



The Meeting of the Americas

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Development and Availability of a Network-Based Positioning in Brazil

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OUTLINE

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Theoretical Considerations

Network-Based

VRS concept

Atmospheric Models

SP Network

VRS Internet Plataform

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INTRODUCTION

GNSS network-based positioning has been widely used by the geodetic community

Several countries have adopted such kind of service

Applying multiple reference station methods one can obtain higher positioning accuracy (cm) in a larger coverage area

In addition to gain in:

Reliability

Availability

Integrity



INTRODUCTION

It can be used in several applications as for example:

Surveying

Traffic

Precise Agriculture



Data from GNSS Active Network of West of São Paulo State (SP/NET) are being used in Brazil to develop the network-based positioning



The idea is to make available a **post-processed service** at soon – available on the internet



Later a real time service

NETWORK RTK

Using network-based positioning, it is possible to model the distance dependent errors



Ionosphere Effect



Troposphere Refraction

Several methods have been developed to formulate corrections from a network stations data

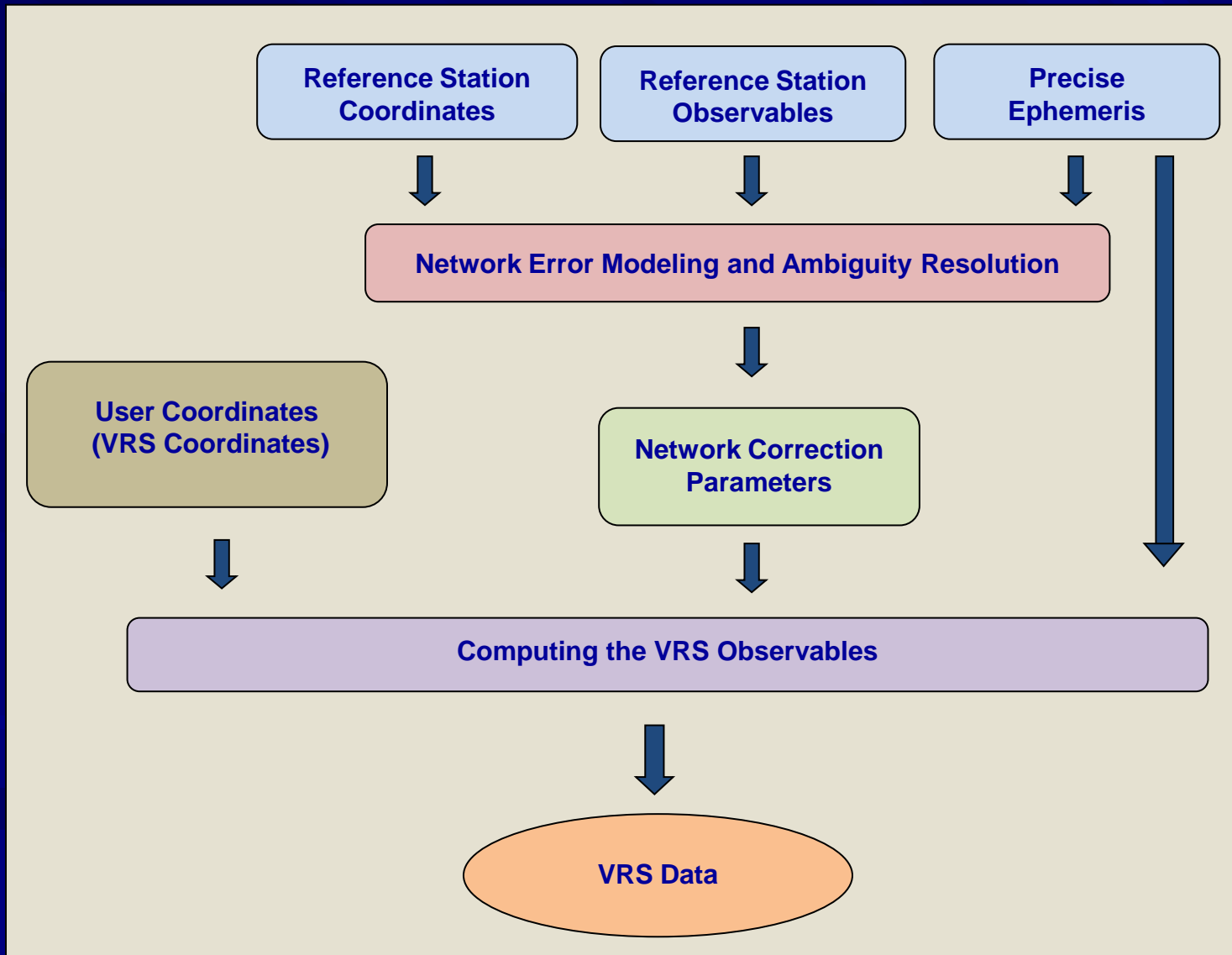


In this paper it is used the **VRS** concept



A reference station is generated close to the user

VRS CONCEPT



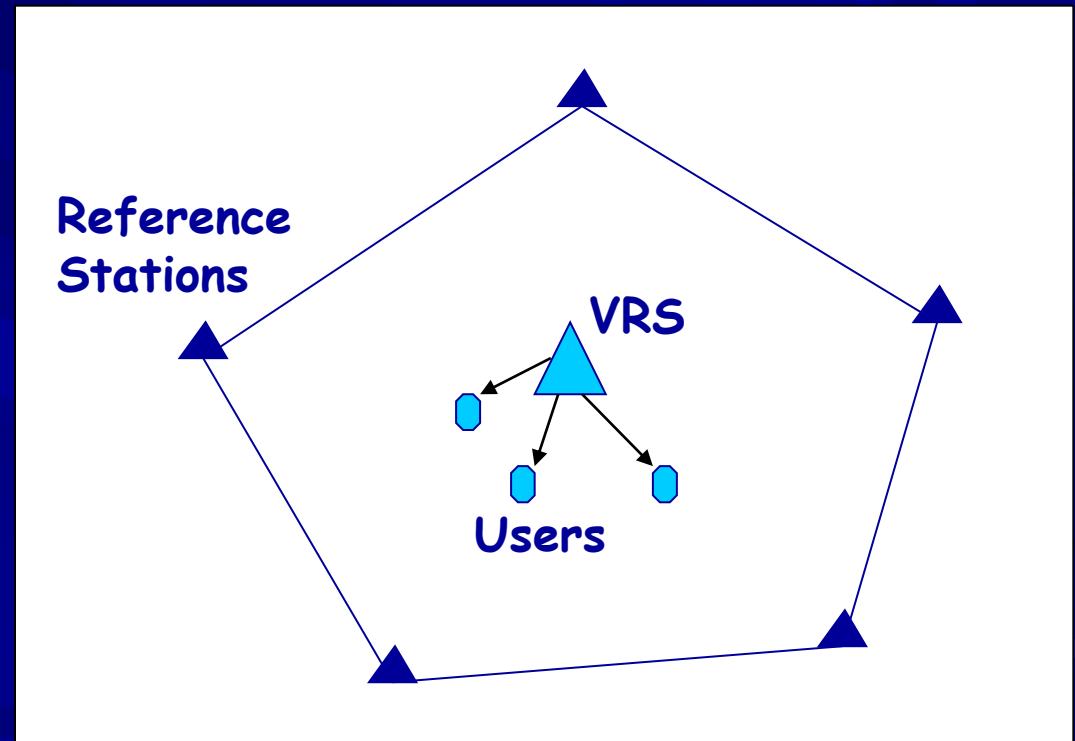
VRS CONCEPT

The VRS data are not provided by a real receiver, but its data are generated from real GPS observations collected by an active multiple reference station network

The idea is that the VRS data resemble as much as possible a **real** receiver data at the same location

The user has the possibility of using the VRS as if it were a real reference station in your proximities

The user can accomplish the relative positioning using a **single frequency** receiver



Wanninger (1999)

TROPOSPHERE MODEL

A **NWP** model was used

This kind of troposphere modeling has been very used by the scientific community

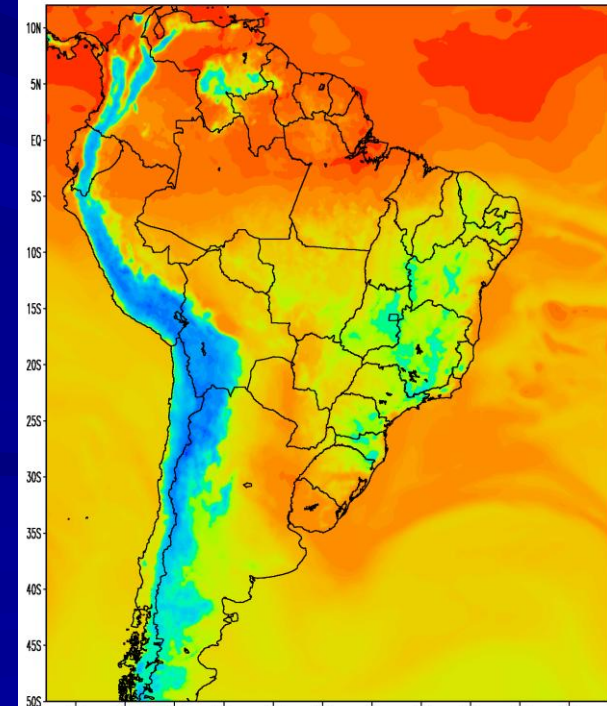
The procedure used to compute the ZTD by NWP model was jointly developed by UNESP and CPTEC/INPE - Brazil

This model uses:

