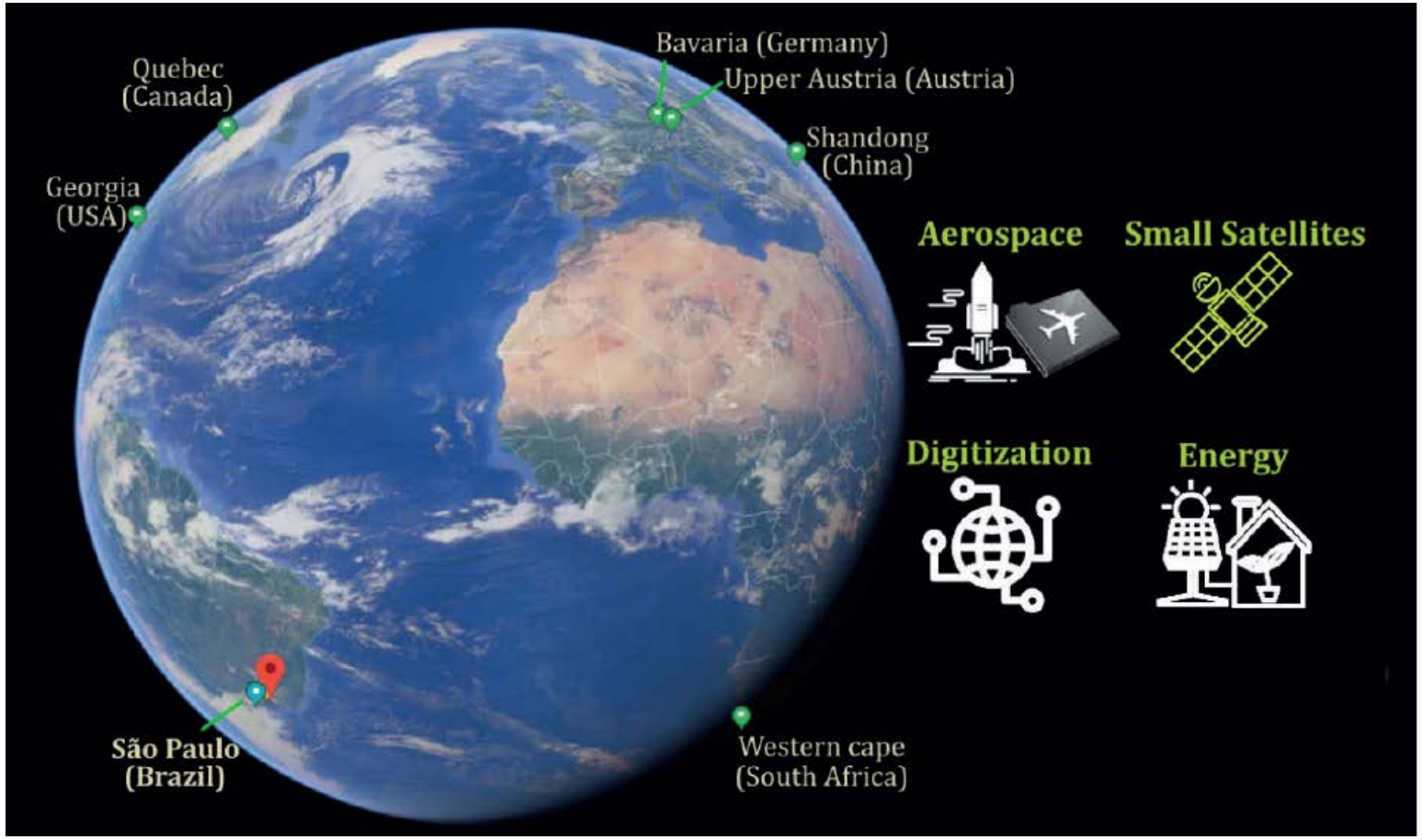
The *Young Scientists 24h Challenge*

How RLS regions can contribute to the São Paulo of tomorrow (in 10 years) from an aerospace, digitization, energy and satellite perspective?

