

**Updates on  
SAR trends in Europe,  
sarmap & SARscape**

**ヨーロッパにおけるSARトレンド情報と  
SARscapeの最新情報**

Open Access Hub x

Sicuro | https://scihub.copernicus.eu

App Ricette Casa Bimbi AgritVegTende https://scihub.copernicus.eu Converti i video di YouTube Maker Musica Pi Giapponese Accademia Italiana di Scienze (5) Welcome Board IT SAR AIS CAD

Copernicus Copernicus Open Access Hub esa

Welcome to the Copernicus Open Access Hub

The Copernicus Open Access Hub (previously known as Sentinels Scientific Data Hub) provides complete, free and open access to Sentinel-1, Sentinel-2 and Sentinel-3 user products, starting from the In-Orbit Commissioning Review (IOCIR).

Open Hub

Access Points

43550 products downloaded in the last 24h (SciHub + API Hub + S3 PreOps)

Open Access Hub : access point  
 API Hub : access point for API  
 Sentinel-3 Pre-operational Hub : pre-operational access point for all users to Sentinel-3 data. Login credentials are s3guest:s3guest .

For more details or request of help support please send an e-mail to [eesupport@copernicus.esa.int](mailto:eesupport@copernicus.esa.int)

Statistics

10631 products published in the last 24h (S1 + S2 + S3)

43550 products downloaded in the last 24h (SciHub + API Hub + S3 PreOps)

日本語訳

Open Access Hub x

Sicuro | https://scihub.copernicus.eu

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Statistics

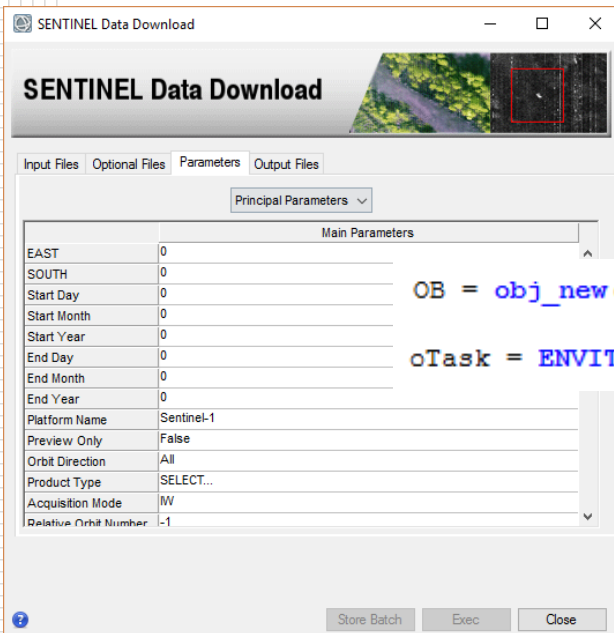
10631 products published in the last 24h (S1 + S2 + S3)

43550 products downloaded in the last 24h (SciHub + API Hub + S3 PreOps)

The screenshot shows the ESA Earth Online website. The main navigation bar includes 'Missions', 'Earth Topics', 'Data Access', and 'PI Community'. The current page is titled '- Announcements of Opportunity' and features a section for the 'ESA EOHopS Call submission area'. The text explains that the EOHopS call is part of the ESA TFM programme and provides a list of steps for applying, such as selecting products from the EOHopS Store and submitting a proposal. A sidebar on the right contains a 'PI Community' menu with options like 'Fast Registration', 'Full Proposal', and 'Service Request'. At the bottom, there is a banner for the 'eohops Store' and the ESA logo.

This is an identical copy of the screenshot above, showing the ESA Earth Online website with the EOHopS call submission area highlighted. It includes the same navigation menu, main content area with application steps, sidebar, and footer elements.

## Sentinel data archive access



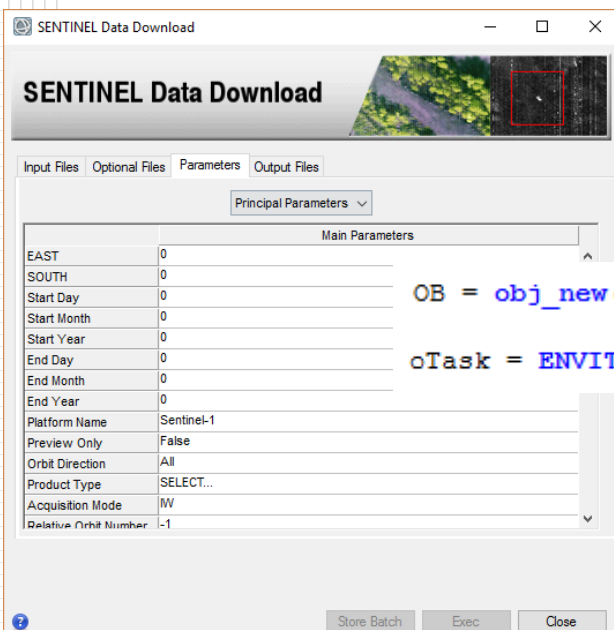
|                       |            |
|-----------------------|------------|
| EAST                  | 0          |
| SOUTH                 | 0          |
| Start Day             | 0          |
| Start Month           | 0          |
| Start Year            | 0          |
| End Day               | 0          |
| End Month             | 0          |
| End Year              | 0          |
| Platform Name         | Sentinel-1 |
| Preview Only          | False      |
| Orbit Direction       | All        |
| Product Type          | SELECT...  |
| Acquisition Mode      | IW         |
| Relative Orbit Number | -1         |

```
OB = obj_new('SARscapeBatch',Module='ToolSciHubGet')
```

```
oTask = ENVITASK('ToolSciHubGet')
```

5.4.1

## Sentinel データ アーカイブアクセス



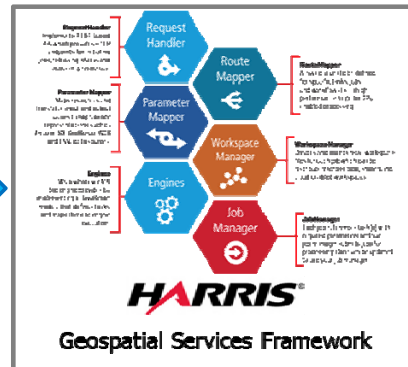
|                       |            |
|-----------------------|------------|
| EAST                  | 0          |
| SOUTH                 | 0          |
| Start Day             | 0          |
| Start Month           | 0          |
| Start Year            | 0          |
| End Day               | 0          |
| End Month             | 0          |
| End Year              | 0          |
| Platform Name         | Sentinel-1 |
| Preview Only          | False      |
| Orbit Direction       | All        |
| Product Type          | SELECT...  |
| Acquisition Mode      | IW         |
| Relative Orbit Number | -1         |

```
OB = obj_new('SARscapeBatch',Module='ToolSciHubGet')
```

```
oTask = ENVITASK('ToolSciHubGet')
```

5.4.1

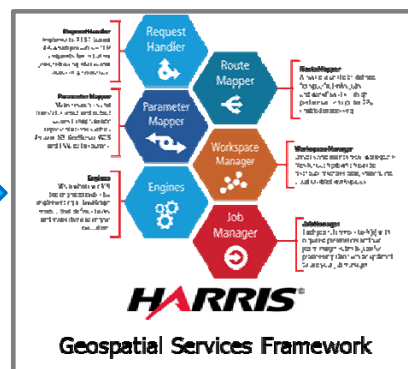
# SARscape in an enterprise / distributed environment



```
oTask = ENVITASK('ToolSciHubGet')
```

```
OB = obj_new('SARscapeBatch',Module='ToolSciHubGet')
```

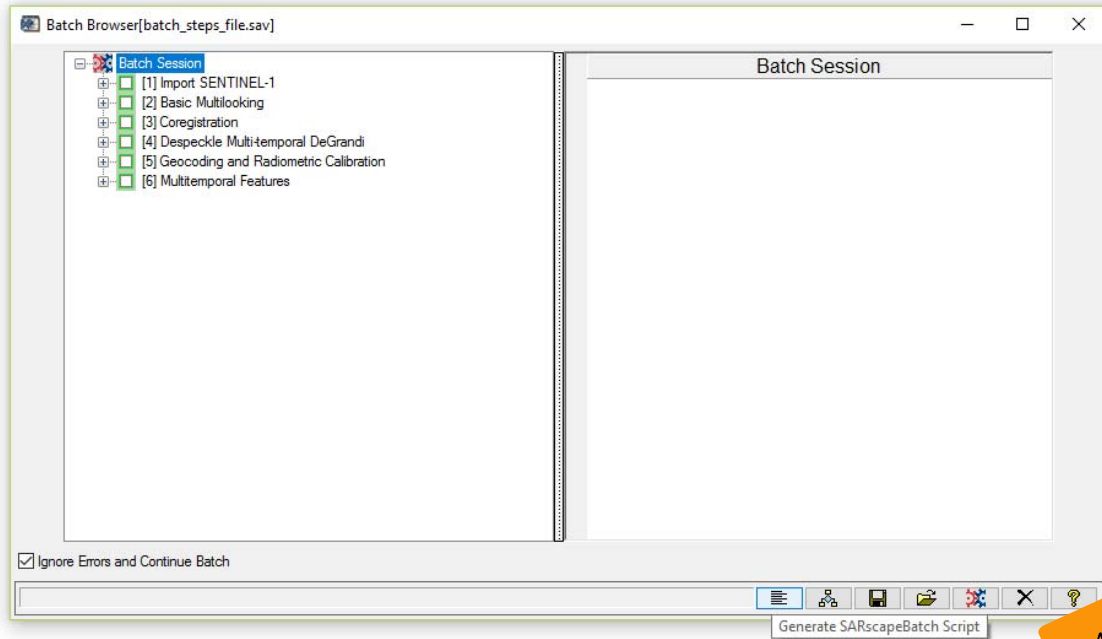
# エンタープライズ / 分散処理環境での SARscape



```
oTask = ENVITASK('ToolSciHubGet')
```

```
OB = obj_new('SARscapeBatch',Module='ToolSciHubGet')
```

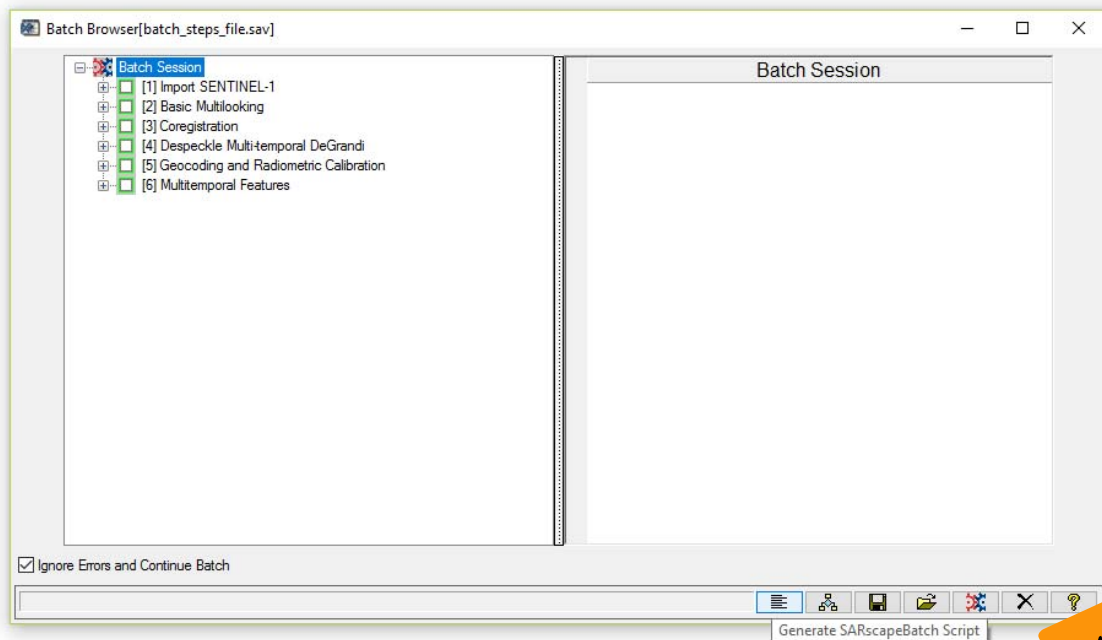
## IDL SARscapeBatch scripts automatic generation



[www.sarmap.ch](http://www.sarmap.ch)