- ✓ 20x20 km horizontal resolution
- ✓ 19 levels vertical

<http://satellite.cptec.inpe.br/zenital>

FORECAST FROM: 2010073000 VALID FOR: 2010073018

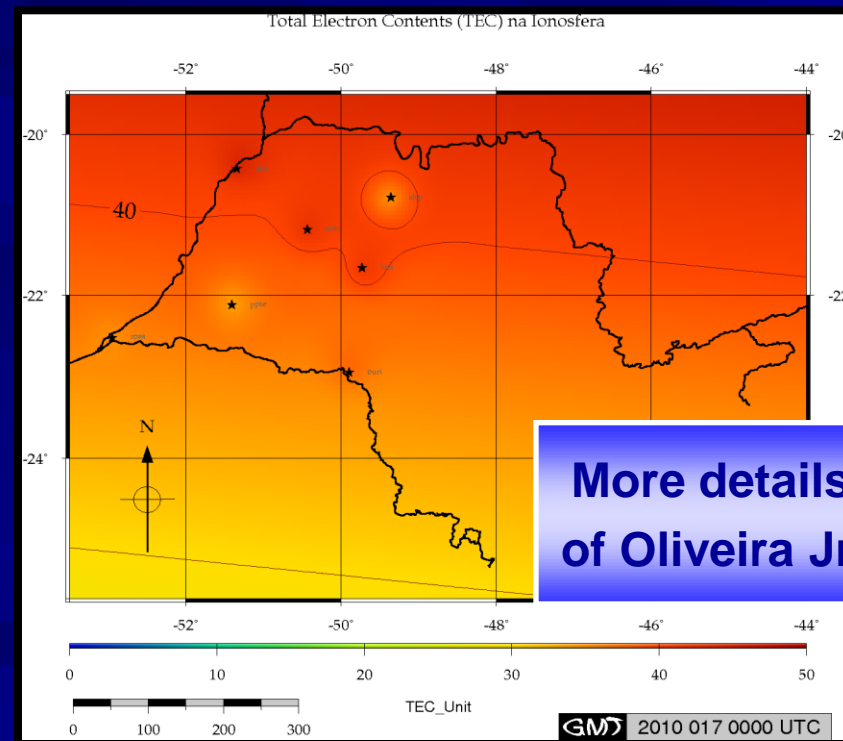


GHDS: COLA/IES

IONOSPHERE MODEL

A **regional** ionosphere model has been developed at UNESP

The TEC values are computed directly from SP/Net data

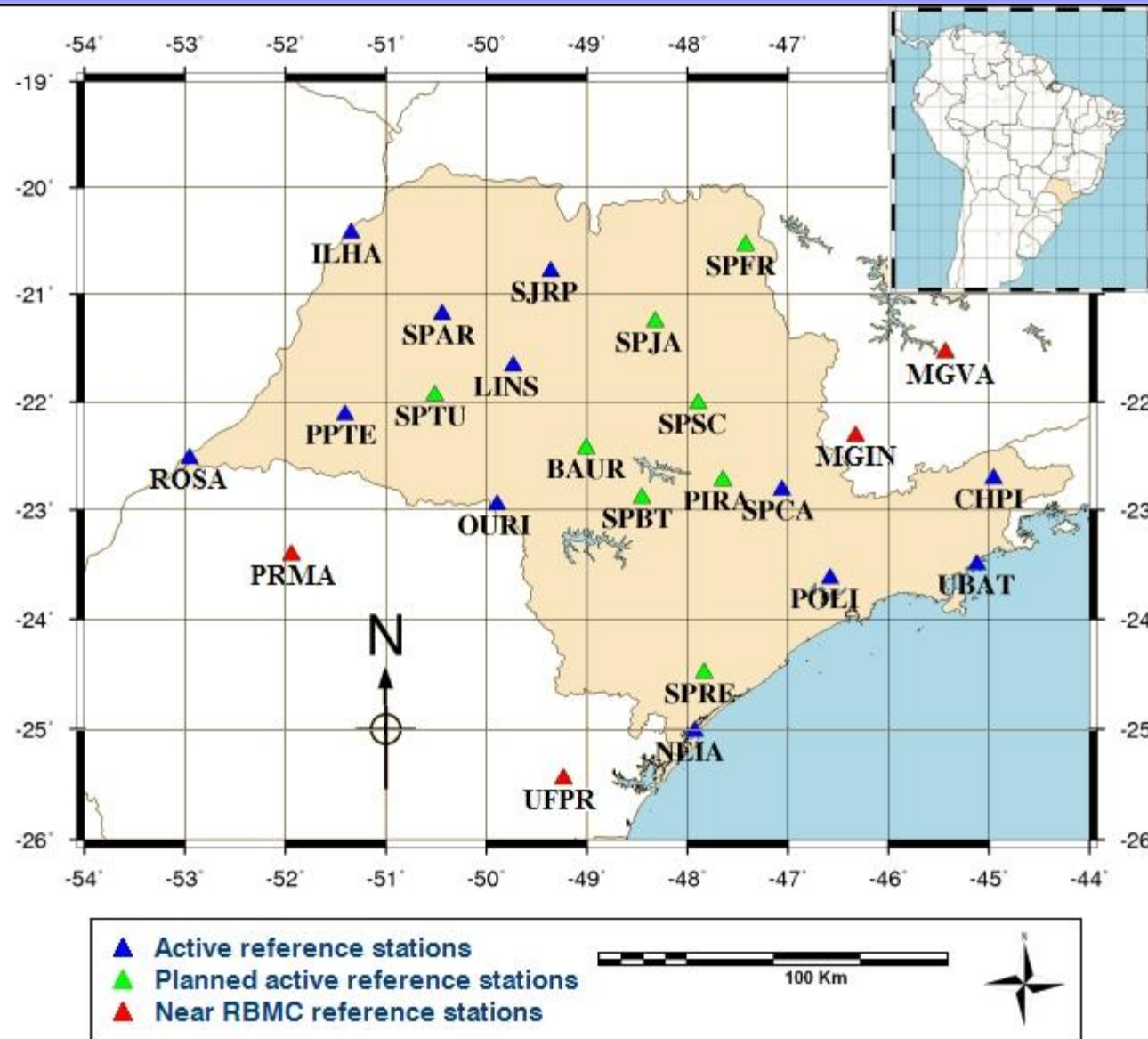


More details in a paper
of Oliveira Jr. tomorrow

SÃO PAULO STATE NETWORK

In order to

ct.unesp.br>

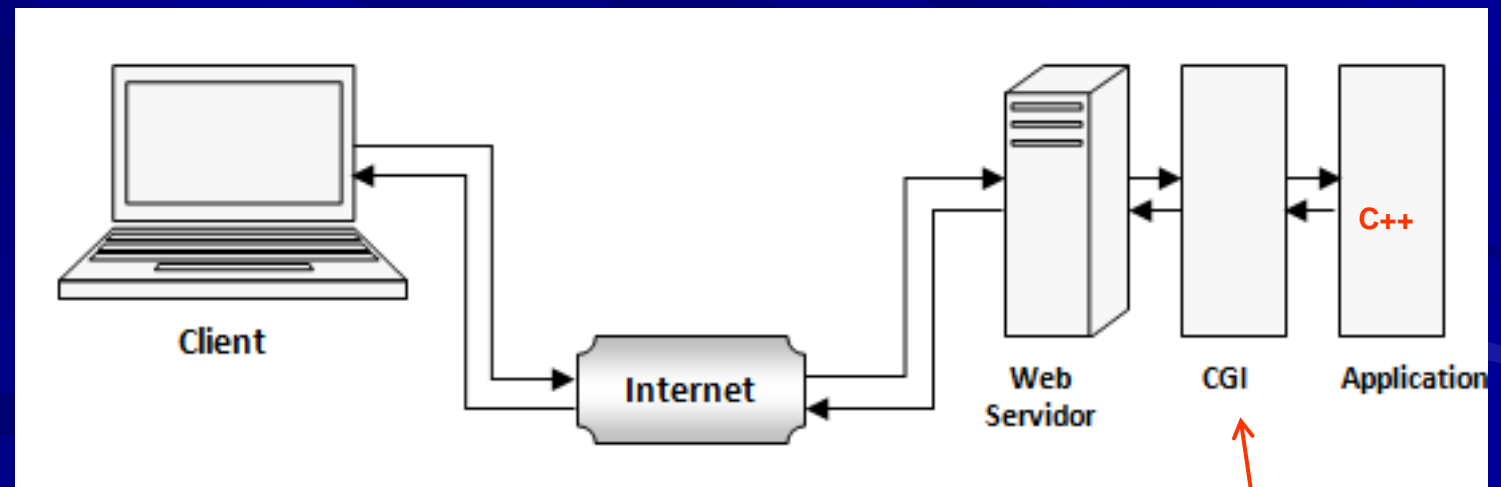
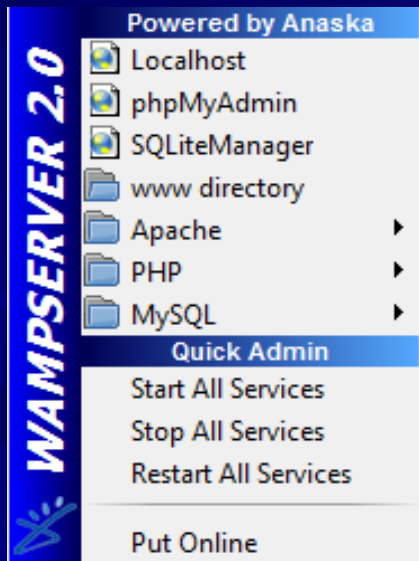


INTERNET PLATAFORM

