

# Study of the TEC gradients and assessment of their impact on ALOS-PALSAR images

Elvira Musicò<sup>1,2</sup>, Claudio Cesaroni<sup>2</sup>, Luca Spogli<sup>2</sup>, John Peter Merryman Boncori<sup>2</sup>,  
Giorgiana De Franceschi<sup>2</sup>, Roberto Seu<sup>1</sup>

(1) Istituto Nazionale di Geofisica e Vulcanologia - Rome, Italy

(2) Department of Information, Electronics and Telecommunications , Sapienza University of Rome, Italy,

Ground and space-based instruments for future research in Solar-Terrestrial physic  
6-11 June 2016, L'Aquila (Italy)

# Goal

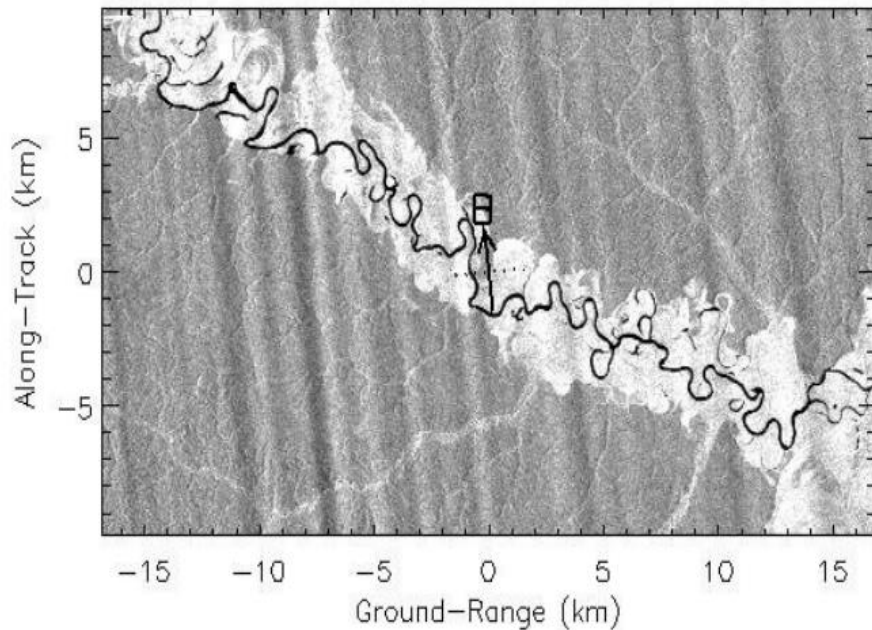


- Study of the TEC (Total Electron Content) fluctuations over Italy, from RING (Rete Integrata Nazionale GPS) network.
- Study of the impact of TEC fluctuations on ALOS (Advanced Land Observing Satellite) - PALSAR (Phased Array type L-band Synthetic Aperture Radar) images

# Why this work?

## The ionosphere is a problem!

The free electrons present in the ionosphere can cause streaks on SAR images



Carrano et al. (2010), IGARSS (pp. 162-165).

*Example of ionospheric streaking*

## Seed Questions 2/7



2. What is the state-of-the-art in tropospheric correction (stratified & turbulent atmosphere) by use of external NWP data?

3. What is the state-of-the-art in ionospheric correction by estimation from the data themselves or by use of external data?