Regional Leadership Summit (RLS)

Annual Meeting 2019 at LIT, INPE, São José dos Campos

27 – 31 May



Issues and challenges at São Paulo identified by the RLS young scientists

Infrastructure & communication

Water & air quality

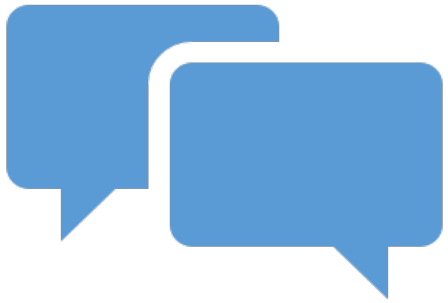
Flood & water pollution

Urban traffic

UNIVERSITY COMMUNICATION WITH THE SOCIETY AND THE DECISION MAKERS

Emphasis on the need of São Paulo universities to engage with the people, the stakeholders and the decision-makers

- São Paulo could benefit from an optimized communication and exhange between its universities and people
- The scientific and societal relevance of multidisciplinary and interdisciplinary research & innovation must be known
- We shall raise the impact of São Paulo universities & science on people !



How can we do this ?

- ✓ Using the best communication technologies and approaches available
- ✓ Using the expertise of the RLS-Network in Aerospace, Digitalization, Energy and Small Satellites to fight all problems at the same time

The solution: a innovative satellite system for São Paulo, driven by its universities !

To monitor and address São Paulo's…

Flood occurrence and risk mapping area

Water quality

Air quality, heat

Urban traffic, frequence of accidents

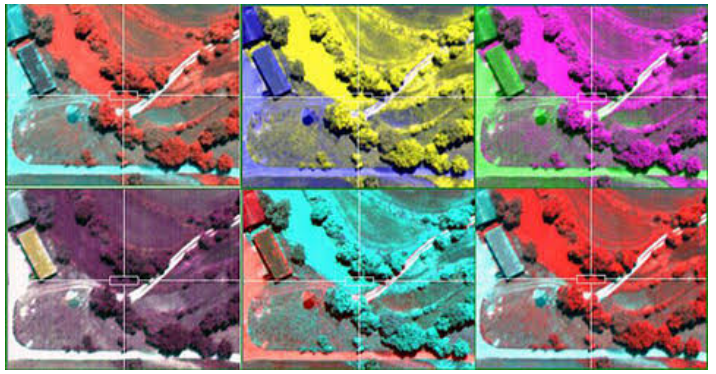
Local food production and access

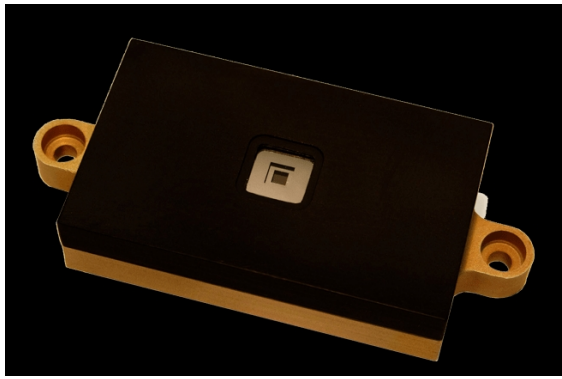
Proposed technology :

SÃOTELLITE^{RLS}

The ultimate cubesat constellation !

- ✓ For a full and continuous coverage of São Paulo, a constellation of 6 cubesats is necessary.
- ✓ With this number, a continuous coverage is provided with fault resilience providing a safe operation.