An Internet plataform has been developed to generate VRS data for users from SP/Net



Post-Processed mode



Common Gateway Interface

INTERNET PLATAFORM



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Faculdade de Ciências e Tecnologia

Historical

Contributors

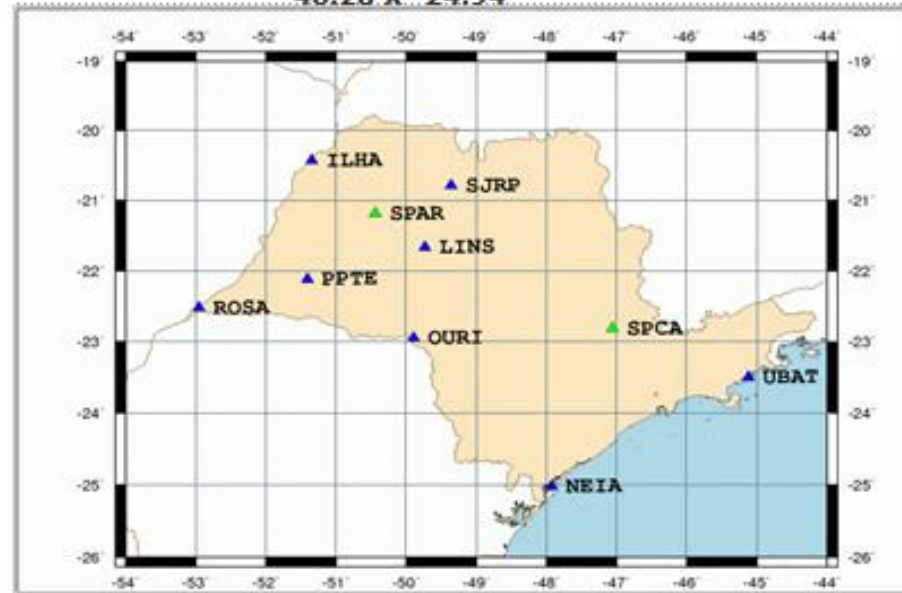
Theoretical Aspects

Software



VRS

-48.28 X -24.94



Coordinate System

Phi, Lambda, h

X, Y, Z

Type the VRS coordinates

Phi:

Lambda:

H:

400



Type the day to generate the VRS data

Type initial time ?

Initial time: hh:mm:ss

Type the final time ?