5.4.1  
7 Ju 7

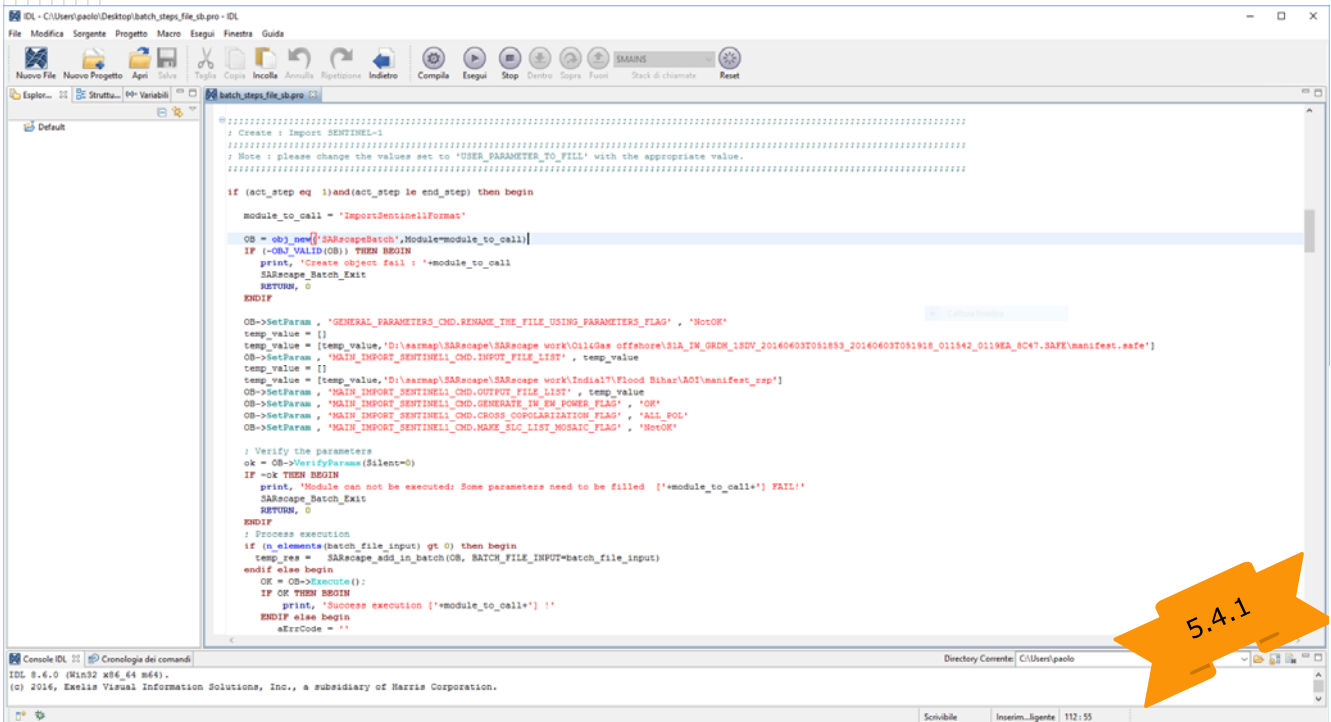
## SARscape IDLバッチスクリプト自動生成



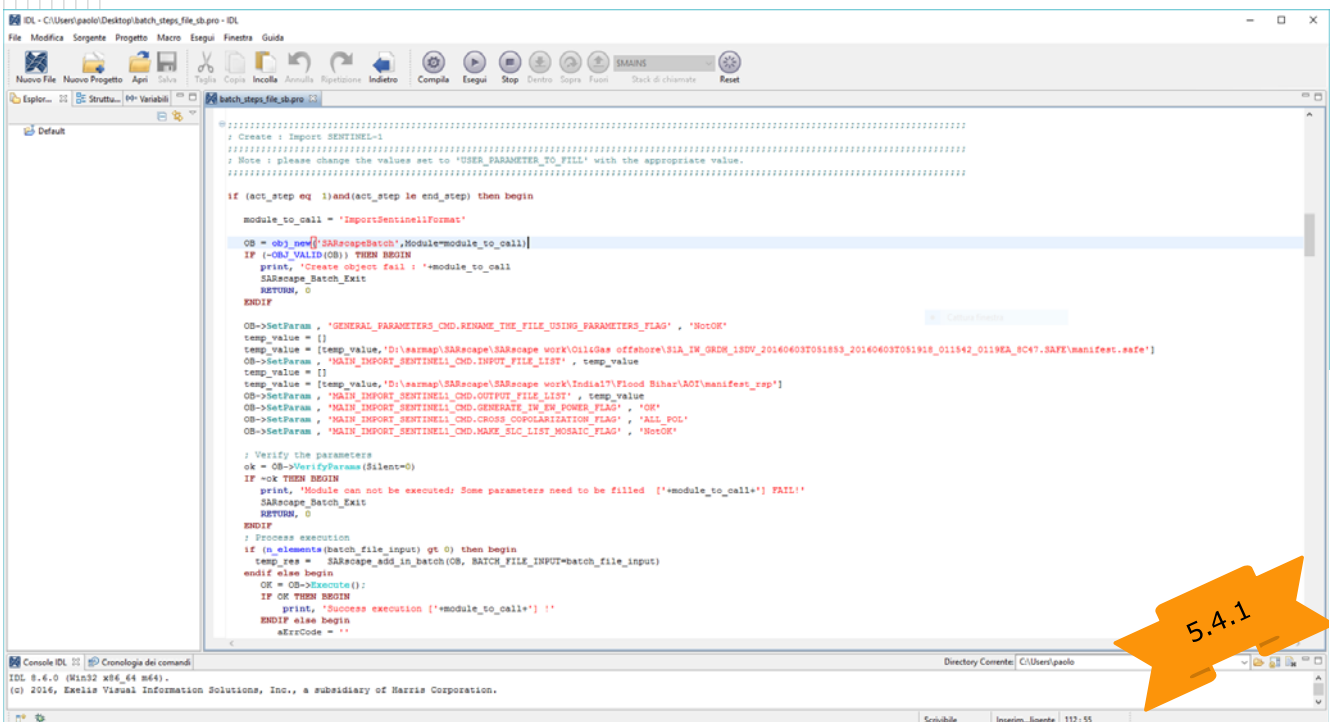
[www.sarmap.ch](http://www.sarmap.ch)

5.4.1  
7 Ju 7

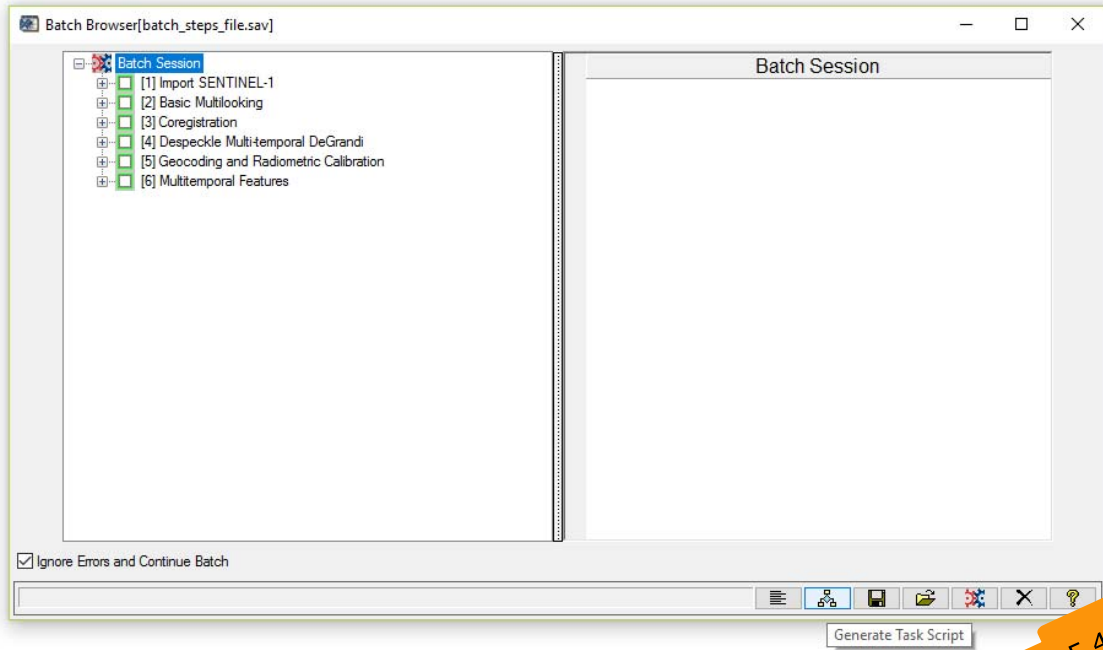
# Automatically generated IDL SARscapeBatch script



# SARscapeで自動生成されたIDLバッチスクリプト



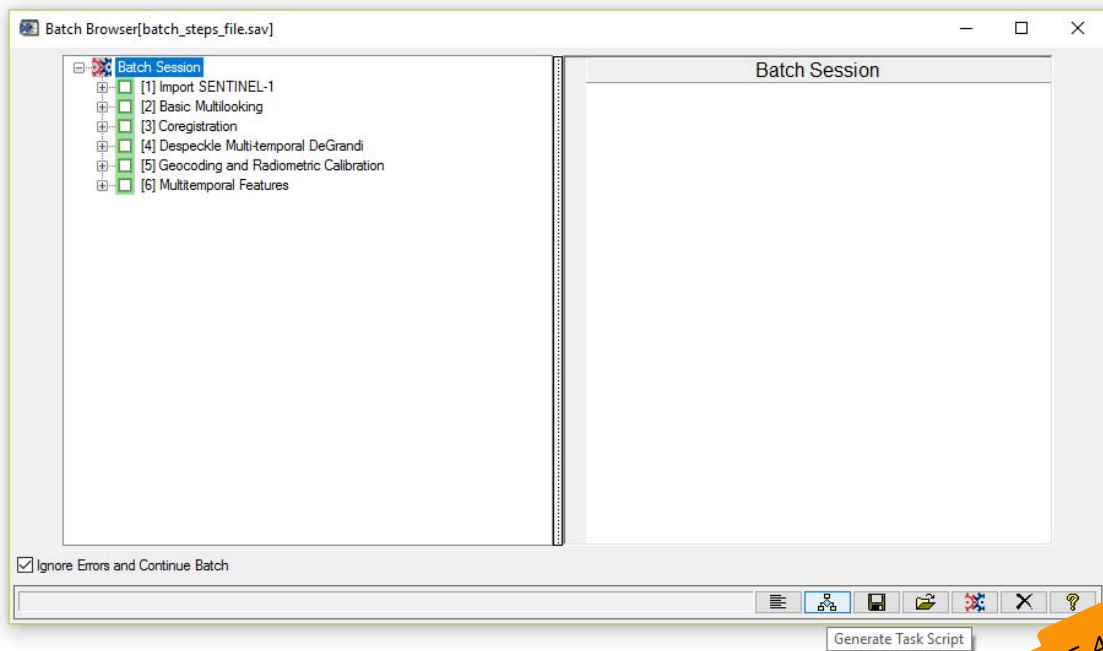
## IDL ENVI Task scripts automatic generation



[www.sarmap.ch](http://www.sarmap.ch)

5.4.1  
7 Ju 7

## IDL ENVI Task スクリプト自動生成

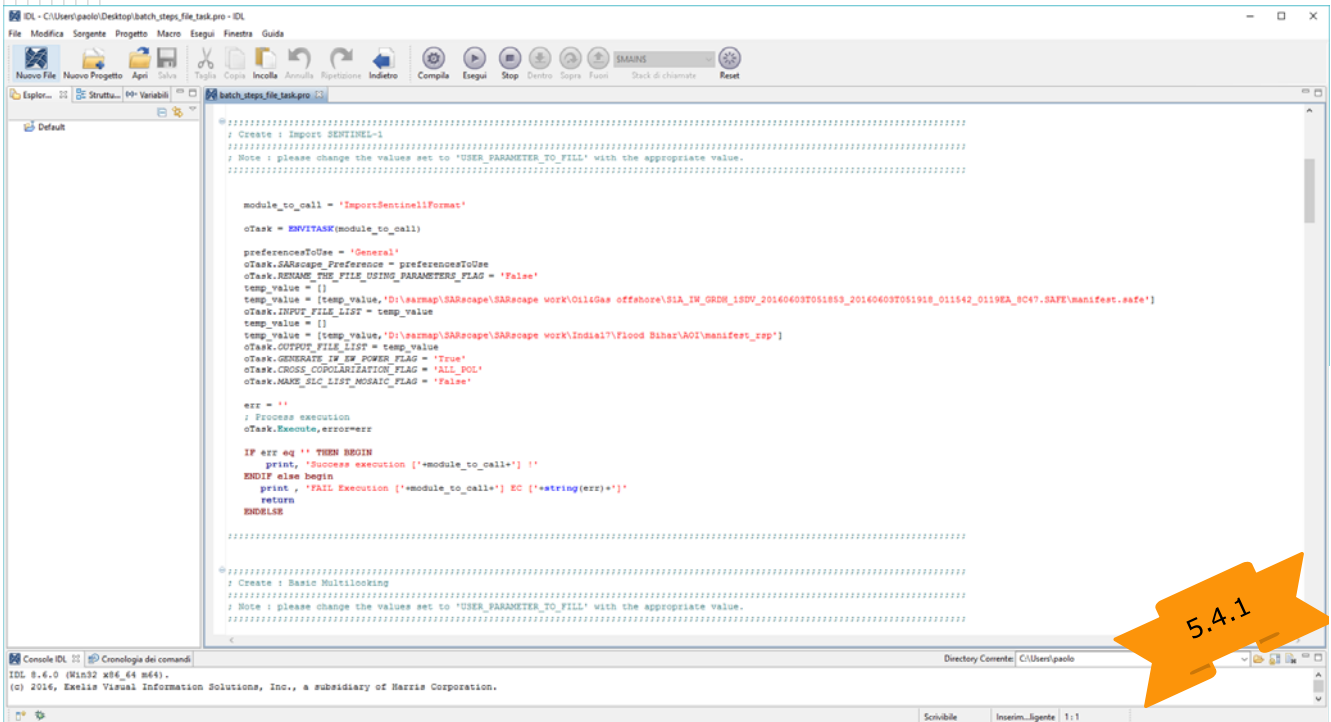


[www.sarmap.ch](http://www.sarmap.ch)