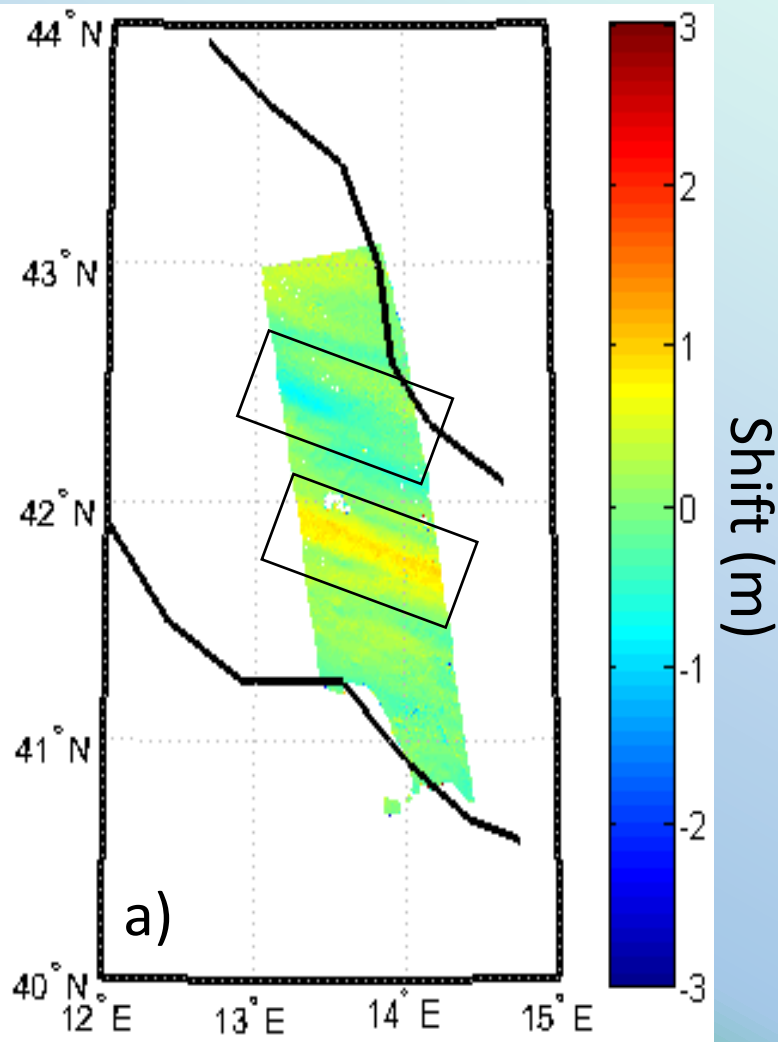
- Weather models able to reduce large scale path delay variations and stratification (topography-dependent) effects in many cases
- Short scale variations rarely resolved; need other data such as radiometers which are rarely available/useable
- Ionospheric delays considered non-critical in C-band but very relevant in current and future L-Band missions. Good progress demonstrated using split-band-approaches by G. Gomba (poster). Proposal by F. Meyer to establish supersites for further studies. Effect of ionospheric TEC trends in azimuth on the azimuth-coregistration accuracy of S1 TOPS should be investigated.
- Available meteo/iono data should be provided with SAR products (see R3)



