions on Water Security from Climate Services

- Water resources and water security
- Nature-based Solutions
- People Centered Early Warning Systems
- Climate change mitigation: net zero carbon emissions, water/energy/food nexus
- Climate change adaptation: risk & resilience, flood management
- Circular economy, treatment technologies, reuse and recycling
- Modelling & control of water+wastewater systems, digital twins
- Sensors and sensor data analysis
- Water management in urban, peri-urban and rural areas, WASH
- Sustainable Insurance of WaterMulti-Risk, Multi-Hazards
COVID-induced interdisciplinary communication among INCTMC2’s partners & pos-IPCC/AR6 intersectorial dialogue with international stakeholders under new regulation framework of the Brazilian Water Security Plan (PNSH, 2019-2035), the New Brazilian Water Security Act (#14026/2020) and the Payment for Ecosystem Service Act (#14.114)

INCTMC2 water security alliances with international initiatives of: UNESCO-IHP IX Phase (2022-2029), UNEP WWQA/GEMS, WMO Strategic Plan, #Act4SDGs, IBPES & COP27 to accelerate science-for-policy adaptation with disruptive open innovation for climate-resilient startups and jobs for a low-carbon economy under SDGs (2022-2030)

“Absorptive”-type Resilience

INCTM-C2 water security alliances with other FAPESP interdisciplinary projects (C4AI #2019/07665-4, MADIS #2019/23393-4, CeMEAI #2013/07375-0) through: NbS efficiency under LULC (SSP) & climate (RCP), EbA valuation & water risk management

“Adaptive”-type Resilience

“Transformative”-type Resilience
Water Security in Brazil

Agência Nacional de Água - Plano Nacional de Segurança Hídrica
Example I: climate services, water security and circular framework with feedbacks, scales and stakeholders [c]

Community of Practice NbS related to:
- River pulse patterns in biomes
- Flood rating curves
- Flow-duration Curves
- Payment of Ecosystem Services
- Stakeholders’ risk aversion

[c]: https://doi.org/10.1016/j.cliser.2017.10.005
Figure 3. Spatial risk estimation model for sanitation infrastructure through geospatial integration of its components.
Unveiling water security in Brazil: current challenges and future perspectives

Gabriela Chiquito Gesualdo, Jullian Souza Sone, Carlos de Oliveira Galvão, Eduardo Sávio Martins, Suzana Maria Gico Lima Montenegro, Javier Tomasella & Eduardo Mario Mendiondo
Incertezas de Segurança Hídrica: exemplo de cenários 2010-2099 com modelos hidrológicos diferentes (p.ex. SWAT/TAMU, MHD/INPE)...

Discrepância de Segurança Hídrica

Discrepância de Segurança Hídrica mas mecanismos de resiliência financeira (p.ex. seguros) mostram evidências de forte dependência espacial* (áreas de drenagem de: 294, 277, 508 e 972 km²)

“ÁGUA E A NATUREZA”: Resiliência depende do tamanho de bacias doadoras

Intervalo de impactos...

...resiliência econômica diferente com escala de bacias

Economic indicators of hydrologic drought insurance under water demand and climate change scenarios in a Brazilian context

Guilherme Samproagna Mohor *, Eduardo Mario Mendinlondo

Department of Hydrology, Engineering and Statistics, São Carlos Engineering School, University of São Paulo, São Carlos, SP, Brazil

National Center for Monitoring and Early Warning of Natural Disasters, São Paulo, SP, Brazil

Cacareco

Economic indicators of hydrologic drought insurance under water demand and climate change scenarios in a Brazilian context

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Cacareco
Simulated outputs of climate-driven insurance premiums for Brazilian Megacity's Water Utility from one water supply system under climate change scenarios for different coverage (%) considering the DURATION of water spell and for different future time horizons depending on:

1st column: Stationary Demand (SD) or Non-Stationary Demand (NSD), 2nd column: climate models; 3rd column: levels of climate perturbation (RCPs), and 4th column: return period (Tr = 2 yrs, Tr = 20 yrs, Tr = 100 yrs)

Multi-driver ensemble to evaluate the water utility business interruption cost induced by hydrological drought risk scenarios in Brazil

Diego A. Guzmán, Guilherme S. Mohor and Eduardo M. Mendiondo
Example II: multi-stage disaster risk reduction (DRR) management [d]

A novel multistage risk management applied to water-related disaster using diversity of measures: A theoretical approach

Fabricio Alonso Richmond Navarro R., Gabriela Chiquito Gesualdo, Renan Gon Ferreira, Luis Miguel Castillo Rápalo, Marcos Roberto Benso, Marina Batalini de Macedo, Eduardo Mario Mendiondo

[d]: https://doi.org/10.1016/j.ecohyd.2021.07.004

Figure 1. Relationship of three main elements of water security. Description: In gray boxes the relationship of three main elements of water security: human activities, ecosystem maintenance, and resilience to natural threats, in two different moments: conventional approach (orange arrows) and a novel approach using NbS, insurance policy and multidimensional indices (blue arrows).
A novel multistage risk management applied to water-related disaster using diversity of measures: A theoretical approach

Figure 2. Risk management approach composed for a four-quadrant graph. Description: The solid lines represent the first moment, when only is considered a stationary event (I quadrant), grey infrastructure (II quadrant) and people and government are not awake about the necessity to adapt (III and IV quadrant). The dashed line represents our novel approach to improve resilience, considering non-stationary events (I quadrant), NbS combined with grey infrastructure (II quadrant), and the use of multidimensional indices (III and IV quadrant).
How can we communicate Climate Services and Water Security using nature-based solutions (NbS)\textsuperscript{[a]} under risks of F-E-H nexus?