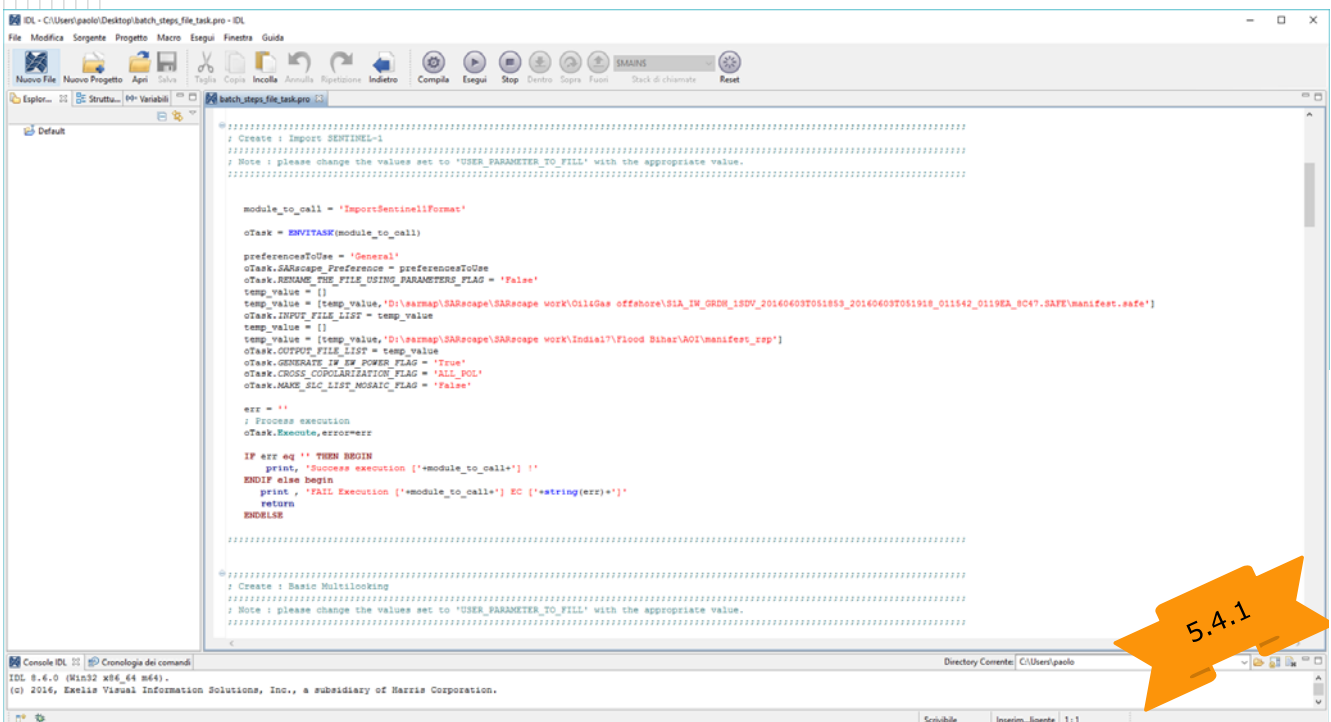
5.4.1  
7 Ju 7



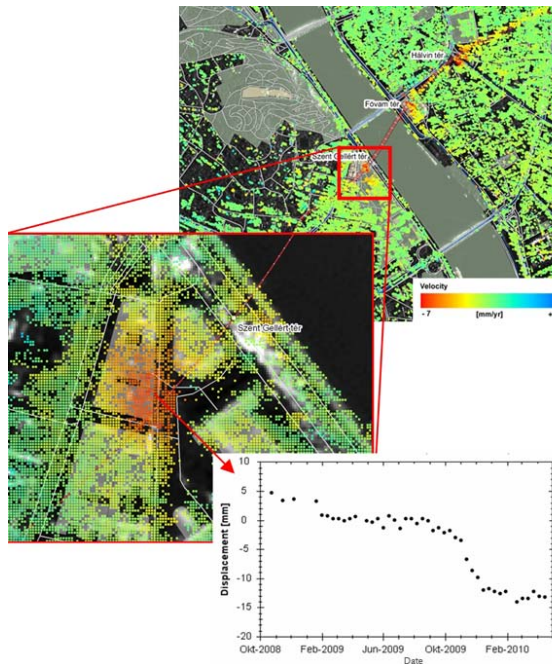
# Automatically generated IDL ENVI Task script



# 自動生成された IDL ENVI Task スクリプト



## Non-linear time series

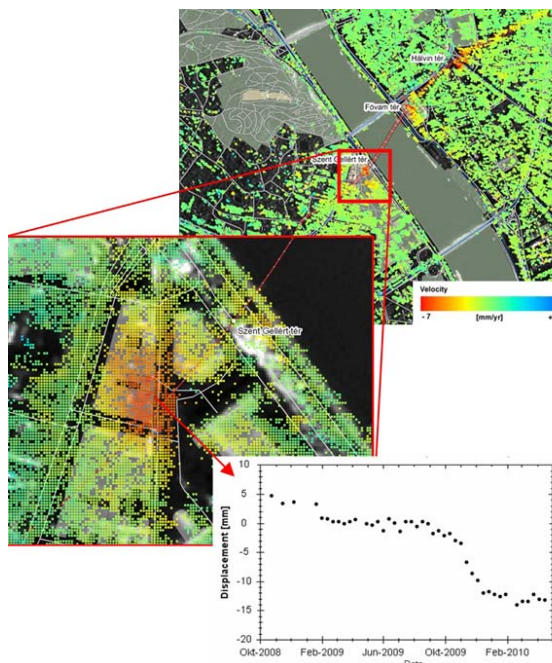


[top] PSI Analysis in the wider area of Station Szent Gellért tér based on 43 TerraSAR-X satellite data sets;

[middle] Focused SBAS Analysis in the area of Station Szent Gellért tér based on 8 TerraSAR-X satellite data sets;

[bottom] Sample time series of surface displacements showing the highly non-linear displacements induced by temporarily restricted time of construction  
© Infoterra GmbH

## 非線形時系列解析



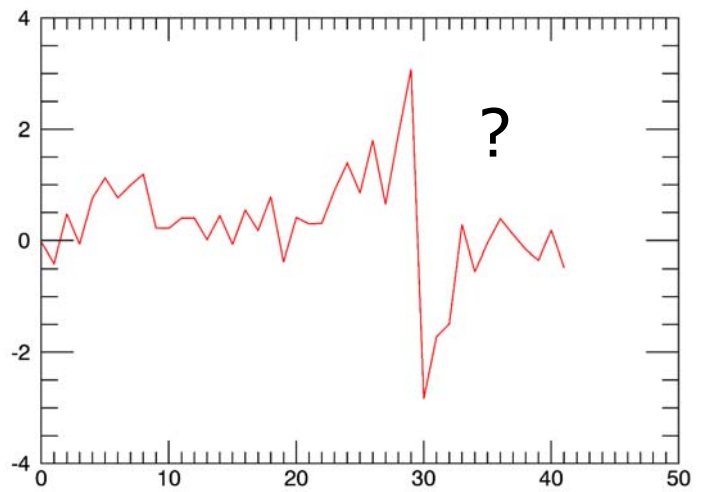
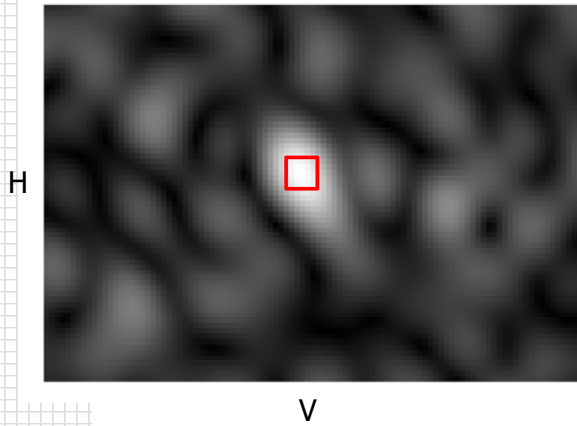
[上] 43シーンのTerraSAR-XによるSzent Gellert 駅周辺のPSI解析結果

[中] 8シーンのTerraSAR-XによるSzent Gellert 駅周辺のSBAS解析結果

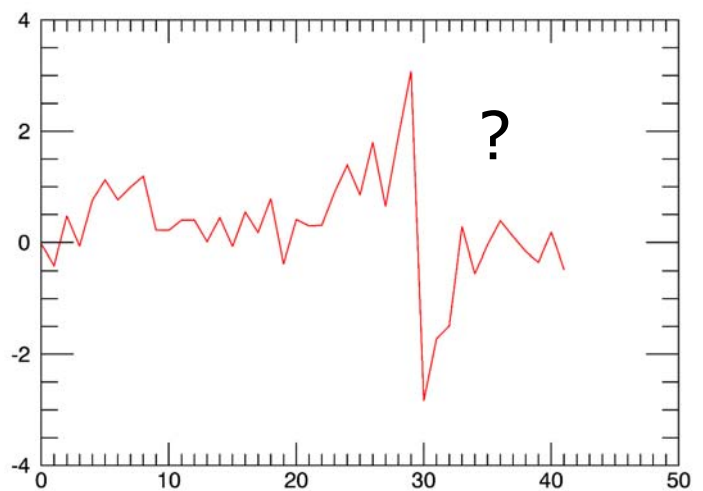
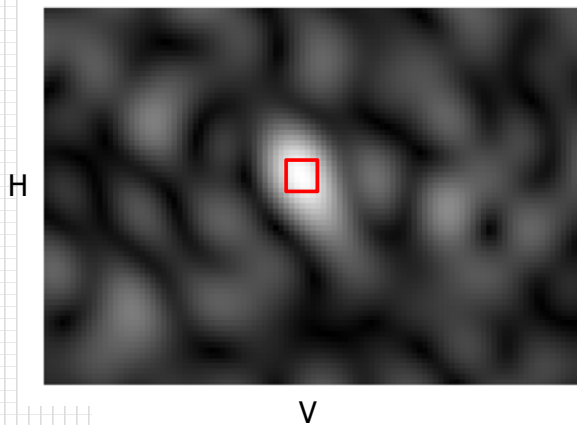
[下] 地表面変位の時系列プロットは工事期間に強く紐づく非線形変位を示している

© Infoterra GmbH

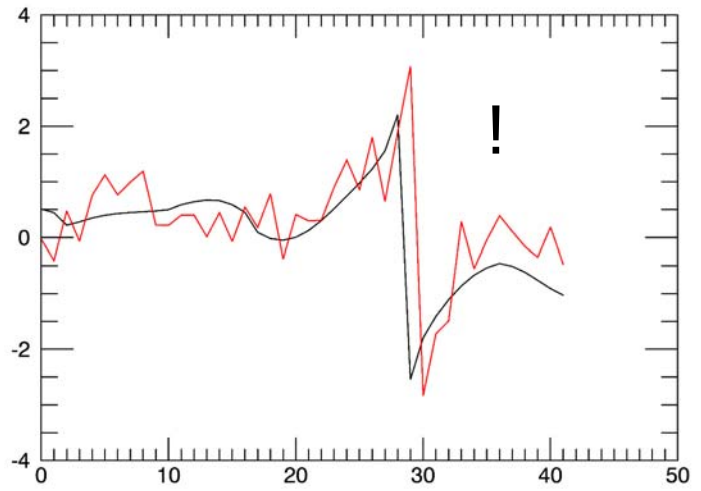
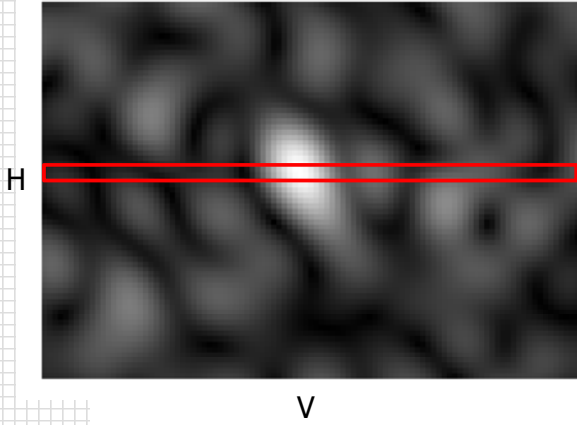
## PS and non-linear time series



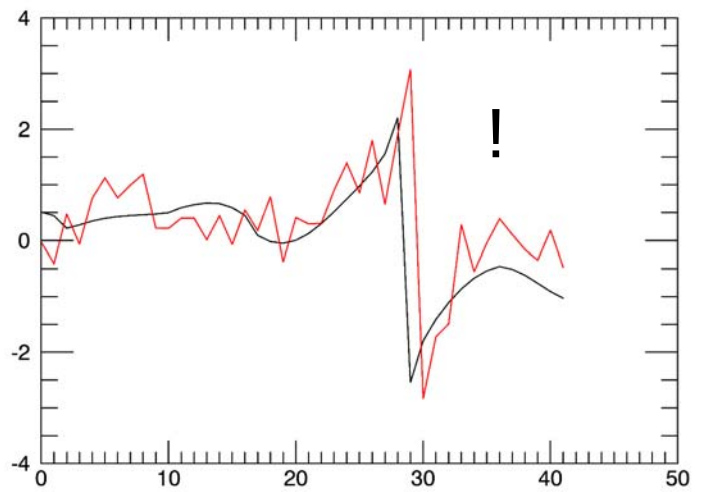
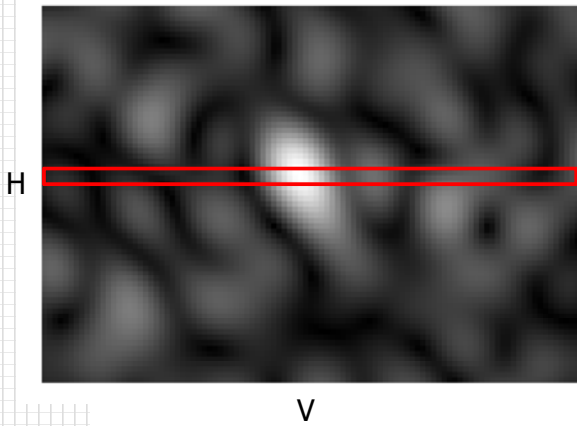
## PSと非線形時系列解析



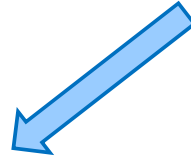
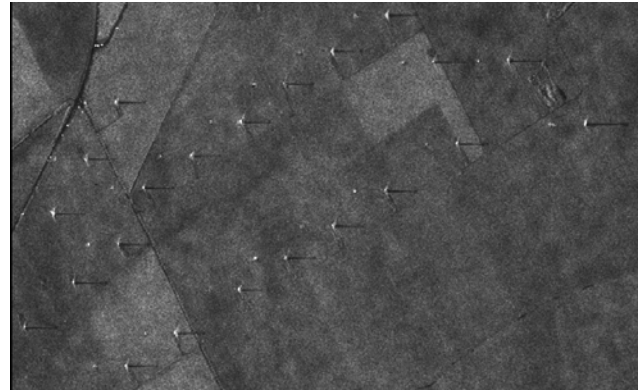
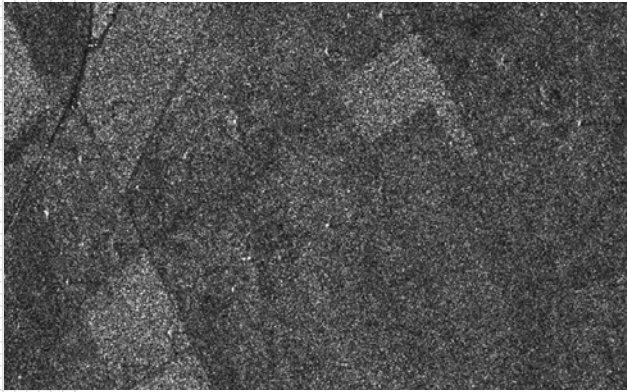
## PS and non-linear time series