# Co-Registration

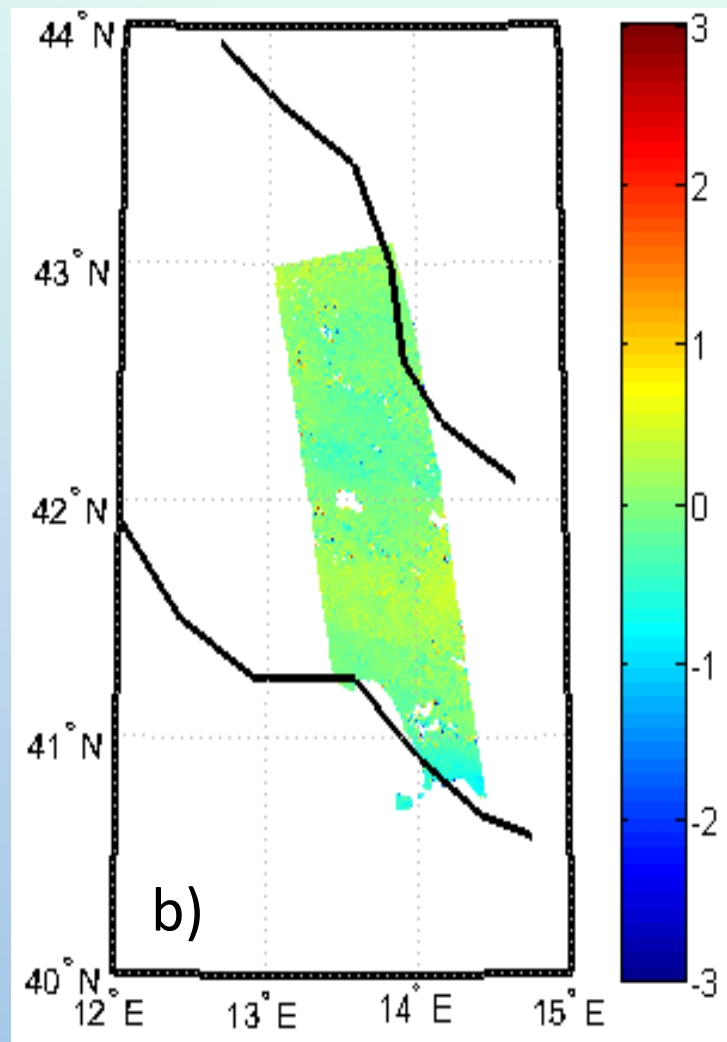
Master 01/07/2007

Slave 16/08/2007



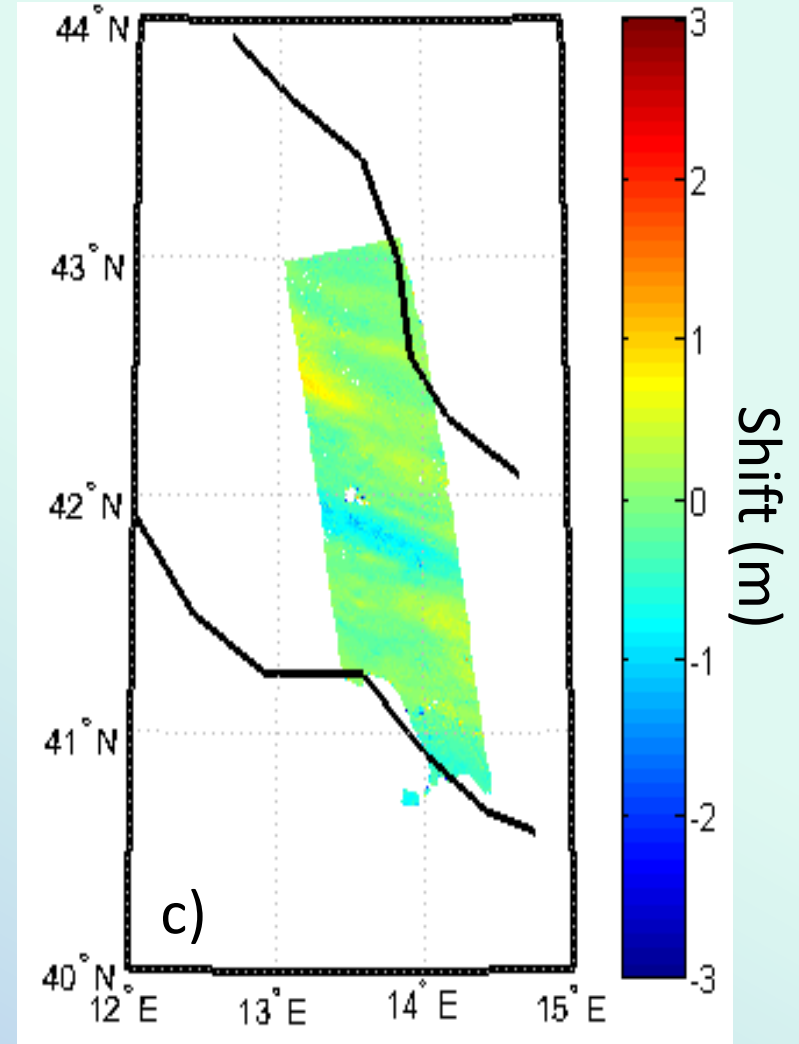
Master 01/07/2007

Slave 01/10/2007