- ✓ Fully equipped with the best of imaging hardware (Chameleon 2019) and ACDS (NST-31 Nano Star Intergalactic Tracker; SSOC-D667 3-Axis digital sun sensor)

Proposed technology :

SÃOTELLITE^{RLS}

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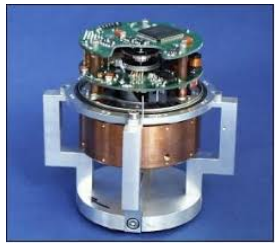
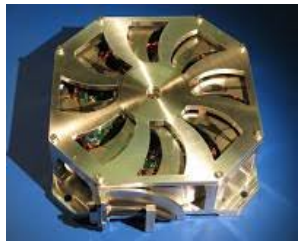
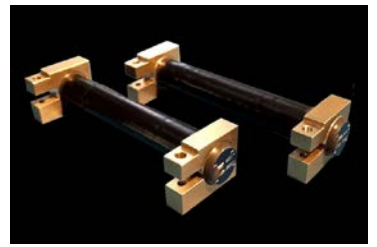
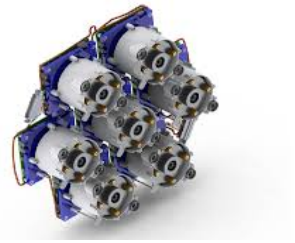
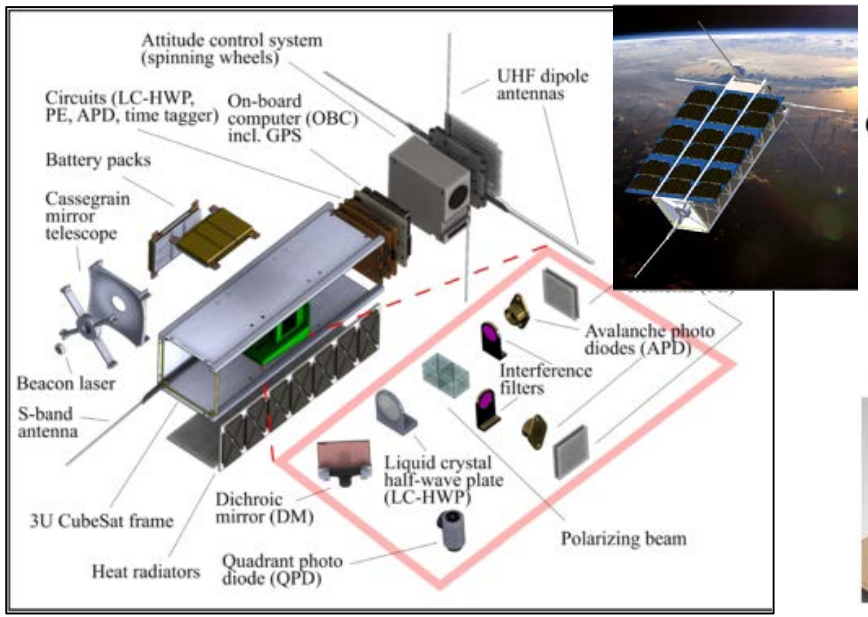
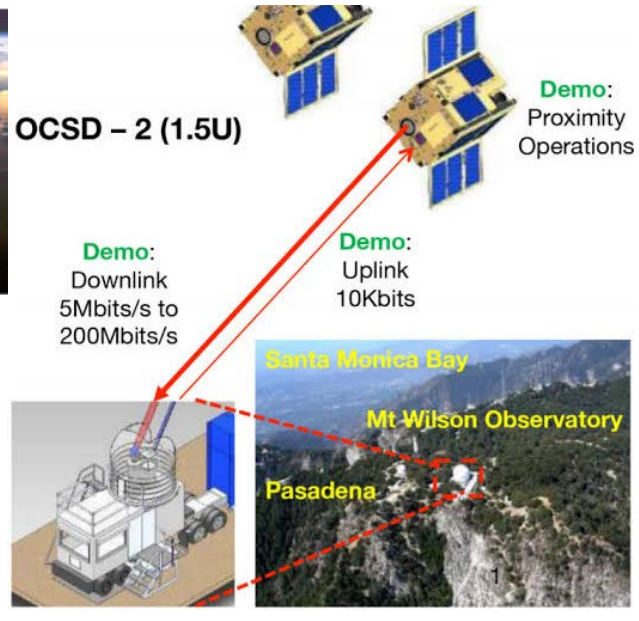
- ✓ For the atitude control, both reaction wheels and magnectic torquers could be used together with electric propulsion to achieve a precision better than 0.2° and to enable the avoidance of space debree.