## PSと非線形時系列解析



## Distributed vs. Point Targets



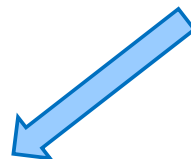
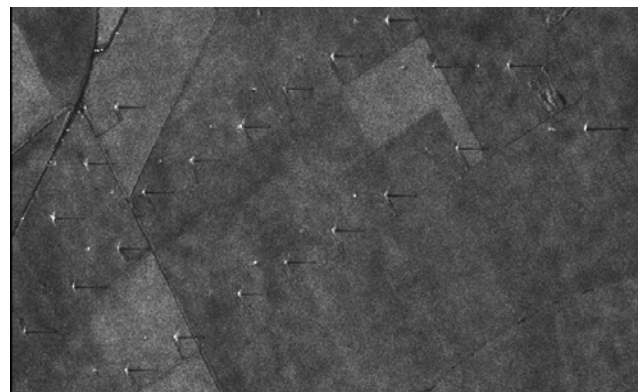
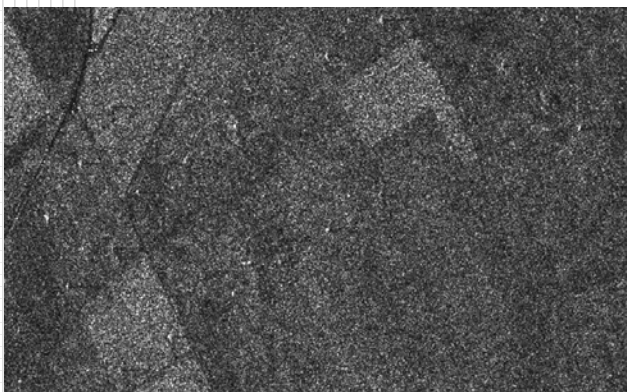
De Grandi 🤝 Goldstein

=

PS 🤝 SBAS

5.5

## 分散ターゲット と ポイントターゲット



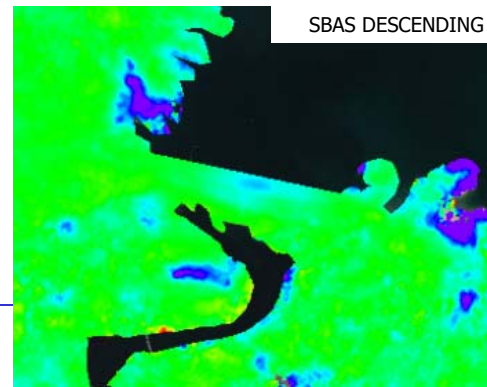
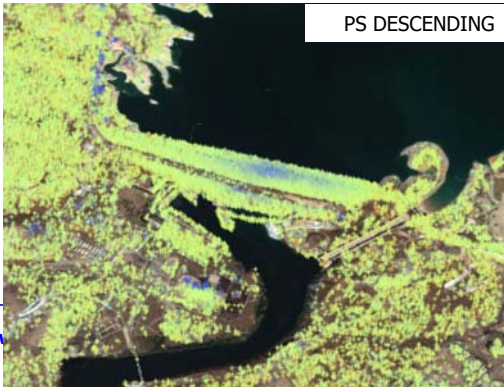
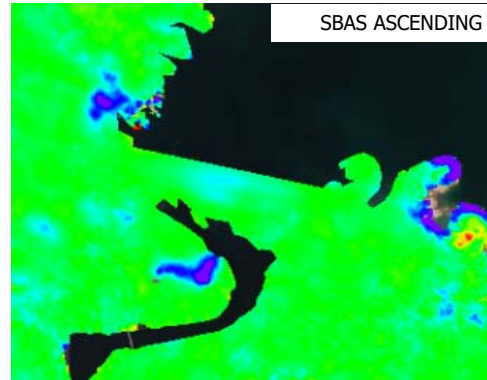
De Grandi 🤝 Goldstein

=

PS 🤝 SBAS

5.5

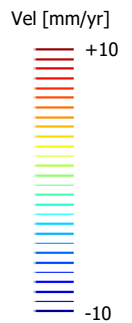
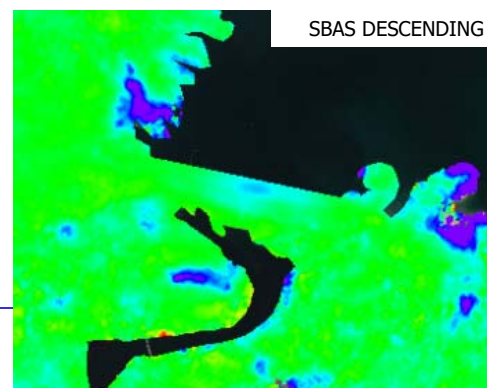
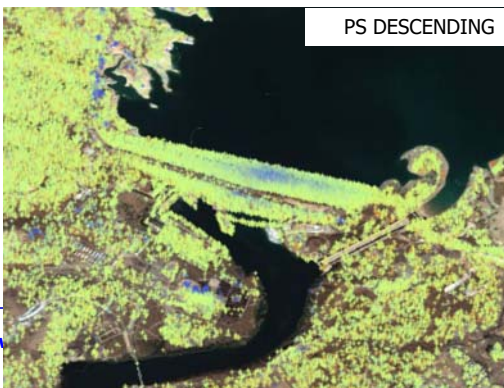
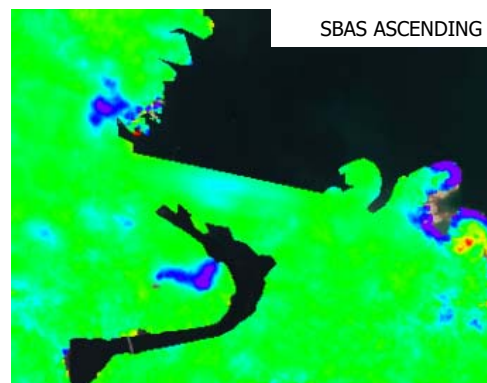
## Ascending & descending



www

17

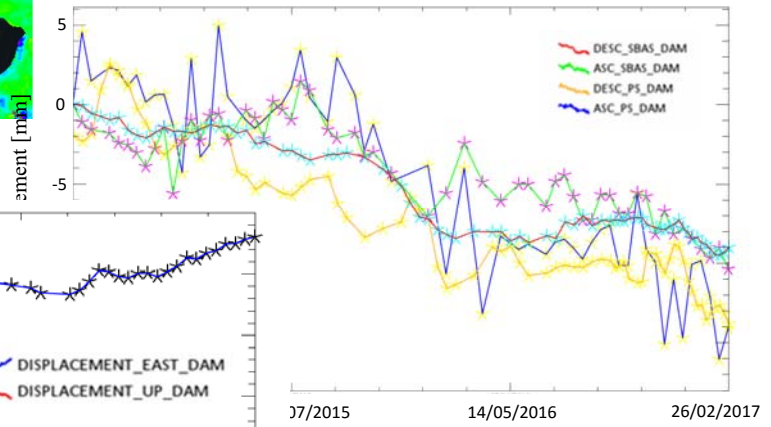
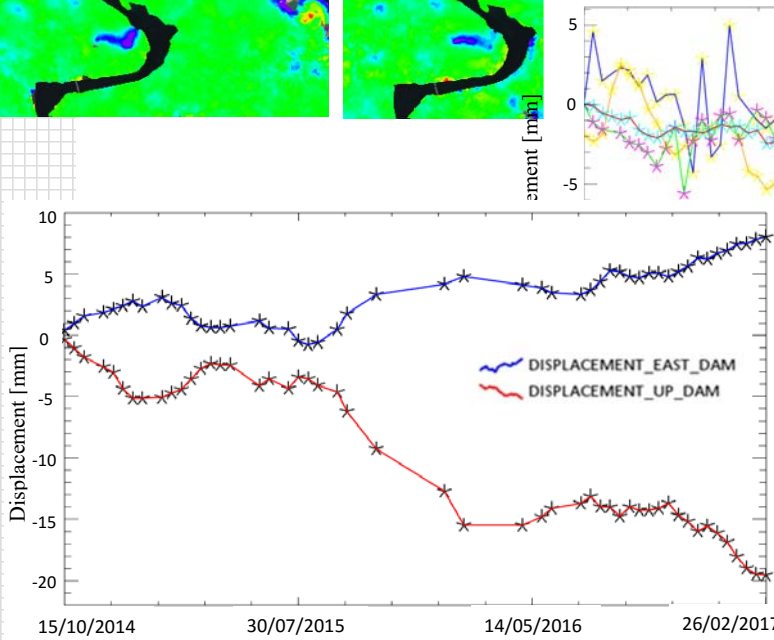
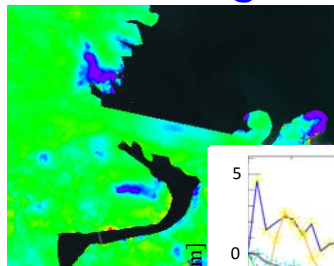
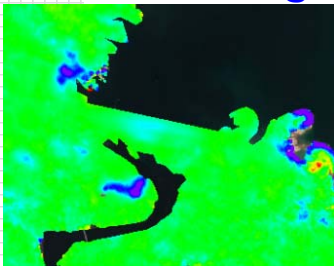
## アセンディング & ディセンディング



www

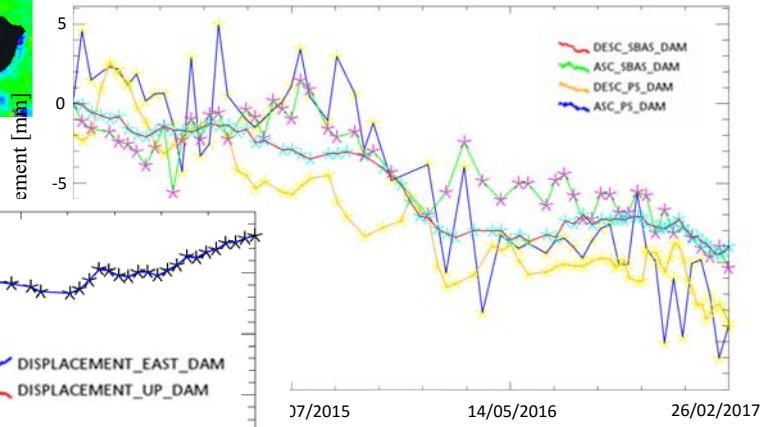
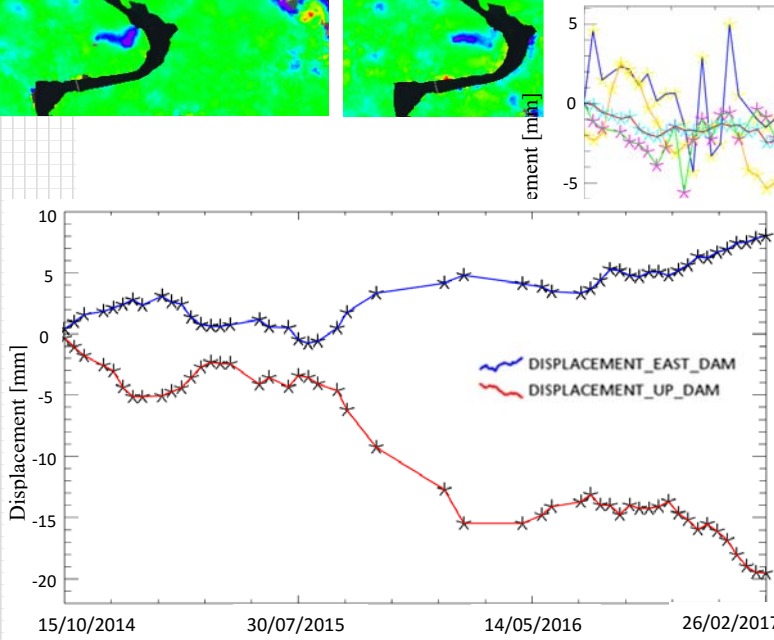
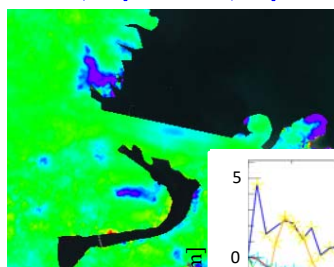
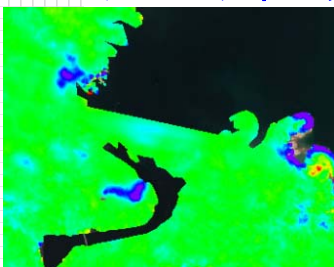
17

