# Near real time VTEC estimation using La Plata Ionospheric Model

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SIRGAS

# Outlook

- ✓LISN Project
- ✓SIRGAS-ION
- ✓LPIM model
- ✓Near real time data
- ✓Conclusions and future work

# The actual state of the Argentinean component of the LISN project

# LISN

- ✓Low-latitude Ionospheric Sensor Network
- ✓Distributed multi-instrumental observatory
- ✓Monitoring and predicting the equatorial ionosphere

# Instruments

- ✓70 GPS receivers (modified firmware)
- ✓5 flux gate magnetometers
- ✓5 ionospheric sensors

# GPS

Guatemala
Nicaragua
Venezuela
Guyana
Suriname
Colombia
RR
AP
Ecuador
AM
PA
MA
CE
RN
PB
PE
AL
SE
PI
AC
Brasil
Brazil
RO
MT
BA
GO
Bolivia
MG
ES
Paraguay
SP
RJ
PR
Chile
SC
Uruguay
Argentina

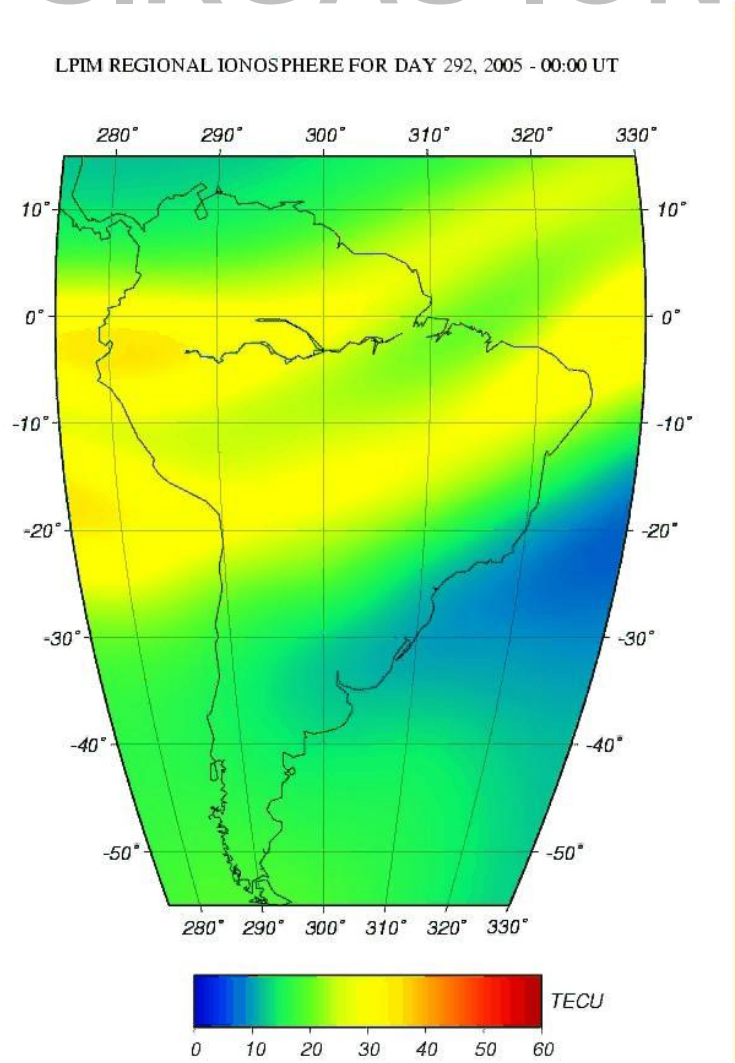
# GPS

# Magnetometer

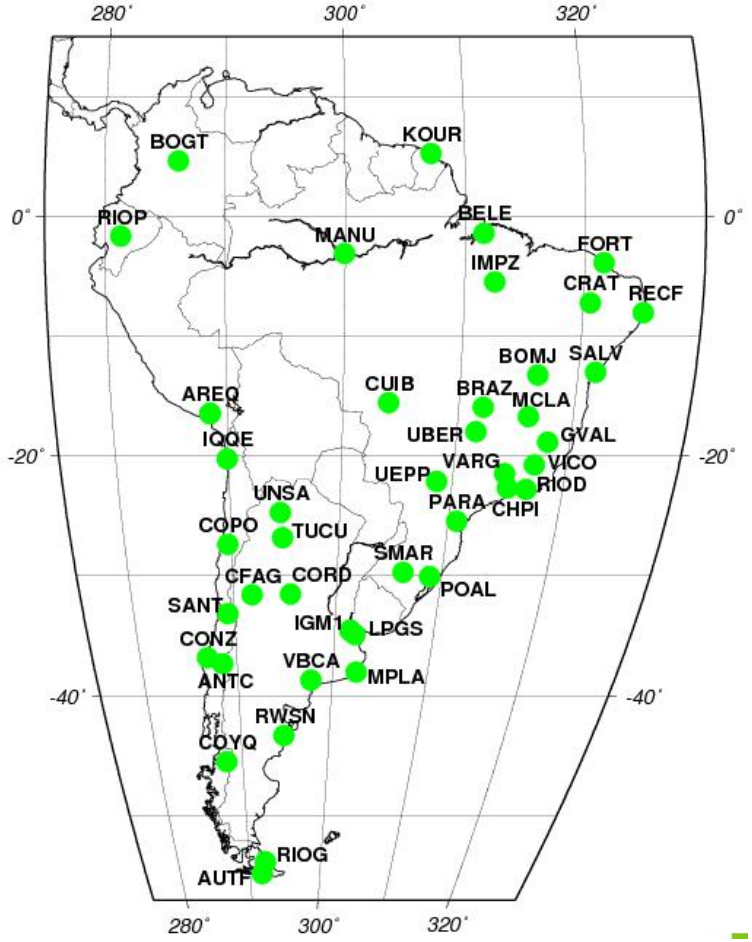
# Ionospheric sensor

| Sensor | Geophysical Quantity | Associated with |
|---|---|---|
| GPS receiver | TEC | N |
| GPS receiver | Amplitude and phase scint. | ESF |
| GPS receiver | TEC depletion | ESF |
| GPS receiver | TEC perturbation | TID, AGW |
| Dynasonde | Virtual height vs. frequency | Dh/dN, AGW |
| Dynasonde | Ordinary and extraordinary | N, redundantly |
| Dynasonde | Echo-locations | dN/dx, dN/dy |
| Dynasonde | Vector Velocities | Ex, Uy, Ez |
| Dynasonde | Phase structure Function | $dN/N_{1\ km}$, spectral index $\nu$ |
| Fluxgate magnetometer | 3D magnetic field | B |