- ✓ Optic link is going to be used as it can achieve high bandwith and communication with both the ground station and with the other satellites from the constellation. Together with the optical link, to ensure the safety of the data a quantum key generation hardware shall be used.



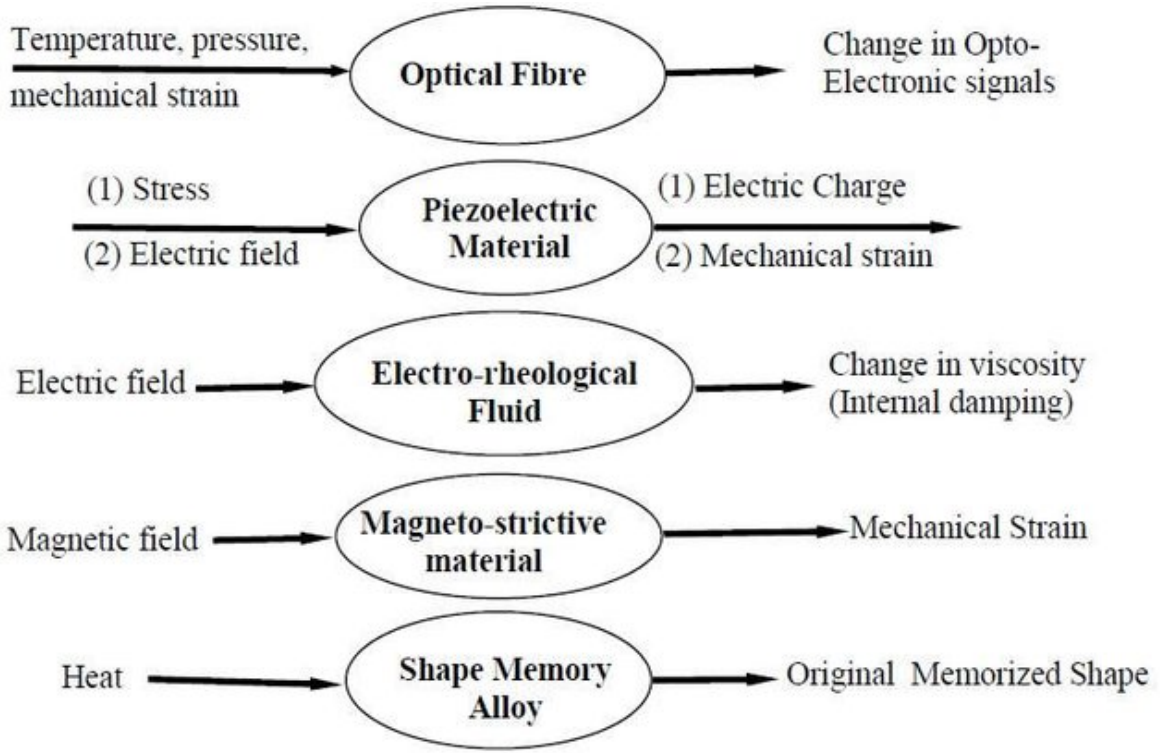


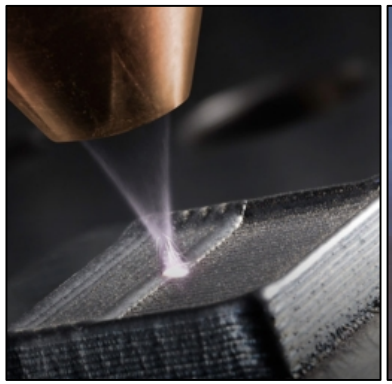
Proposed technology :

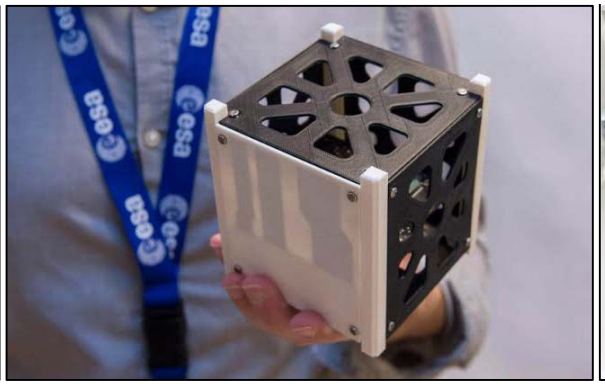
SÃOTELLITE[RLS]

The ultimate cubesat constellation !