## Ascending & descending combination



5.4.1  
7 Jul 17

## アセンディング & ディセンディング の組み合わせ



5.4.1  
7 Jul 17

## Time series modeling

$$y = k_0 + k_1 t + k_2 \sin\left(k_3 + \frac{2\pi}{T} t\right)$$

$$var = \sqrt{\sum_{i=1}^n \frac{(y_i - d_i)^2}{n}}$$

**$k_0$ : constant**

**$k_1$ : velocity coefficient**

**$k_2$ : amplitude of the oscillation**

**$k_3$ : initial phase**

**$t$ : acquisition time**

**$y_i$ : estimated displacement**

**$d_i$ : observed displacement**

**var: variance**

## 時系列モデリング

$$y = k_0 + k_1 t + k_2 \sin\left(k_3 + \frac{2\pi}{T} t\right)$$

$$var = \sqrt{\sum_{i=1}^n \frac{(y_i - d_i)^2}{n}}$$

**$k_0$ : 定数**

**$k_1$ : 速度係数**

**$k_2$ : 振幅強度**

**$k_3$ : 初期位相**

**$t$ : 取得時間**

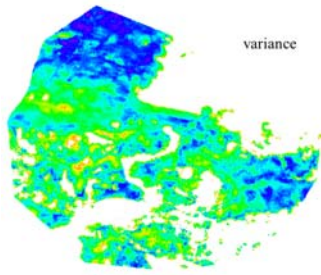
**$y_i$ : 推定変位**

**$d_i$ : 観測変位**

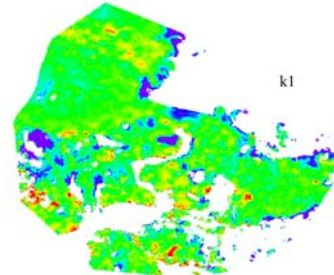
**var: 分散**



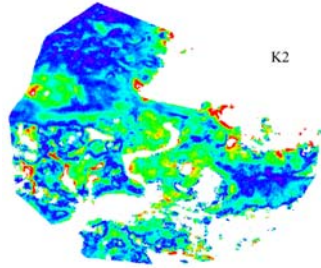
## Time series modeling



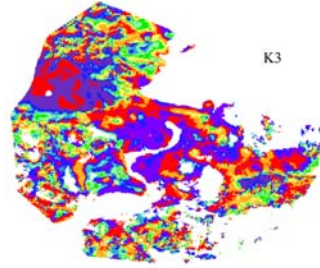
variance



k1



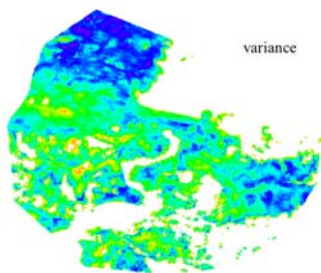
k2



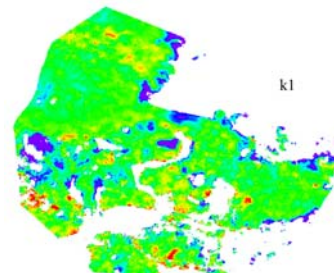
k3

$$y = k_0 + k_1 t + k_2 \sin\left(k_3 + \frac{2\pi}{T} t\right)$$

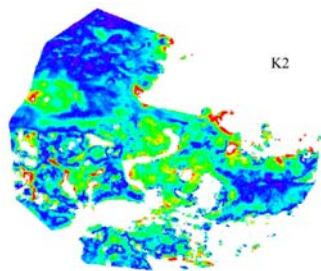
## 時系列モデリング



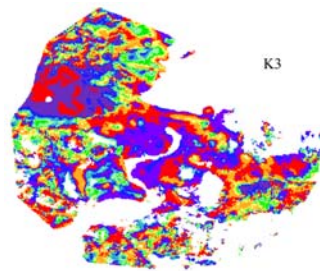
variance



k1



k2



k3

$$y = k_0 + k_1 t + k_2 \sin\left(k_3 + \frac{2\pi}{T} t\right)$$

## Information in single SLC images

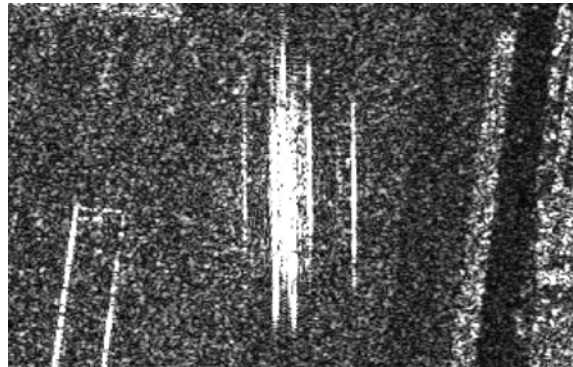


## 単一SLC画像内の情報

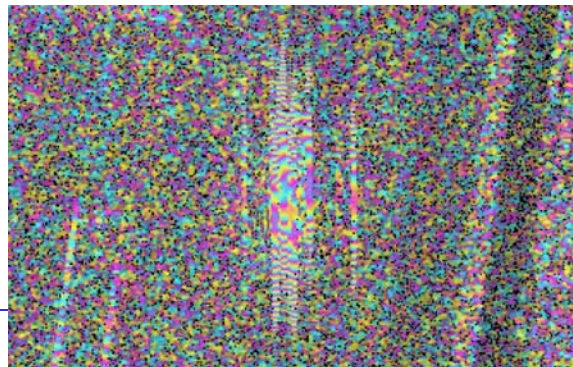


## Information in single SLC images

Amplitude

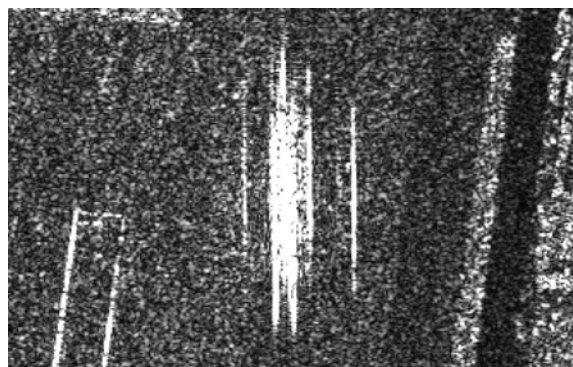


Phase

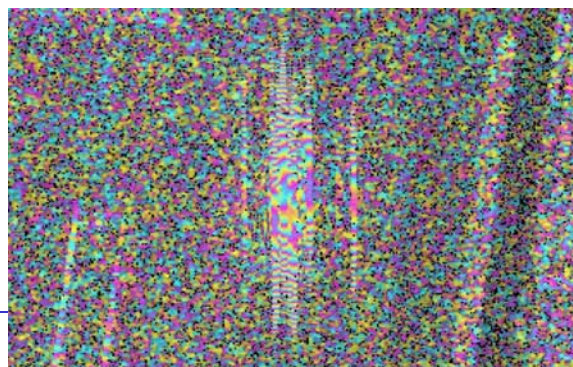


## 単一SLC画像内の情報

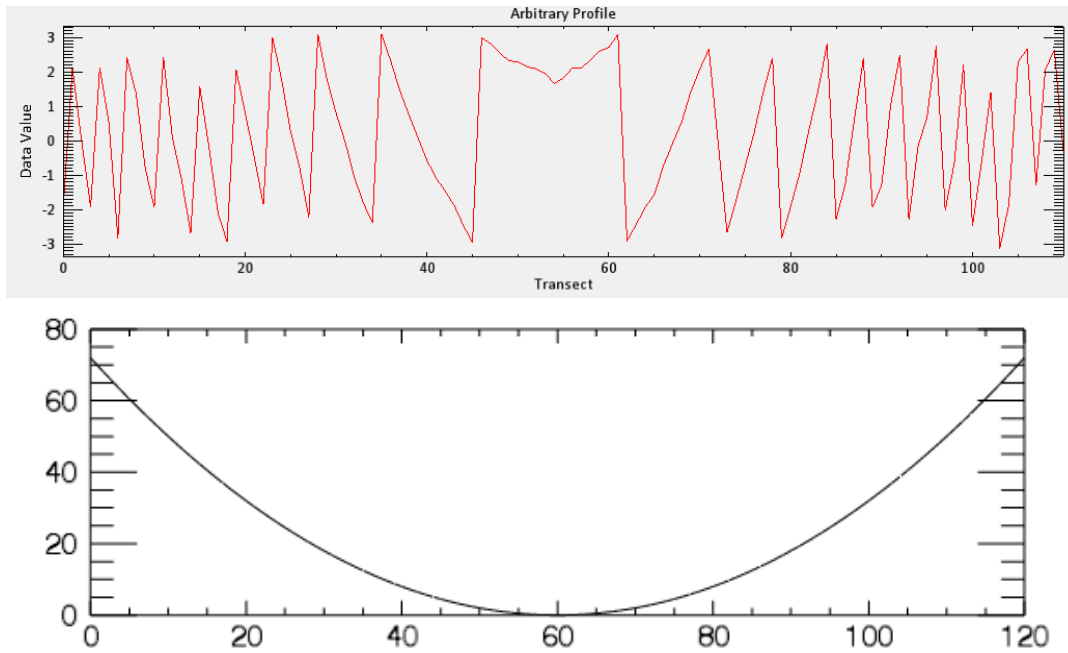
振幅



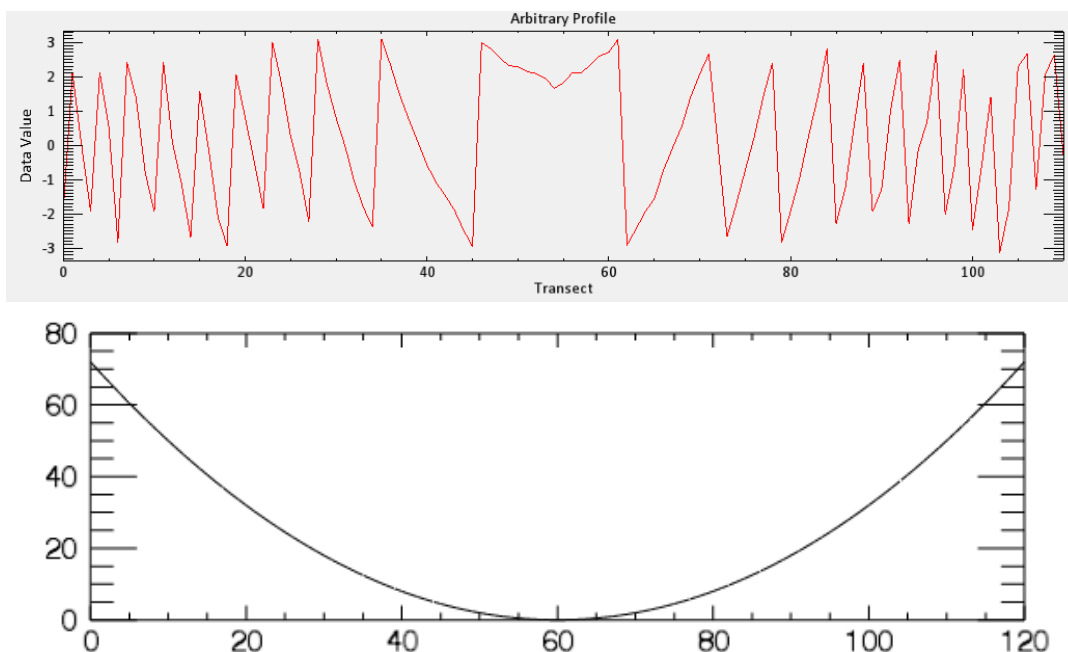
位相



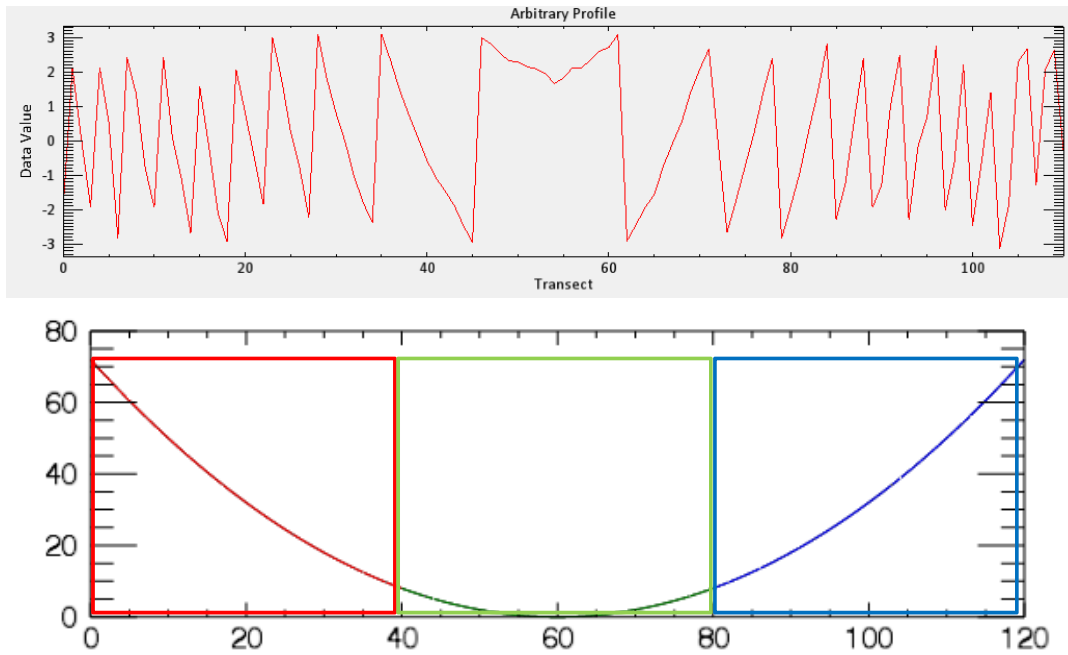
## Phase of Moving Objects in single SLC images



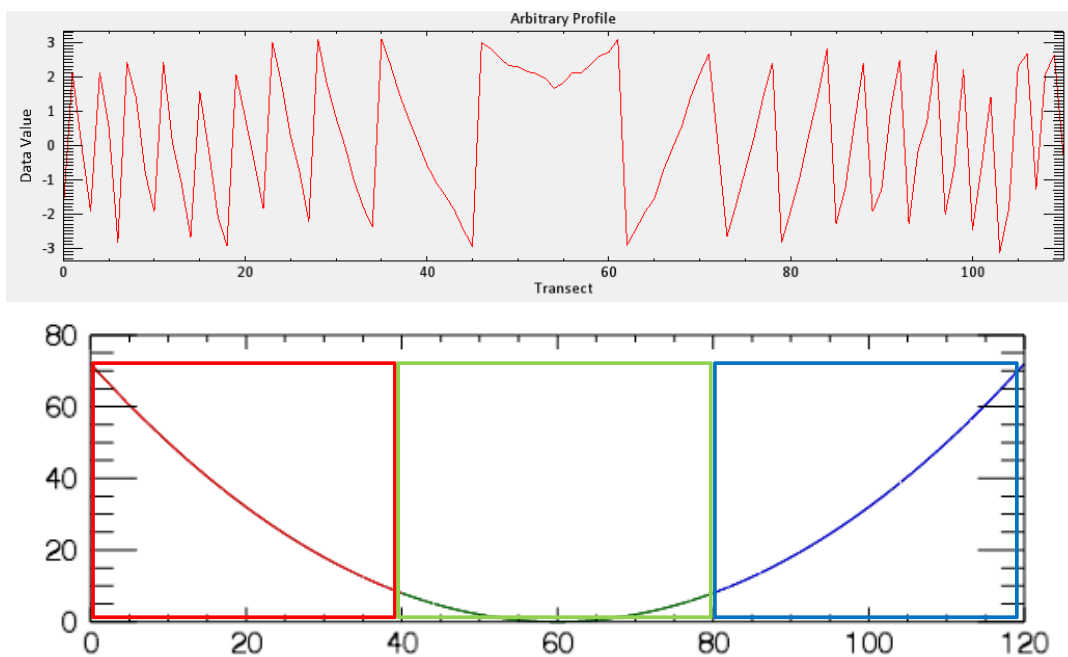
## 単一SLC画像内の移動体の位相



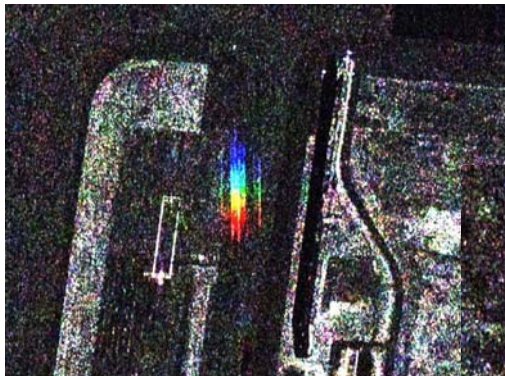
## Phase of Moving Objects in single SLC images