Final Time: hh:mm:ss

Compute

Clean

VRS METHODOLOGY

The network-based positioning using the VRS concept was applied using a different methodology



The ambiguity resolution was not performed

Atmospheric models were used to compute the network corrections

The experiments were accomplished simulating the real time

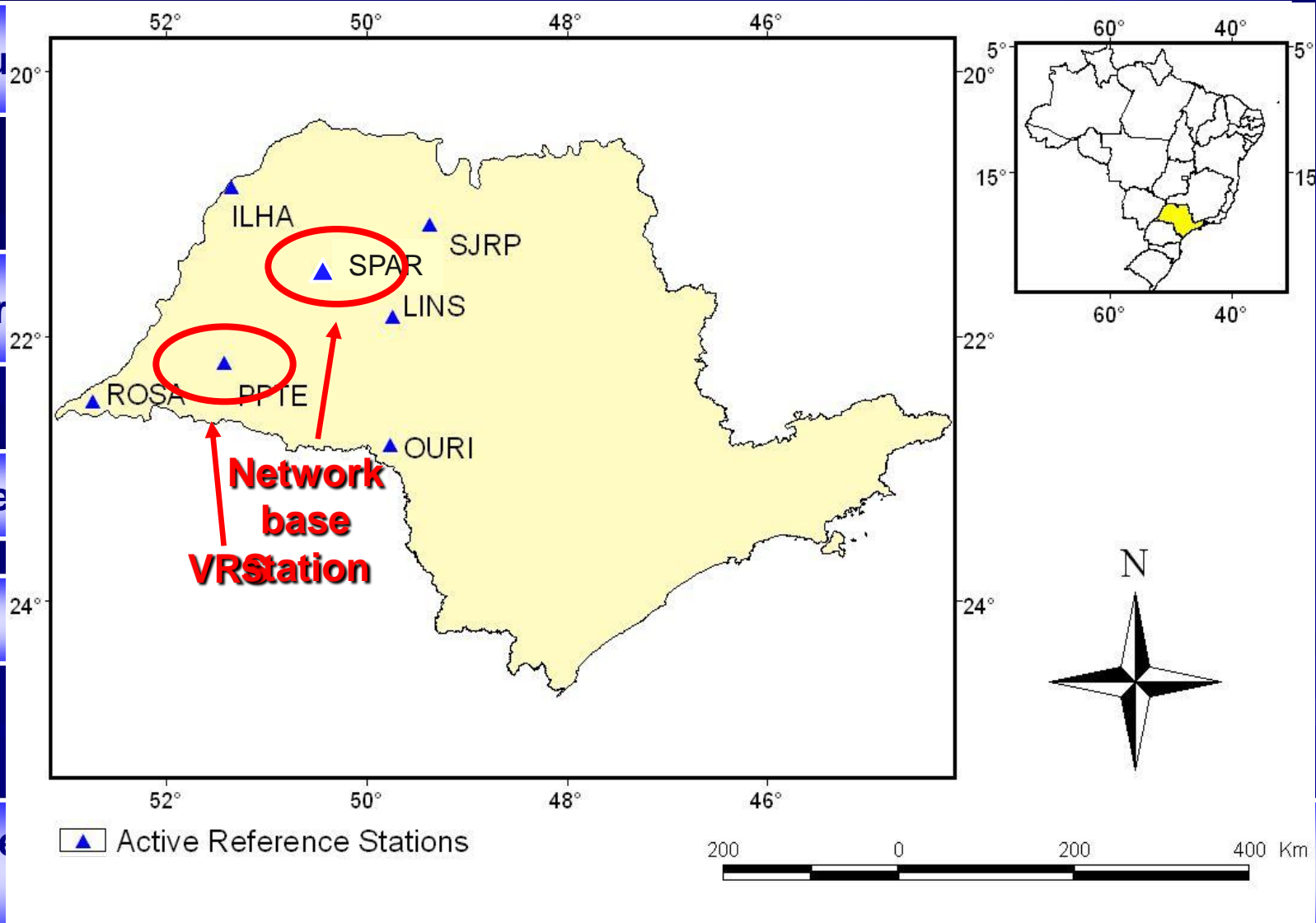
EXPERIMENTS

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RAW DATA ANALYSIS – C1

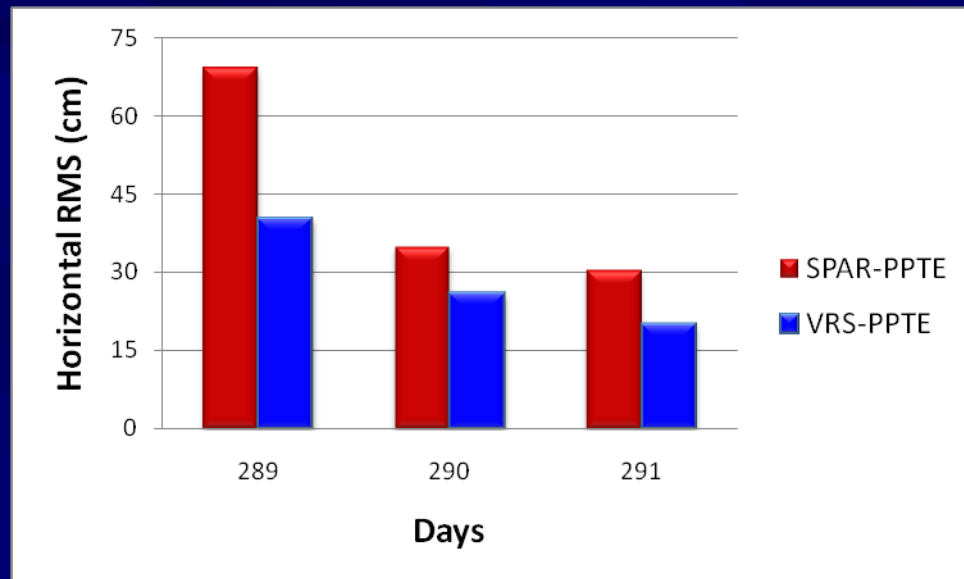
The C1 real file observable was compared with VRS one