A STRUCTURE MADE WITH SMART MATERIALS !!!







Proposed technology :

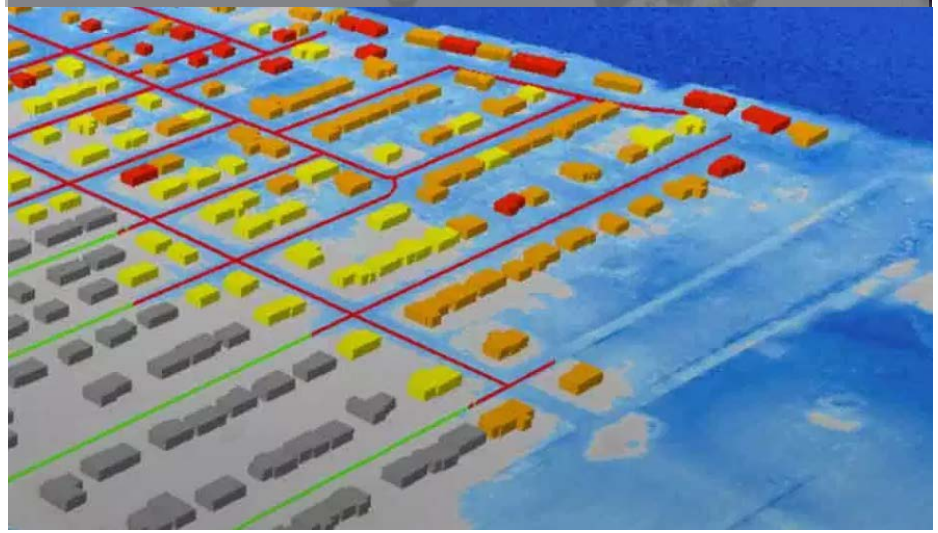
SÃOTELLITE[RLS]

The ultimate cubesat constellation !

Initial ground stations

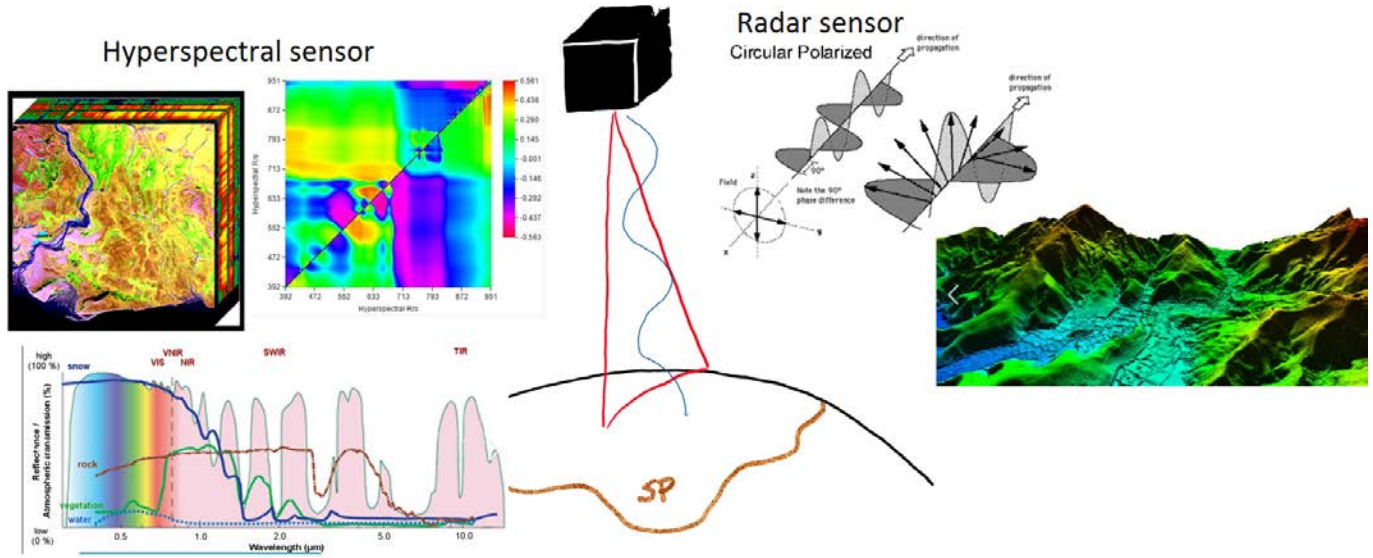
1. **Santa Maria – RS**
2. **Natal – RN**
3. **São José dos Campus – SP Ita**