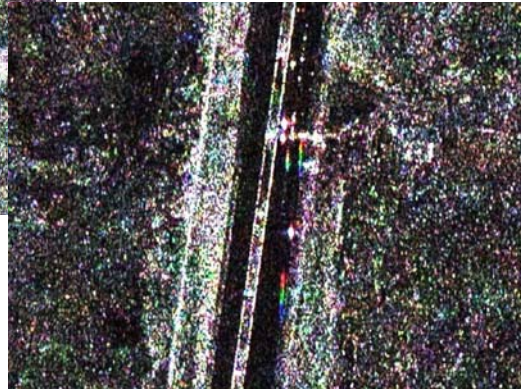
## 単一SLC画像内の移動体の位相



## Moving Target Detection



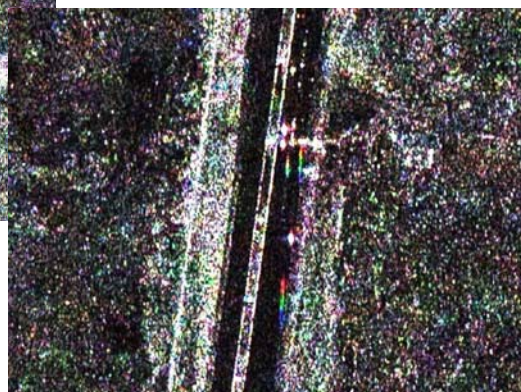
5.4: Workflow for highlighting moving objects within very high resolution imagery



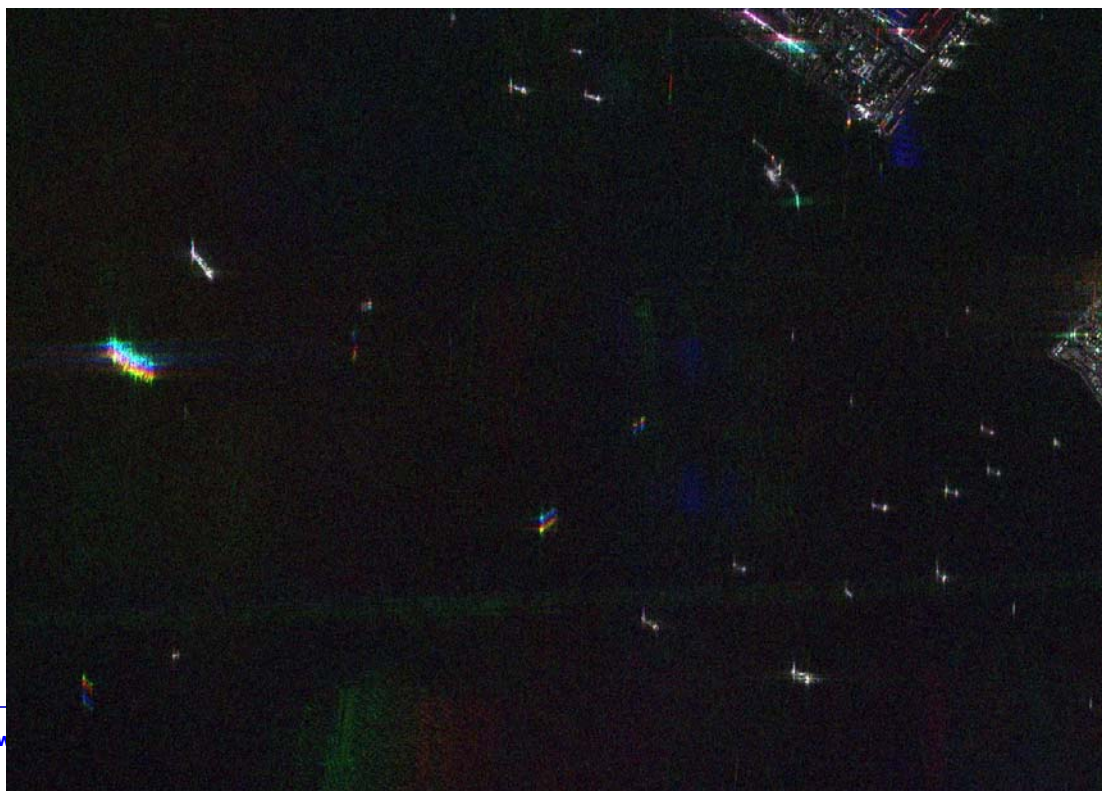
## 移動体検出



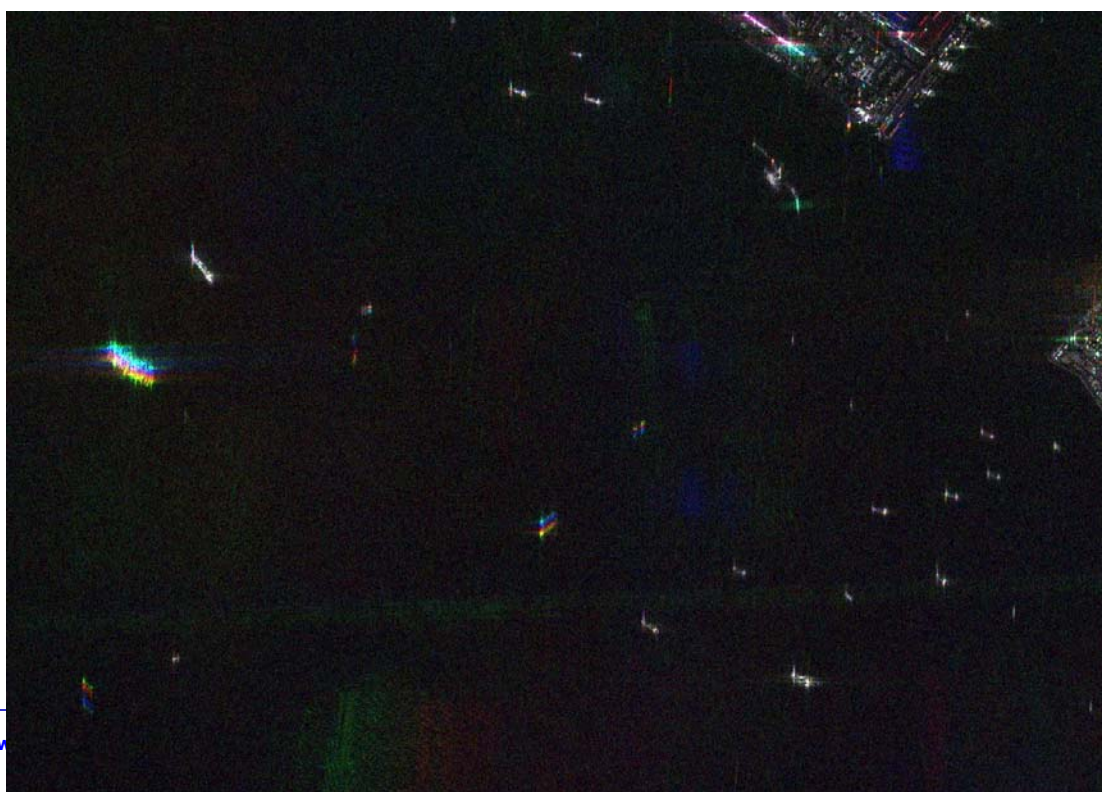
5.4: 高解像度画像を用いた移動体検出ワークフロー



## MTD with PALSAR-2 spotlight data



## PALSAR-2 スポットライトデータを用いた移動体検出



## MTD with PiSAR-L2 data



[www.sarmap.ch](http://www.sarmap.ch)

7 July 2017

## PiSAR-L2を用いた移動体検出



[www.sarmap.ch](http://www.sarmap.ch)

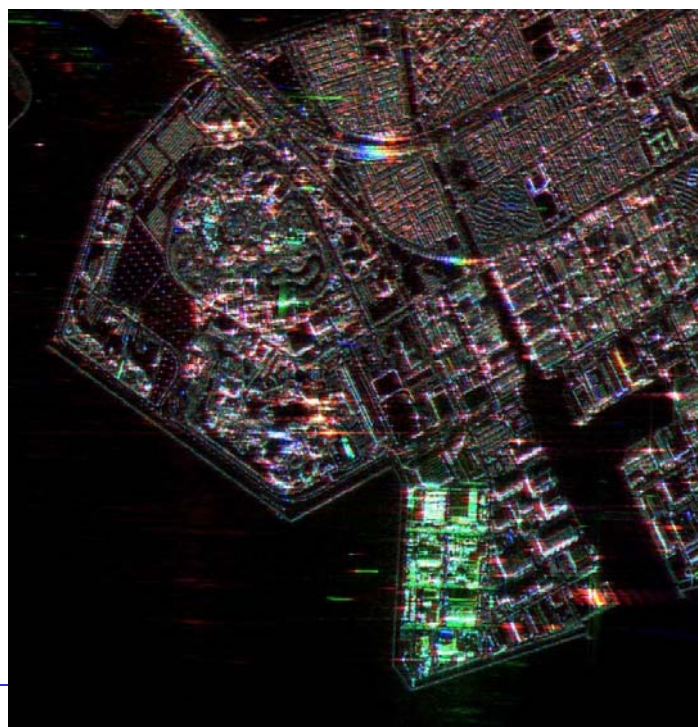
7 July 2017



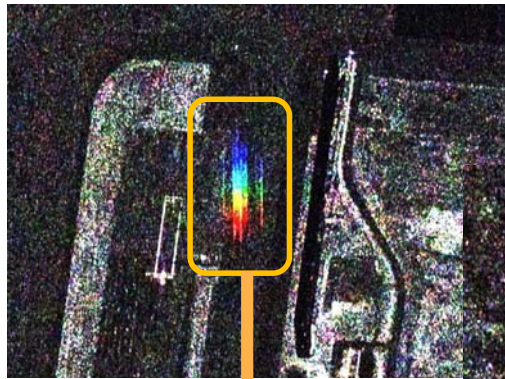
## MTD with PiSAR-L2 data



## PiSAR-L2を用いた移動体検出



## Moving Target Detection

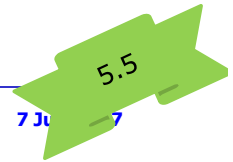


$V_a = 150 \text{ km/h}$   
 $V_r = 10 \text{ km/h}$

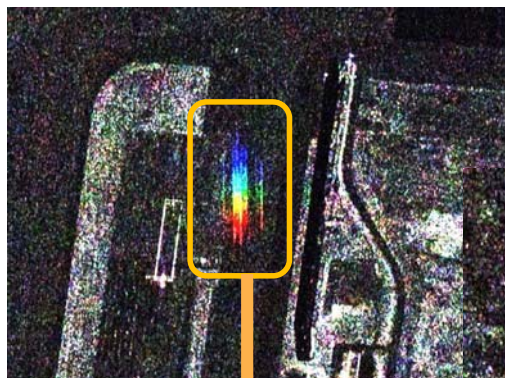
Automated identification  
of Moving Objects  
and measurement of the  
motion parameters