Master 16/08/2007

Slave 01/10/2007



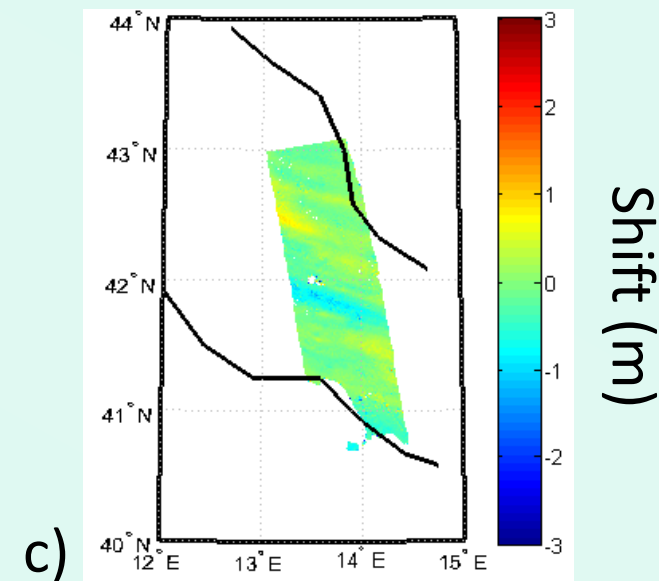
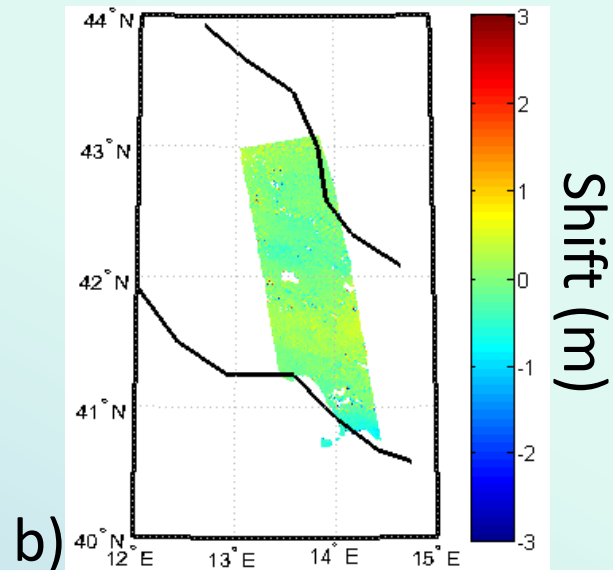
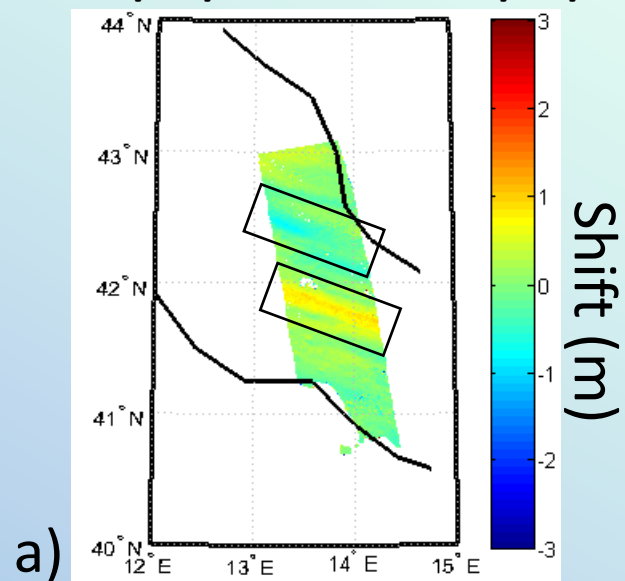
# Results