Applications of SÃOTELLITE^{RLS}

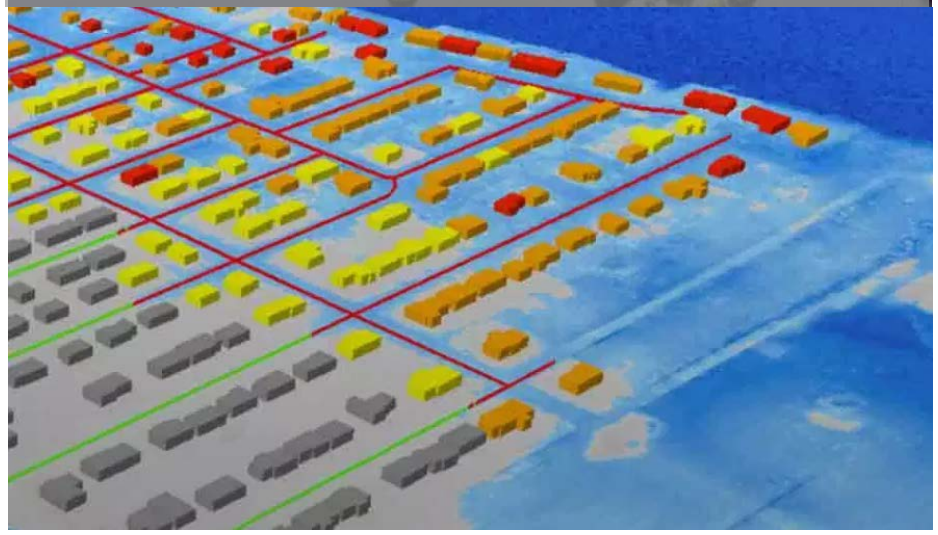


FLOOD RISK MANAGEMENT

- Around 2.6 M people are exposed to river flood risk, especially the Tietê river
- 2019 São Paulo flood and mudslide killed 12 people
- Economic losses estimated to R$ 108 M$
- The SãotelliteRLS will monitoring and forecast flow rates for a better knowledge of flood risks
  - Real-time: Dynamic mapping of flood zones
  - Forecast: Visualization of the extent of the flood based on short-term meteorological data forecasts
  - Simulation of climate change scenarios
  - Estimation of potential economic damage to buildings & critical infrastructure