Ecosystem service valuation method through grey water footprint in partially-monitored subtropical watersheds

D. Taffarello a, b, P. G., M.S. Bittar a, c, K.S. Sass d, M.C. Calijuri a, D.G.F. Cunha a, E.M. Mendiondo a

[https://doi.org/10.1016/j.scitotenv.2020.139408]
New opportunities from climate services to envisioning water security and life cycle analysis

Low Impact Development practices in the context of United Nations Sustainable Development Goals: A new concept, lessons learned and challenges

Marina Batalini de Macedo¹, Marcus Nóbrega Gomes Júnior²³, Thalita Raquel Pereira de Oliveira⁴, Marcio H. Giacomoni⁵, Maryam Imani⁶, Kefeng Zhang⁷, César Ambrogio Ferreira do Lago⁸⁹, and Eduardo Mario Mendiondo⁴

¹WADILab, Department of Hydraulics and Sanitation, Escola de Engenharia de Sao Carlos, University of Sao Paulo, Sao Carlos, SP, Brazil; ²Department of Civil and Environmental Engineering, University of Texas at San Antonio, San Antonio, Texas, USA; ³Water Systems Engineering, Civil Engineering, School of Engineering and the Built Environment, Anglia Ruskin University, Chelmsford, Essex, UK; ⁴Water Research Centre (WRC), School of Civil and Environmental Engineering, UNSW Sydney, NSW, Australia

Figure 1. Concept and evolution of LID practices generations in terms of water balance variables and mitigation purpose. In the figure, P₁, E₁, Q₁, L₁, S₁, I₁ and Tᵣ represent, respectively, rainfall, evapotranspiration, runoff, pollutant load, soil storage capacity, infiltration and return period to base scenario of preurbanization (adapted from Macedo et al. (2017)).
Example IV: climate services, water security and water-quality scenarios of ecosystem-based adaptation [f]

Modeling freshwater quality scenarios with ecosystem-based adaptation in the headwaters of the Cantareira system, Brazil

Denise Taffurello¹, Raghavan Srinivasan², Guilherme Samproga Mohor³, João Luís Bittencourt Guimarães⁴, Maria do Carmo Calijuri¹, and Eduardo Mario Mendiondo¹

Community of Practice of NbS related to: Field observations, Scenario Criteria-Assessment, Scaling Problems, Water Cycle Changes, Ecophysiological Patterns

[ f]: https://doi.org/10.5194/hess-22-4699-2018
Example XI: stormwater reuse in Sao Paulo Megacity [m].

Community of Practice of NbS related to: Historical trends, Level of Rainwater Harvesting, Concurrent water-allocation, Decentralized Water Consumption. Socio-Hydrological Values, Beliefs & Norms

[m]: https://doi.org/10.1080/1573062X.2022.2047735
Example VIII: climate services, water security and citizen science and low impact development [j]

Cooperative EH-NbS related to:
- Low Impact Development (LID),
- Citizen Science Data,
- Flood Observation,
- Climate Change Scenarios,
- Corrected IDF,
- Historical-Future changes.

Article

Linking Urban Floods to Citizen Science and Low Impact Development in Poorly Gauged Basins under Climate Changes for Dynamic Resilience Evaluation

Maria Clara Fava 1-4, Marina Batalini de Macedo 2, Ana Carolina Sarmento Buarque 3, Antonio Mauro Saraiva 4, Alexandre Cláudio Botazzo Delbem 3 and Eduardo Mario Mendiondo 3

[j]: https://doi.org/10.3390/w14091467
How can we scale Governance & Community of Practice of Applied Solutions on Water Security from Climate Services?
https://learningforsustainability.net/pubs/BuildingTransdisciplinarityforManagingComplexity.pdf
Climate Services, Water Security and Adaptation (formal, global approach)

Intergovernmental Hydrological Programme (9th Phase of IHP 2022-2029)

- 5 Priority Areas
  1. Scientific research and innovation
  2. Water Education in the Fourth Industrial Revolution including Sustainability
  3. Bridging the data-knowledge gap
  4. Integrated water resources management under conditions of global change
  5. Water Governance based on science for mitigation, adaptation and resilience

- 34 expected outputs
  - The Strategic Plan has been approved with its 5 priority areas and 34 expected outputs by the IHP Council in its 24th Session last June

- 150 Key activities
  - Operational Implementation Plan endorsed at the 25th Session of the IHP Council 26-29 April 2022

https://unesdoc.unesco.org/ark:/48223/pf0000381318
How to be more engaged in the Community of Practice around the integration of climate services and water security adaptation pathways? - An Open Invitation

Water Wise Cities (C) 2019 I.W.A.

"Panta Rhei" (C) 2019 I.A.H.S.

Earth Observation for water management' Community of Practice
Part of the IWA Digital Water Programme


Special Issue "Green Technologies for Urban Water Management"

https://www.mdpi.com/journal/sustainability/special_issues/Green_Technologies_stormwater

International Day of the Tropics 2022: Urban Sustainability in Tropical Cities

Thank you

Obrigado

Thank you

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