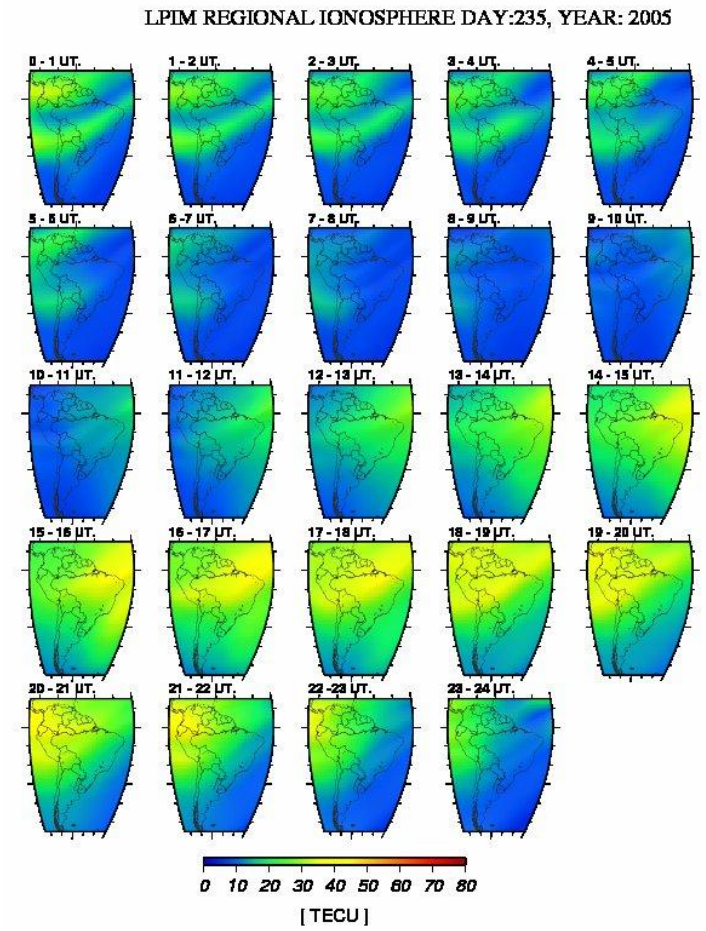
# SIRGAS-ION

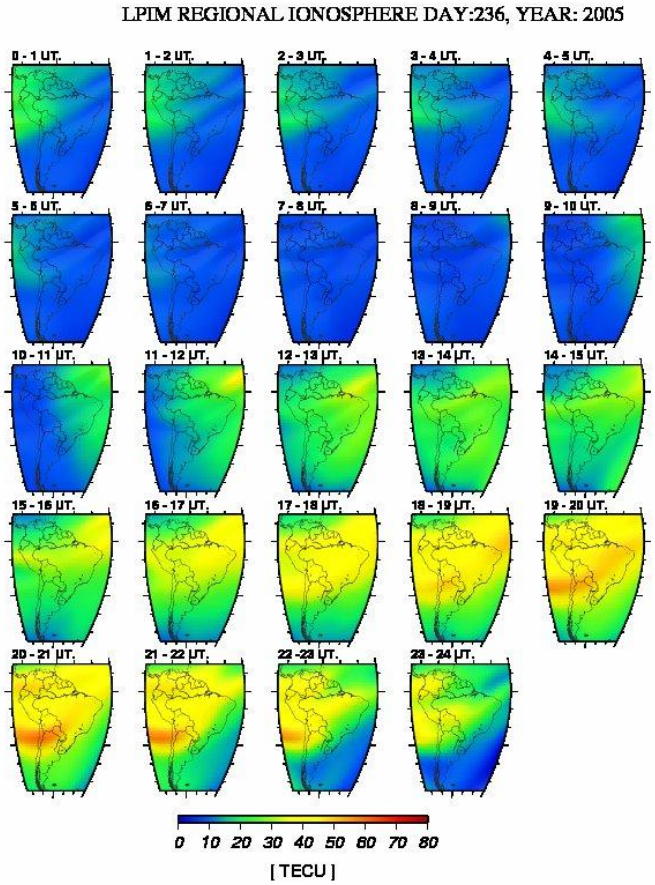

LPIM REGIONAL IONOSPHERE FOR DAY 292, 2005 - 00:00 UT
280°
290°
300°
310°
320°
330°
10°
0°
-10°
-20°
-30°
-40°
-50°
TECU
0
10
20
30
40
50
60