RMS(cm)	
Day	C1
289	61
290	63
291	62
Average	62

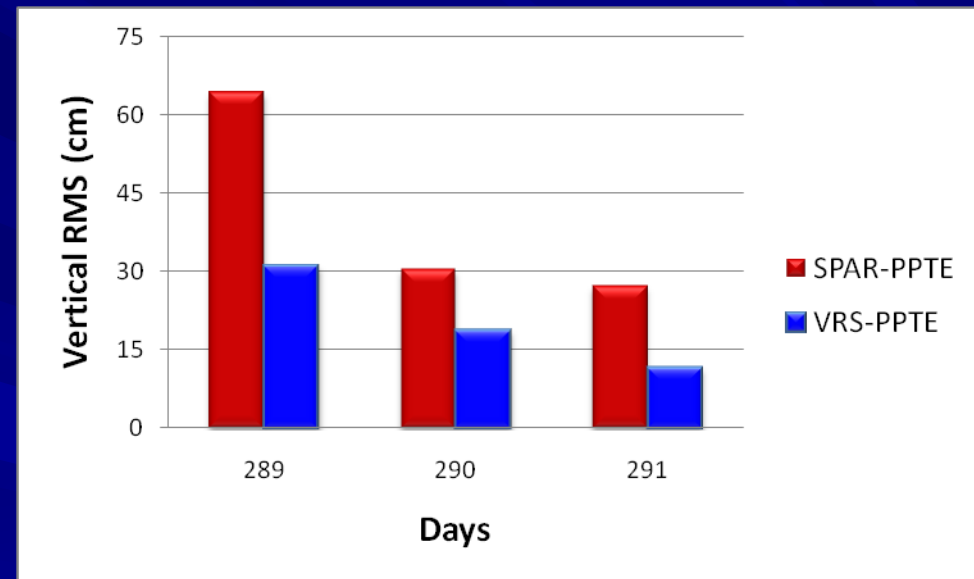
The results agree
with the pseudorange
accuracy

RELATIVE POSITIONING

Relative positioning VRS-PPTE (real file) and SPAR-PPTE (SPAR is the nearest reference station)



Improvement: 34.2%

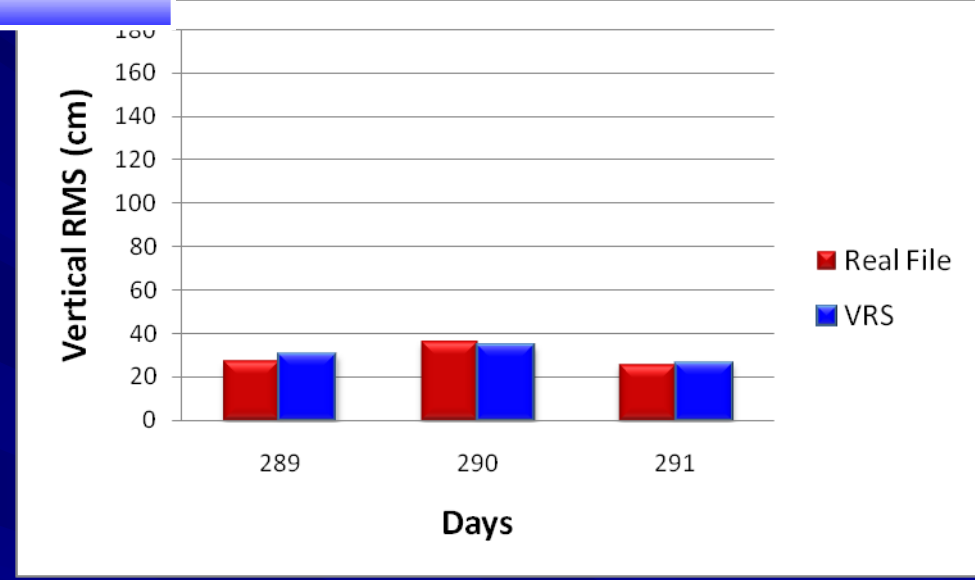
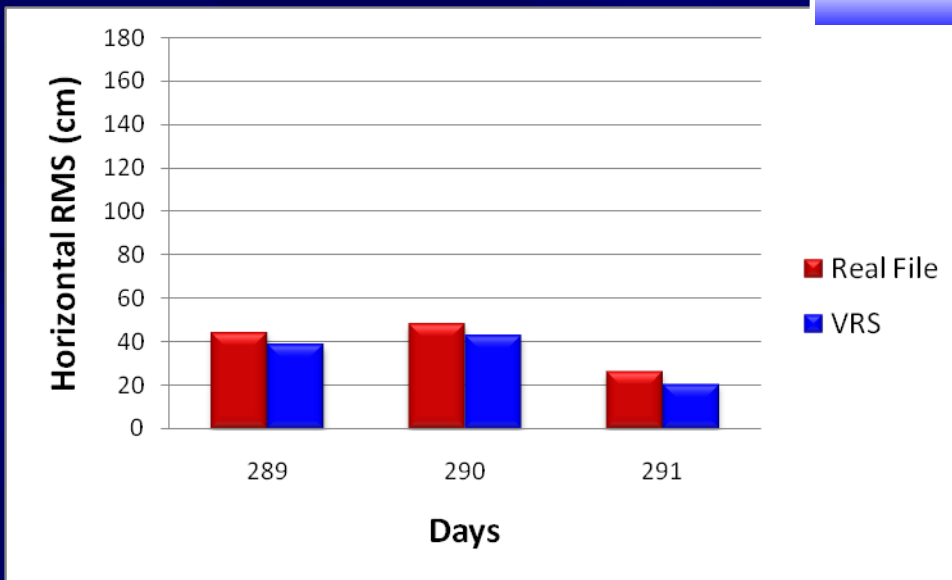