Applications of SÃOTELLITE^{RLS}



FLOOD RISK MANAGEMENT

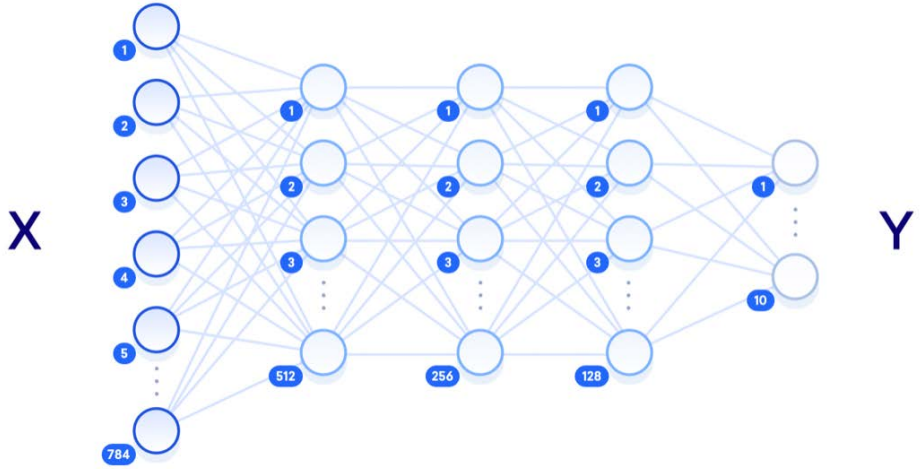
- Satellite data & in situ data
- Method:
  Convolutionnal Neural network

Input data

- Air temperature (MS)
- Soil moisture (TI, O)
- Air pressure (MS)
- Discharge (HS)
- Topography (R)

Output data

- Forecast flow rates (prevention)
- Real-time flow rates (emergency)



Return on investment on our universities

Due floodings at São Paulo:
R$ 108 million/yr

Due traffic congestions at São Paulo:
R$ 156.2 billion/yr

Due traffic accidents at São Paulo:
R$ 28 billion/yr (whole country)

Less financial loss for São Paulo !

More cash to buy and maintain a São Paulo personalized satellite system !!!

Valuable societal impacts

- Less flood vulnerability
- More secure, efficient and fast transportation
- Improved urban health
- São Paulo universities benefits the society and the decision makers
- Contributing to public policies

THAT IS WHAT SMART REGIONS ARE ALL ABOUT !

SÃOTELLITE^{RLS} team

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Guilherme Galhardo	**Sao Paulo**, space engineer
Claudie Ratté-Fortin	**Quebec**, math expert
Yuri Matheus	**Sao Paulo**, software engineer
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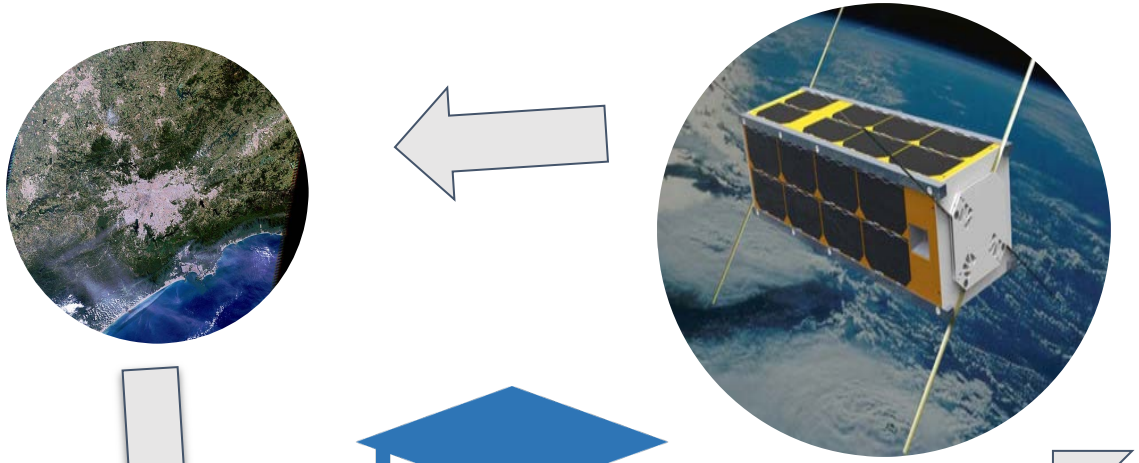
In the next 10 years, São Paulo will have its OWN PERSONALIZED SATELLITE SYSTEM driven by its universities



SÃOTELLITE^{RLS} : Ready to invest ?