# Stations for regional maps



# http://cplat.fcaglp.unlp.edu.ar/iono/us/index.shtml

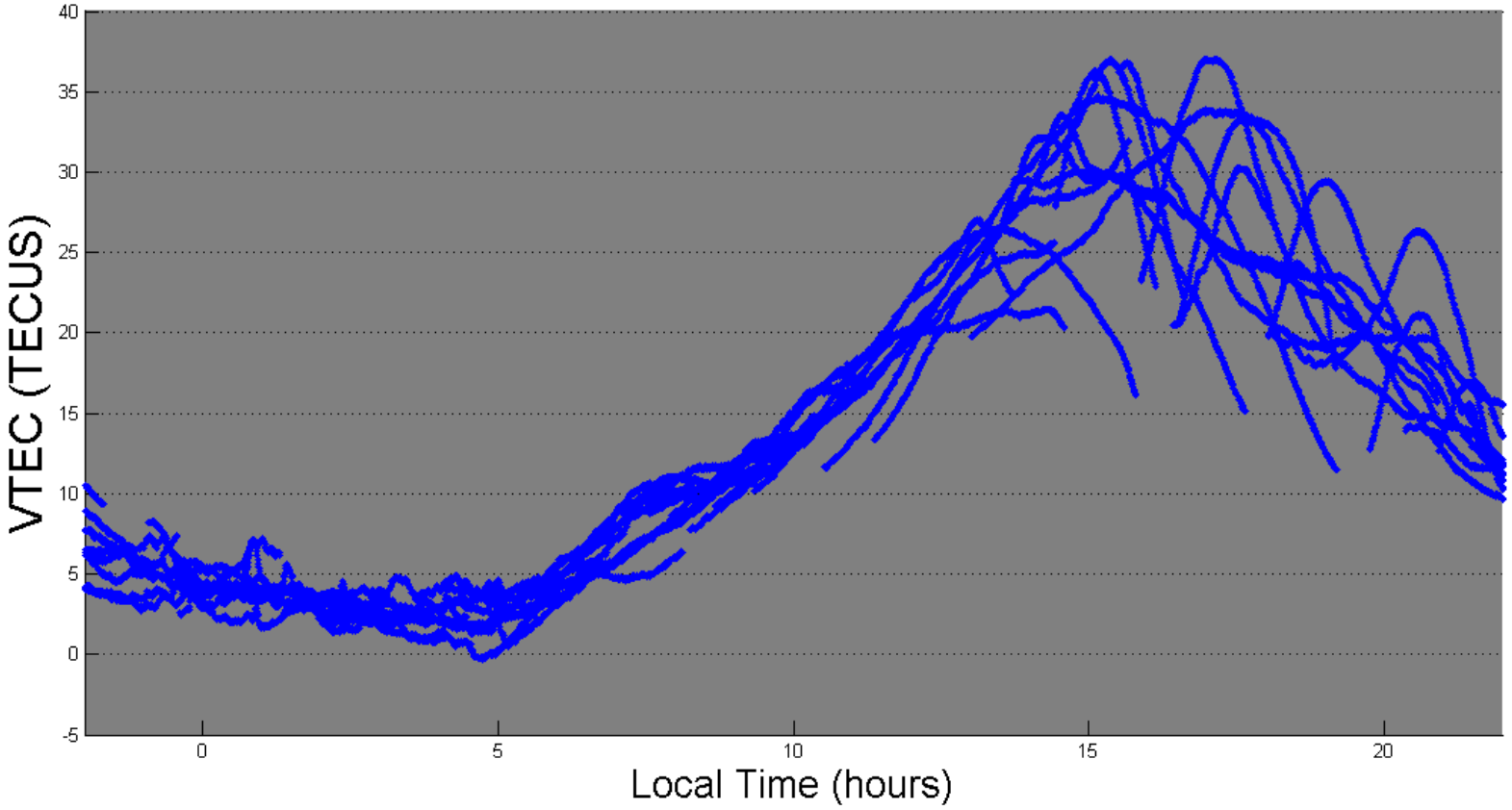


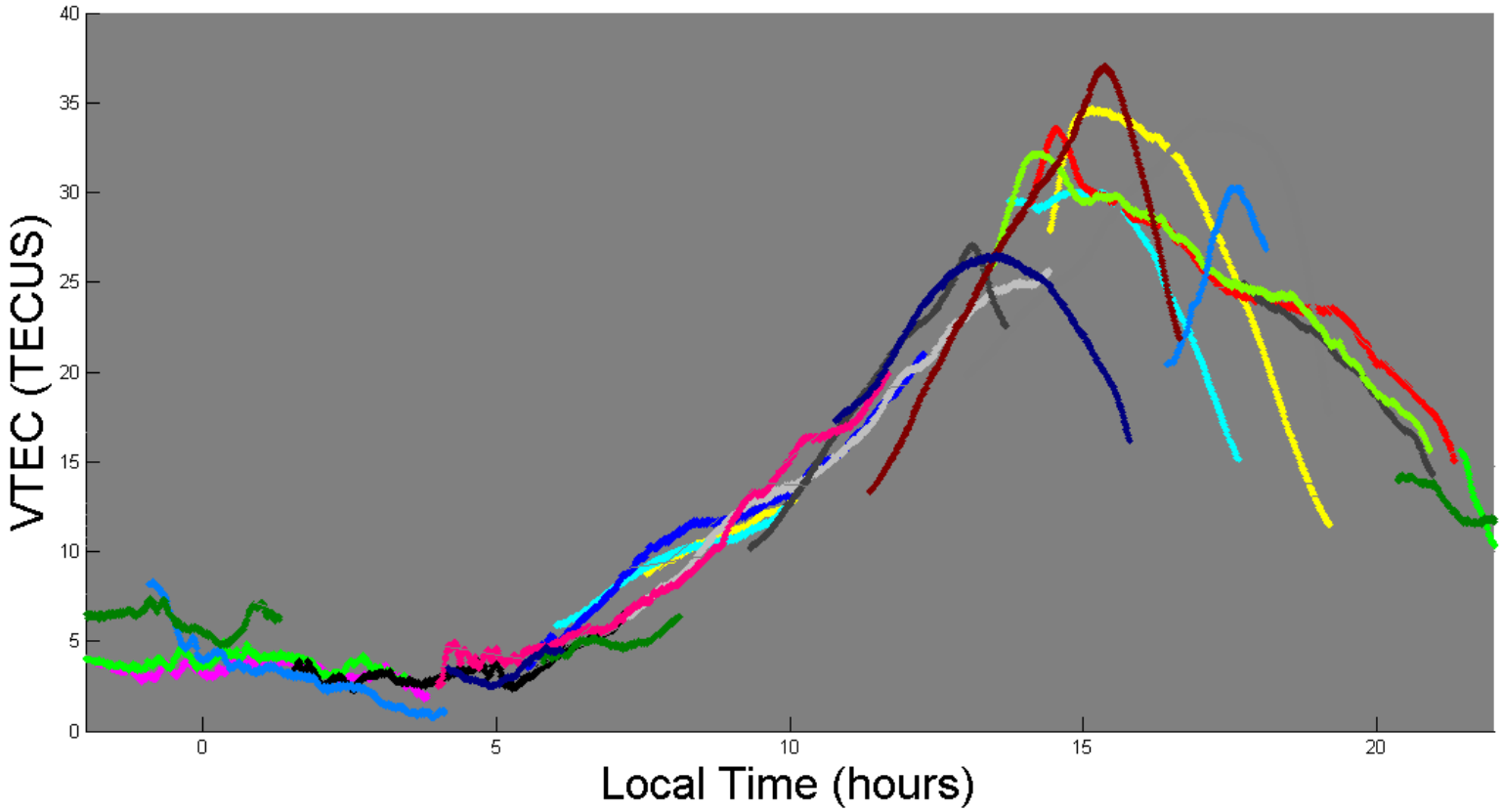
# LPIM model

- ✓ Pre-processing
  - ✓ $L_4 = \mathrm{STEC} + \mathrm{B}_r + \mathrm{B}^s + \mathrm{N} + \varepsilon$
- ✓ Calibration
  - ✓ $L_4 = f(z).\mathrm{VTEC} + \gamma_{arc} + \varepsilon$
- ✓ Interpolation

# Corrientes



# Corrientes



# Conclusions

- ✓ A set of instruments were installed in the frame of the LISN project
- ✓ Part of LPIM routines were used to compute VTEC with a delay of 5 minutes
- ✓ A prototype platform for future services

# *Future Works*

- ✓ Modify LPIM to accept NTRIP data format as input
- ✓ Include more stations so a regional interpolation can be done