$V_a = 80 \text{ km/h}$   
 $V_r = 15 \text{ km/h}$



## 移動体検出

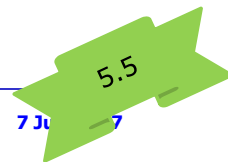


$V_a = 150 \text{ km/h}$   
 $V_r = 10 \text{ km/h}$

移動体の自動認識と、  
速度の推定



$V_a = 80 \text{ km/h}$   
 $V_r = 15 \text{ km/h}$

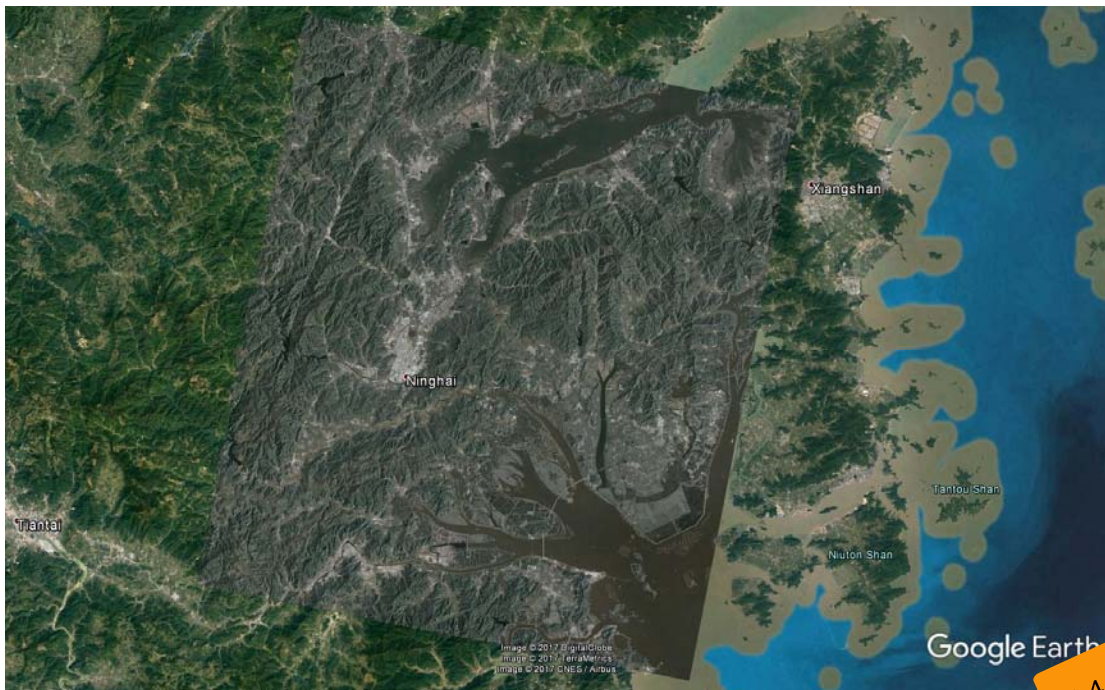


## Gaofen-3



5.4.1

## Gaofen-3



5.4.1

## Gaofen-3

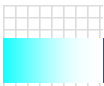


5.4.1

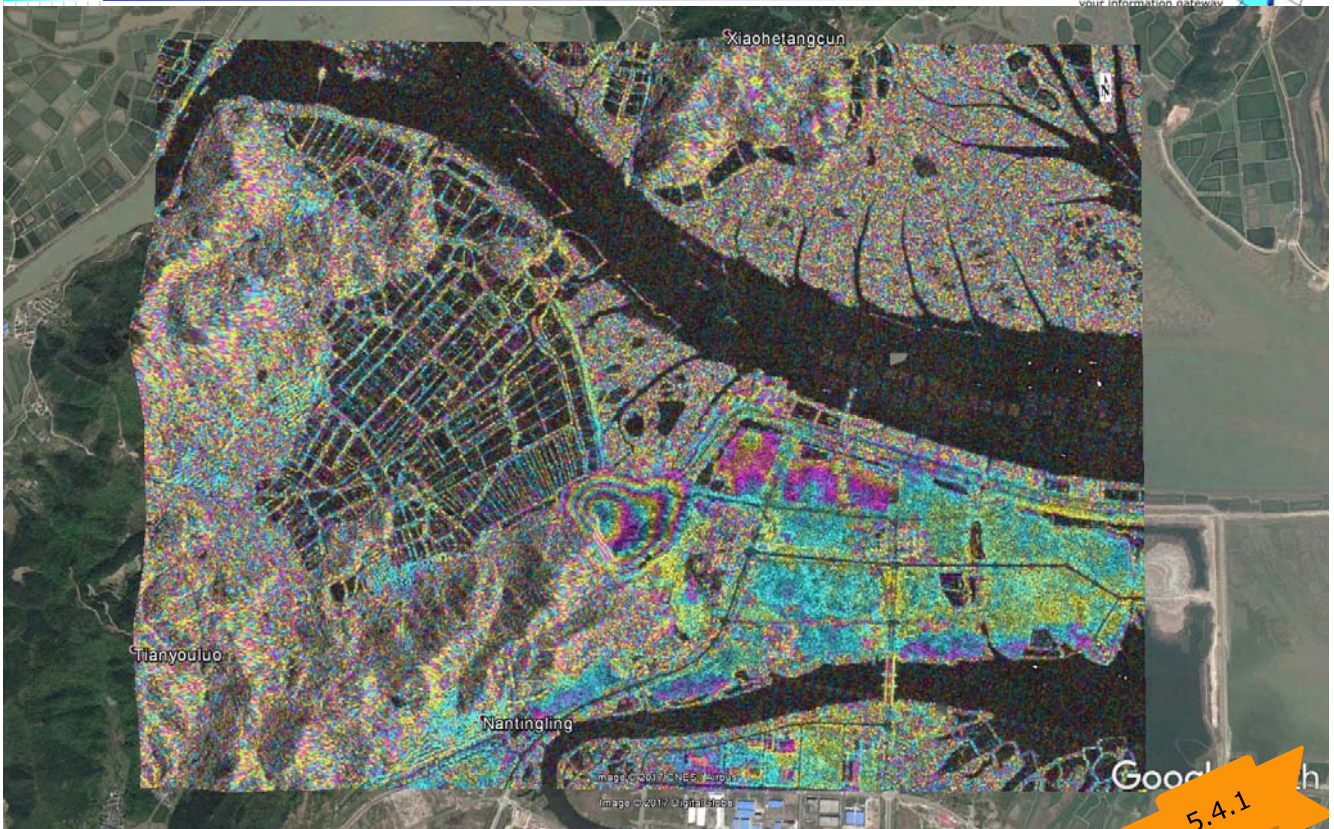
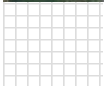
## Gaofen-3



5.4.1

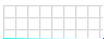


5.4.1  
7/10/17



5.4.1  
7/10/17





updates



[www.sarmap.ch](http://www.sarmap.ch)

7 July 2017

日本語訳

updates



[www.sarmap.ch](http://www.sarmap.ch)

7 July 2017

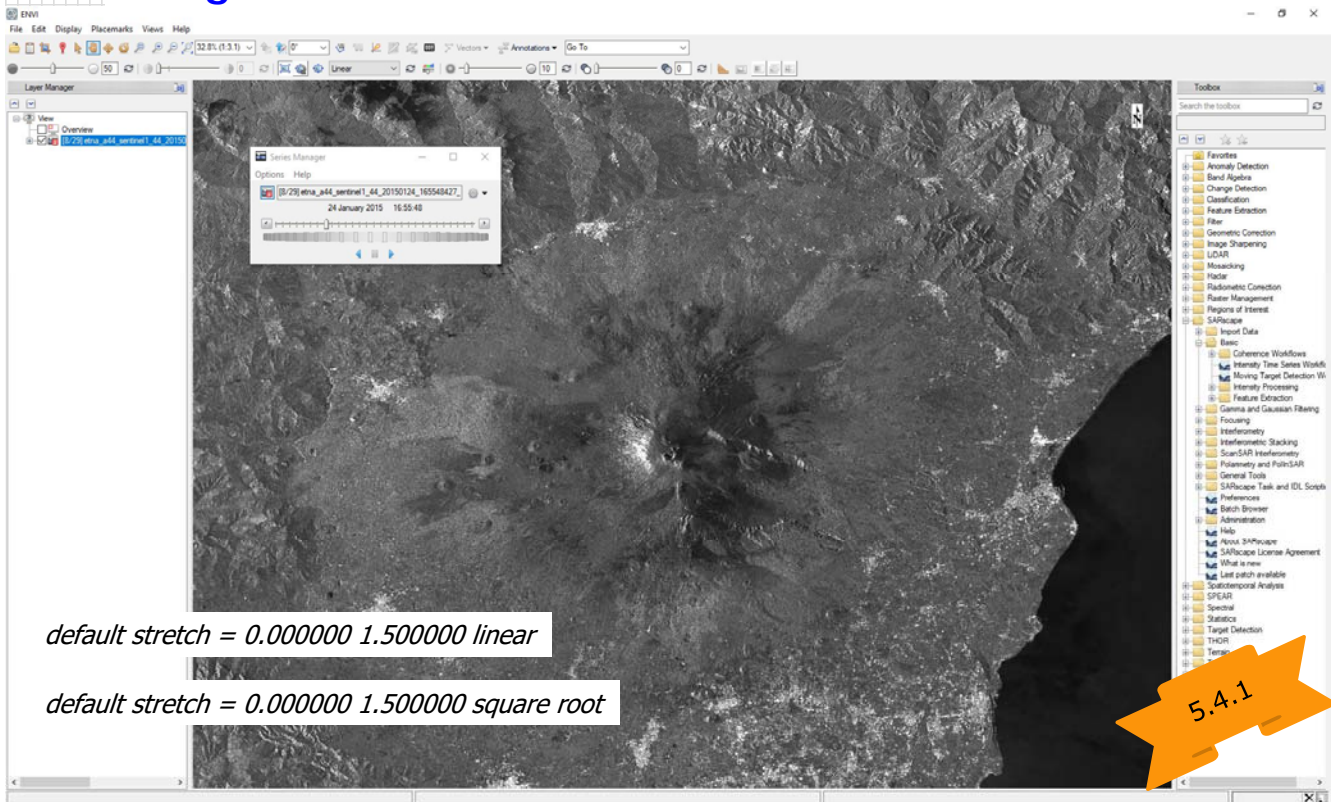
## Forthcoming sensors

- PiSAR-L2
- PiSAR-X2
- ....

## 次期サポート予定センサ

- PiSAR-L2
- PiSAR-X2
- ....

# Integration with ENVI

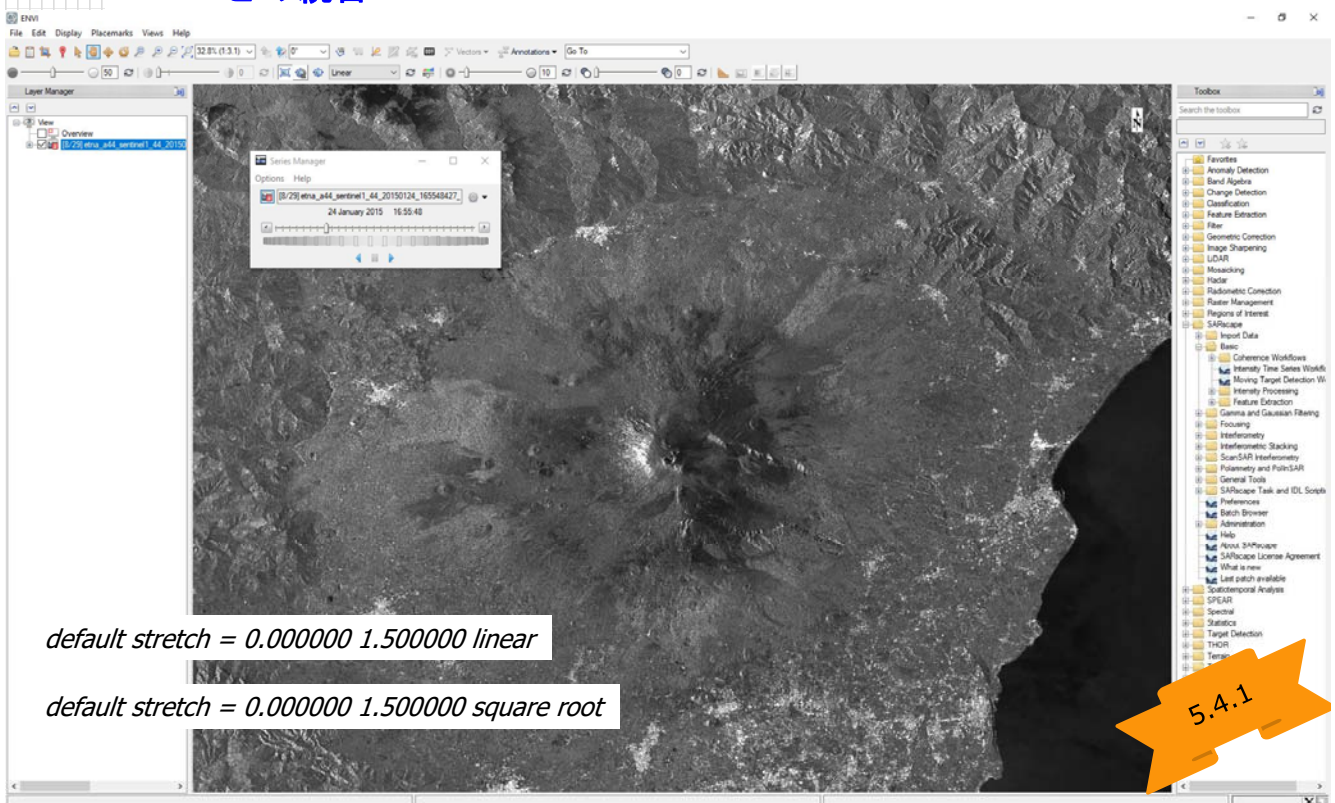


*default stretch = 0.000000 1.500000 linear*

*default stretch = 0.000000 1.500000 square root*

5.4.1

# ENVI との統合

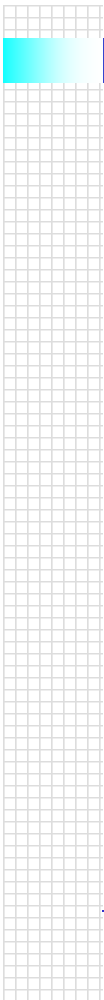


*default stretch = 0.000000 1.500000 linear*

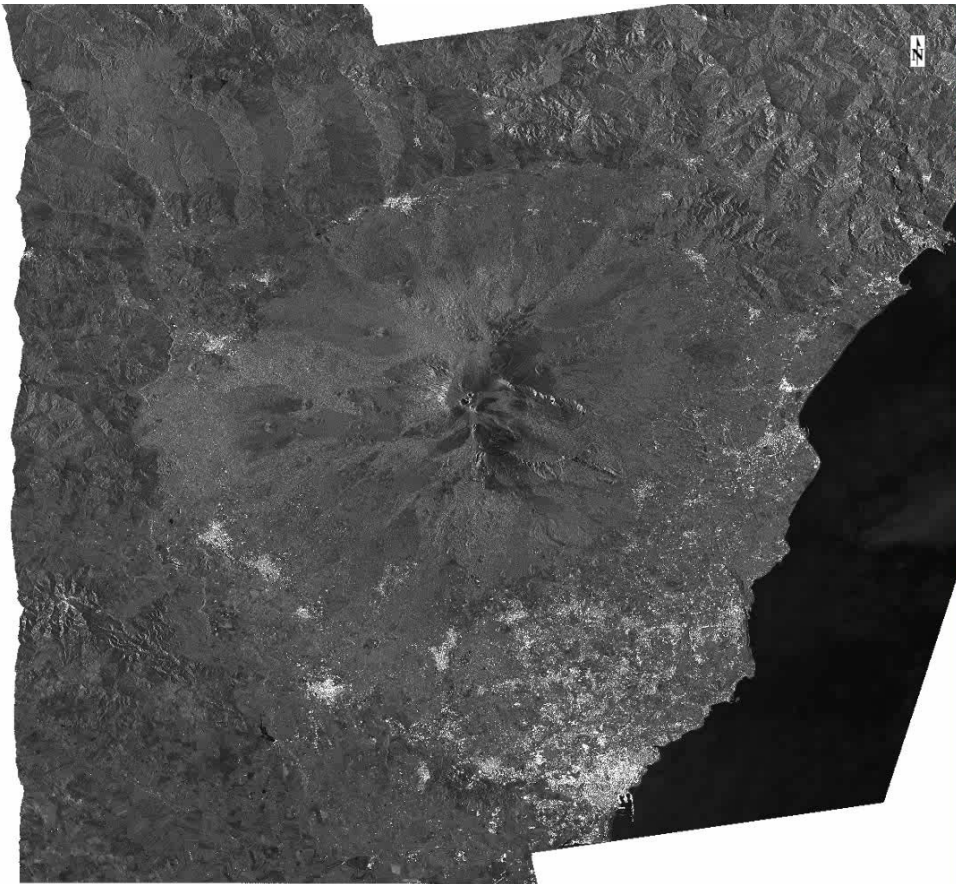
*default stretch = 0.000000 1.500000 square root*