Improvement: 49.5%

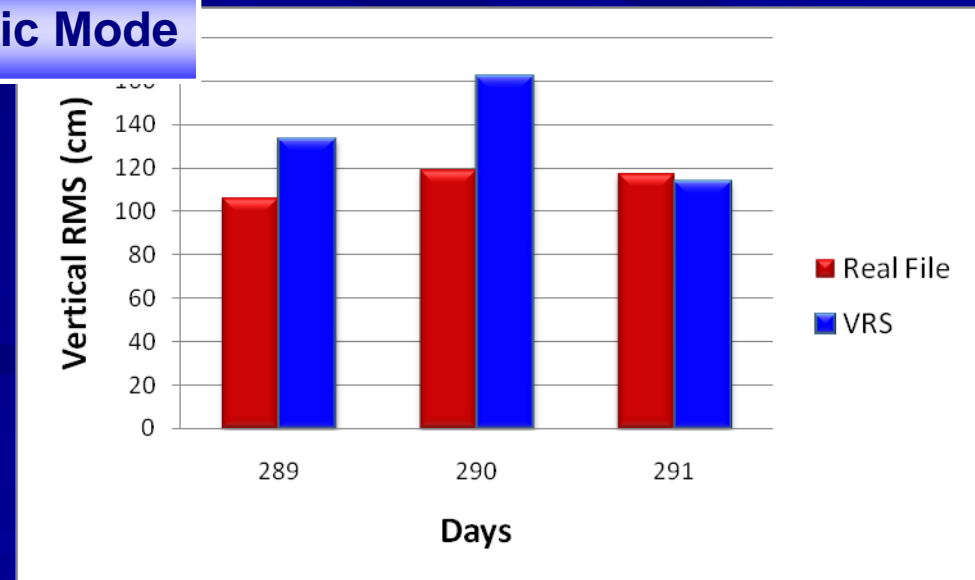
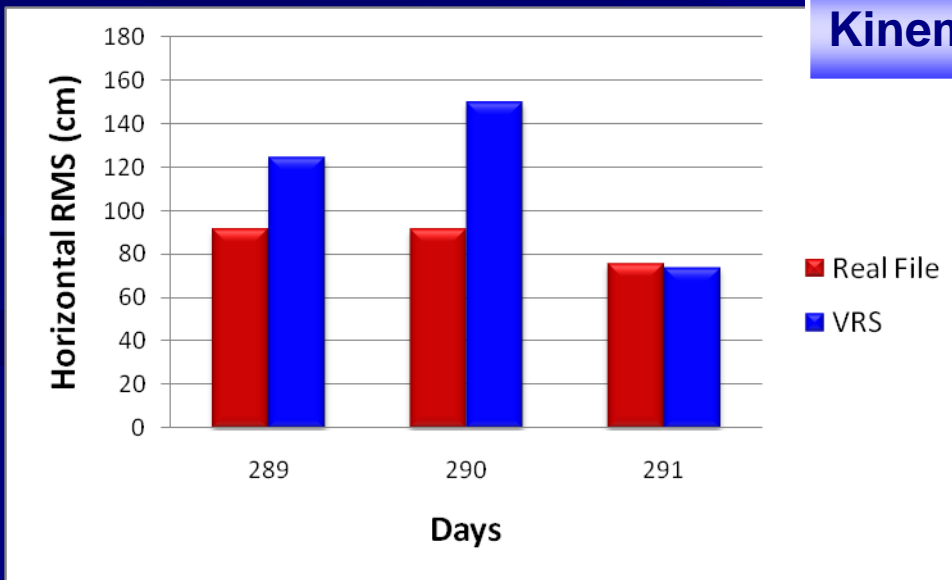
PP – COORDINATES ANALYSIS

