

**GMES  
and  
Ionospheric Issues**

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**Requirements**

- Information needed
- Services provided
- Benefits for Europe's citizens

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**GMES Partnership**

- Data collection
- Production of Policy relevant Information
- Development of knowledge and models
- Users have to be associated

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**Ionosphere Impacts  
on  
Telecom & Navigation systems Contents**

- Ionosphere impacts / Data collection
- Information needed for users
- Services provided

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**GMES Topics**

- Development of a European spatial data infrastructure
- Global atmosphere Monitoring
- Systems for risk management

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**Ionosphere Impacts**

Applications include

- Positioning,
- Earth observation,
- Broadcasting,
- ...

All these activities are affected by ionosphere variations and modifications

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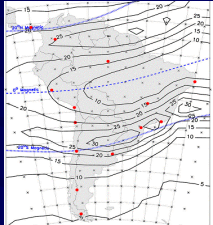
### Positioning

**Information needed**

Range, angular, phase errors  
+ scintillation

**Data collection**

TEC measurements & models  
Mid - latitude regions : TIDs



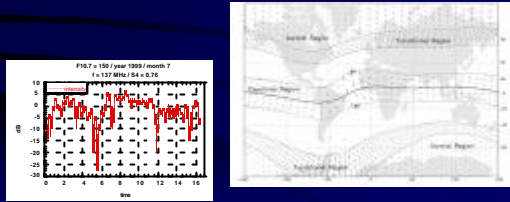
Range error in equatorial regions  
GPS L1 frequency

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### Scintillation impact

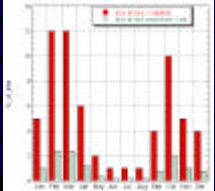
**Intensity and phase scintillation**

- Accuracy and safety for navigation systems
- Availability for telecommunication links

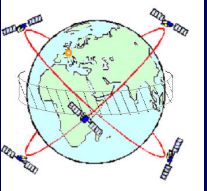


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### Scintillation Impact



Observation point in Singapore  
GPS link



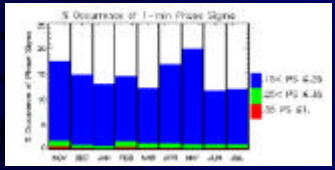
Intensity scintillation belt

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### Earth observation

**SAR / L band**

Phase errors : average errors + fluctuations




Polar phase fluctuations : Auroral regions (Fairbanks)

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### HF Propagation

Modification of ionosphere : magnetic storms



Over The Horizon Radar (OTH)

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### Ionosphere for GMES

**Information needed / Data collection**

The values of electron density : TEC  
Forecast of TEC + magnetic storms **SWIPA, MOPL**

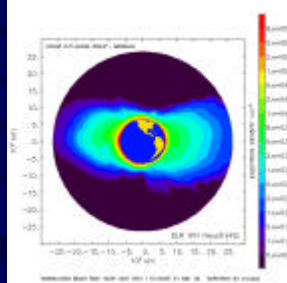
Data assimilation methods, Now cast and Forecast

Forecast of Intensity and Phase Scintillation **FIPS**

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### Ionosphere Plasmasphere density distribution from CHAMP satellite DLR

Detection of storms  
and perturbations which affect  
security of navigation systems



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### Services Provided

#### Positioning

- Increasing the accuracy
- Define and implement space and frequency diversity techniques

#### Communications

- To define a service efficiency depending on geographical location
- To define and implement space and frequency mitigation techniques
- HF : Forecasting of magnetic storms (usable frequencies)

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### Users

- Agencies
- System designers
- System operators
- Military
- ...

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