Master 01/07/2007-Slave 16/08/2007

Master 01/07/2007-Slave 01/10/2007

Master 16/08/2007-Slave 01/10/2007

ALOS-PALSAR

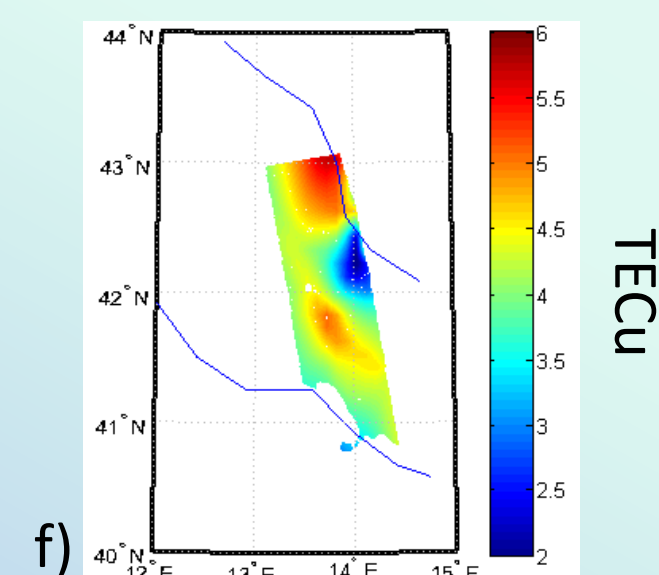
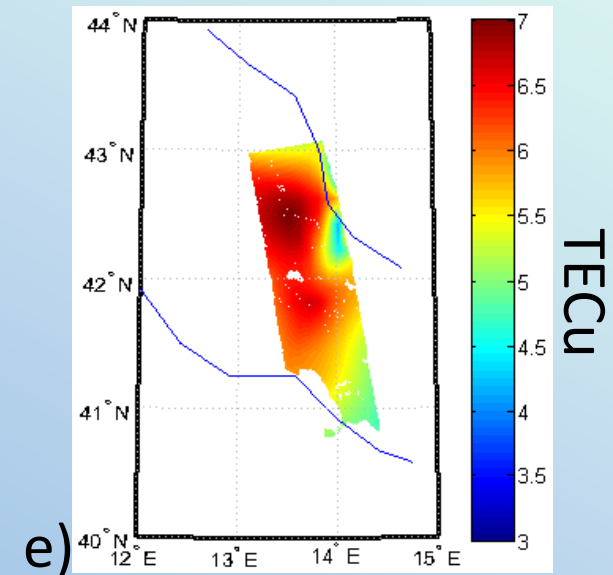
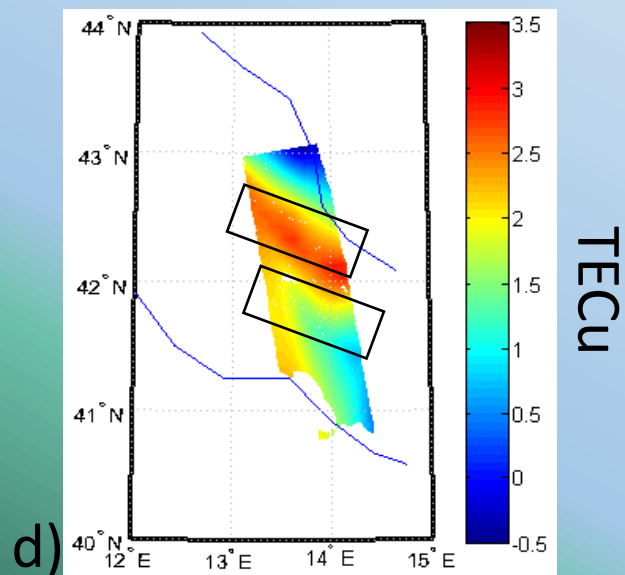


TEC(01/07/2007) - TEC(16/08/2007)

TEC(01/07/2007) - TEC(01/10/2007)

TEC(16/08/2007) - TEC(01/10/2007)

$\Delta$ TECcal



# Conclusion and future work

- Most evident streaks represents a shift of about  $\pm 0.5$  m.
- Clear structures of  $\Delta\text{TEC}_{\text{cal}}$  are present.
  - may be responsible for streaks on SAR images.
- 16 august 2007 seems to be the principal responsible for the streaks appearance.
- Selection and investigation of more interesting case studies at mid latitude in the Italian longitudinal sector

**Thank you**