NRCan software

Static Mode



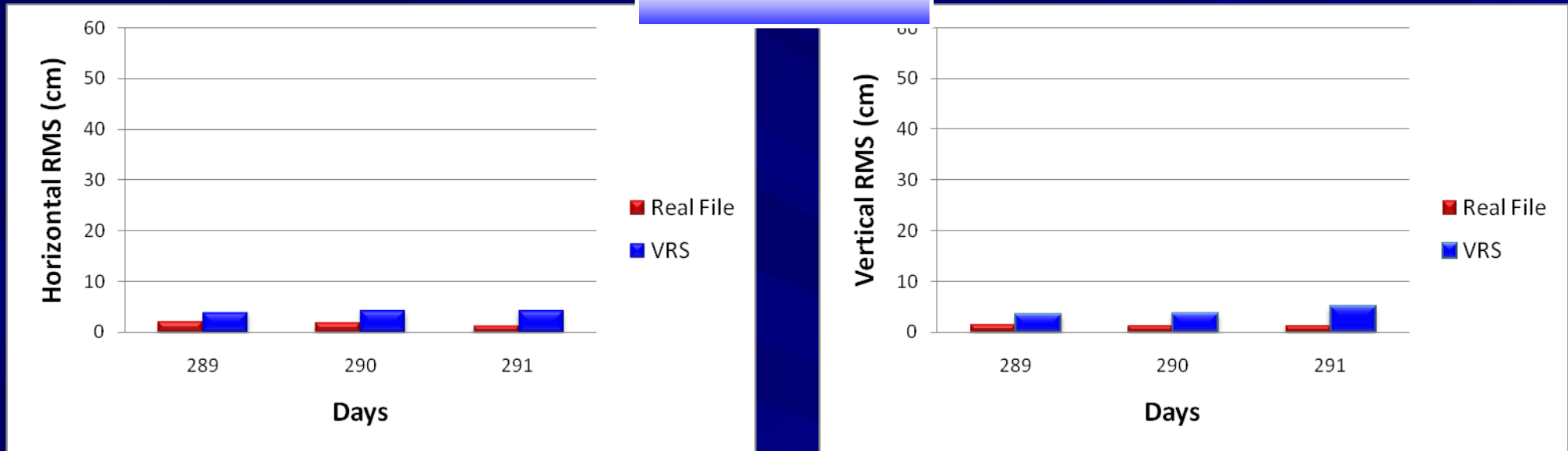
Kinematic Mode



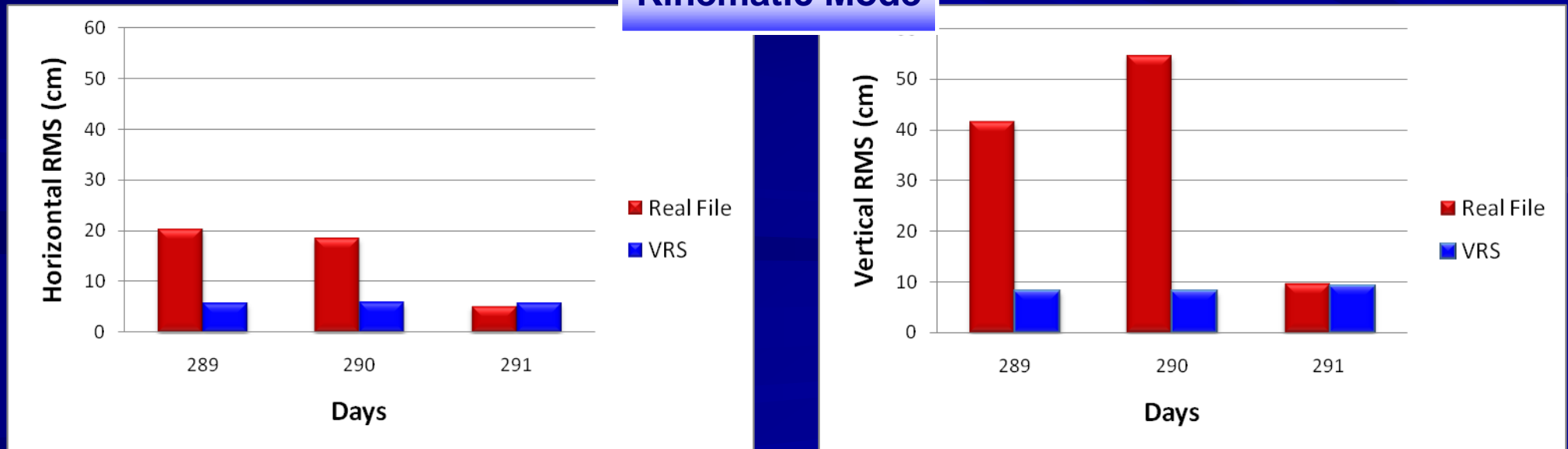
PPP – COORDINATES ANALYSIS

NRCan software

Static Mode



Kinematic Mode



CONCLUSIONS

In this presentation it was showed the performance obtained by a VRS generated using atmospheric models



The system was developed by FCT/UNESP researchers

The results obtained present evidences that the proposed methodology may be quite efficient



The results provided by VRS are similar of those obtained by real data (PPTE)



VRS presented best results than the nearest reference station (SPAR)

CONCLUSIONS

FUTURE works

```
graph TD; A[FUTURE works] --> B[To make available the post-processed network-based on the internet]; A --> C[To develop the real-time network-based positioning (Network RTK)];
```

To make available the post-processed network-based on the internet

To develop the real-time network-based positioning (Network RTK)

Spatial Geodesy Study Group

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Endereço <http://gege.prudente.unesp.br/english/index.php>

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News

[China starts to develop its proper satellite navigation system Beijing, China \(SPX\) Nov 03, 2006](#)

The Spatial Geodesy Study Group (GEGE - Grupo de Estudos em Geodésia Espacial) started its activities in 1997.

This group has as goal to discuss topics related to the researches developed at [Faculty of Sciences and Technology - UNESP](#) in Spatial Geodesy and correlated fields.

Researchers from the [Department of Cartography](#), involved in this area, together with their PhD, MSc, Scientific Initiation (IC - Iniciação Científica) students are member of GEGE.



Visitors since 12/25/2006: **888127**

<http://gege.fct.unesp.br/>

Concluído Internet

Iniciar GeoBras... Apresen... Globo Ví... Evaluati... GEGE - ... Apresen... EN 10:21