5.4.1





updates



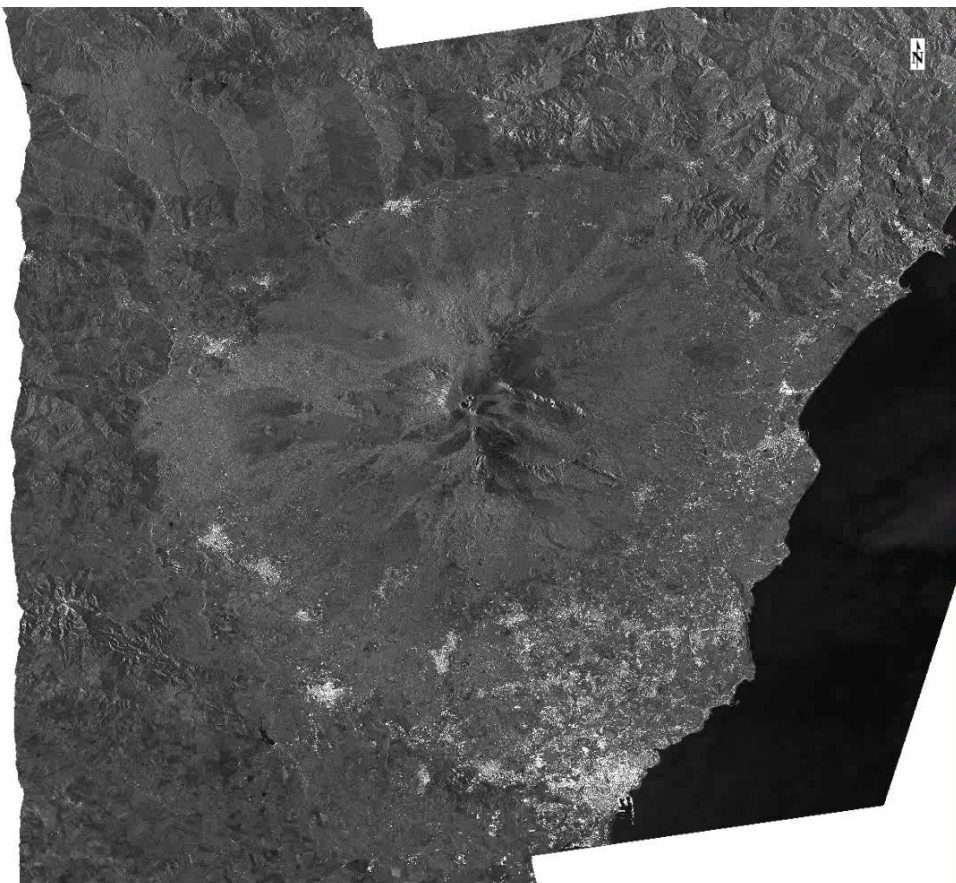
[WWW.SARmap.cn](http://WWW.SARmap.cn)

July 2017



日本語訳

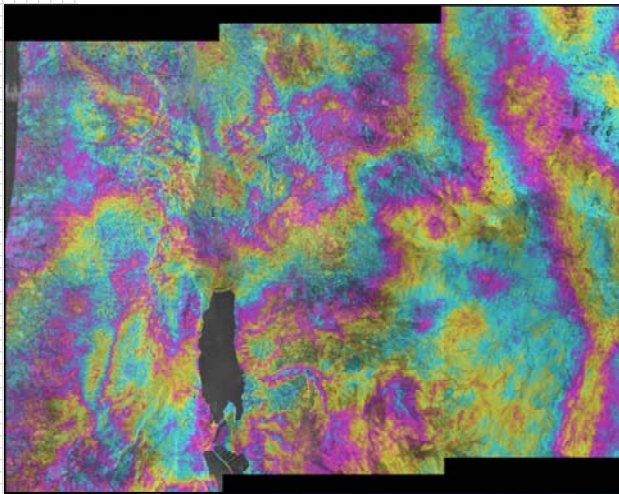
updates



[WWW.SARmap.cn](http://WWW.SARmap.cn)

July 2017

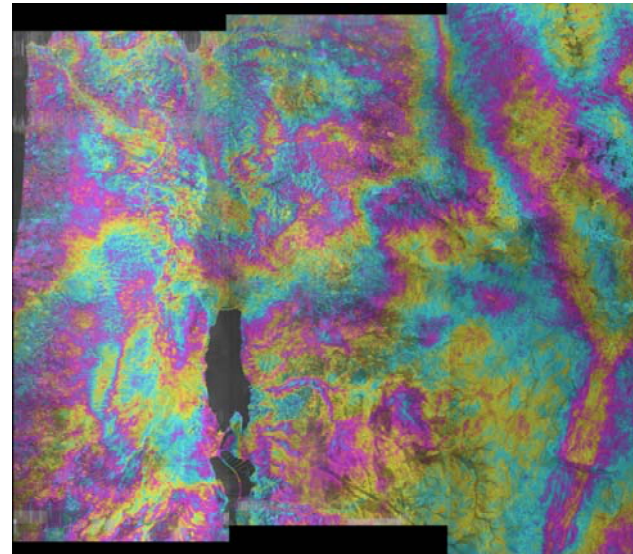
## Sentinel-1 focusing



ESA's SLCs

Acquisition time: 30s  
 Processing time: 150 s  
 Simply scalable (per burst)  
 on multi-GPU machines

[www.sarmap.ch](http://www.sarmap.ch)



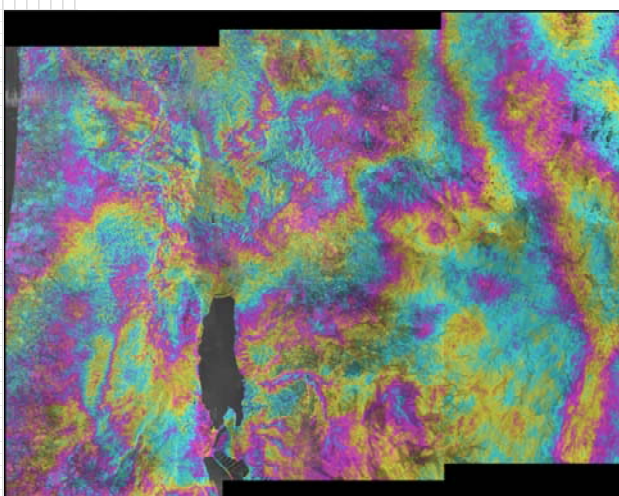
SARscape's SLCs

Server Linux Ubuntu 16.04  
 2x Xeon CPU 6 core (each)  
 64 GB RAM  
 1x AMD FirePro 8100W 8 GB VRAM

5.4.1

7/17

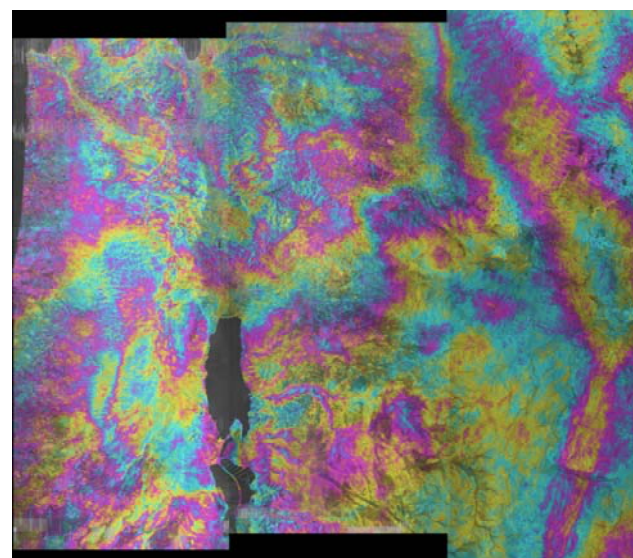
## Sentinel-1 画像再生処理



ESA's SLCs

取得時間: 30秒  
 処理時間: 150秒  
 複数のGPUにてバースト毎に分散  
 処理

[www.sarmap.ch](http://www.sarmap.ch)



SARscape's SLCs

Server Linux Ubuntu 16.04  
 2x Xeon CPU 6 core (each)  
 64 GB RAM  
 1x AMD FirePro 8100W 8 GB VRAM

5.4.1

7/17

## Further "fancy" topics....

- Time Domain Backpropagation processor
  - Bi-static data (XXXX-CS)
  - Verification processor
  - Airborne data
- Tomography
  - Continuous (vegetation)
  - Discrete (urban)

## その他の注目トピック

- タイムドメインバックプロパゲーションプロセッサ
  - バイスタティック データ (XXXX-CS)
  - 検証プロセッサ
  - 航空機データ
- トモグラフィ
  - 連続的 (植生)
  - 離散的 (都市)

## Forthcoming SAR platforms with AIS receivers on-board

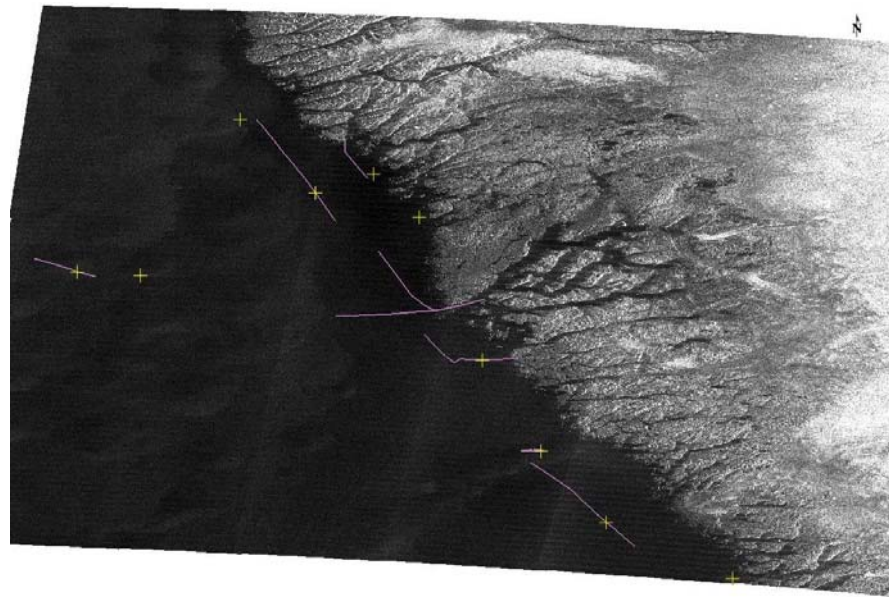
- PAZ
- Radarsat CM
- Sentinel-1 C/D
- ...

## AISレーダー搭載の今後のSARプラットフォーム

- PAZ
- Radarsat CM
- Sentinel-1 C/D
- ...

## Ship Detection

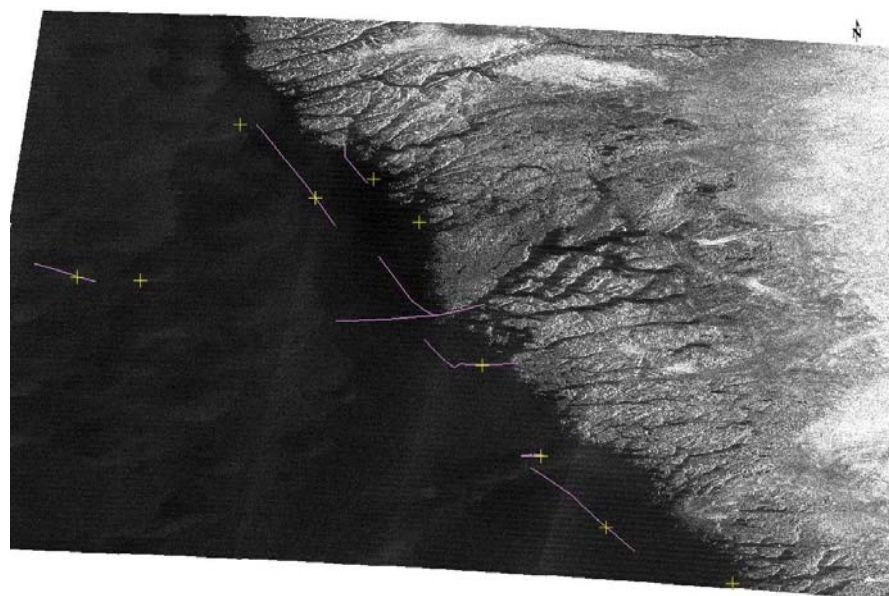
+ SAR  
- AIS



SAR, detected ships and AIS data

## 船舶検出

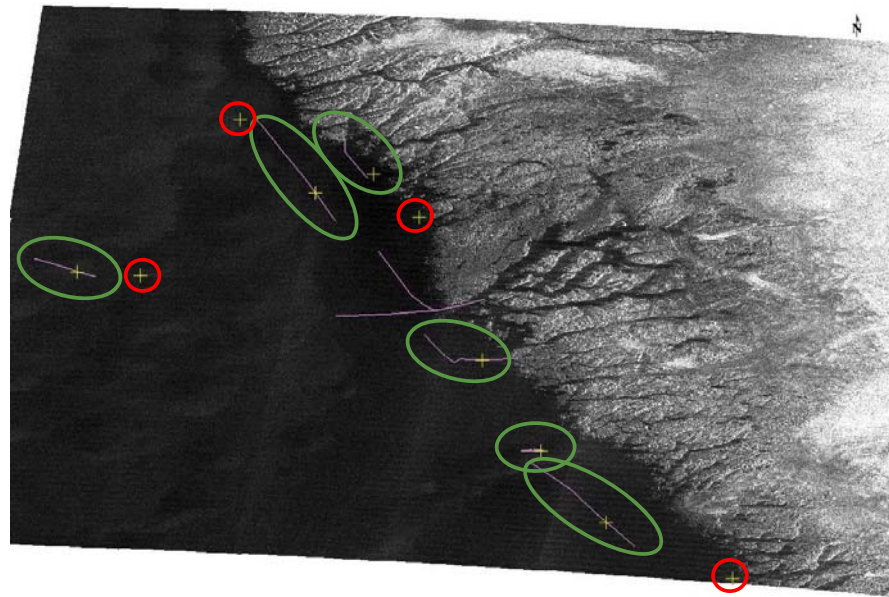
+ SAR  
- AIS



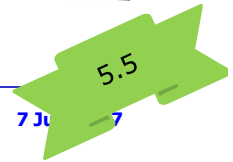
SARで検出された船舶とAISデータ

# Ship Detection

- + SAR
- AIS
- Match
- ???????

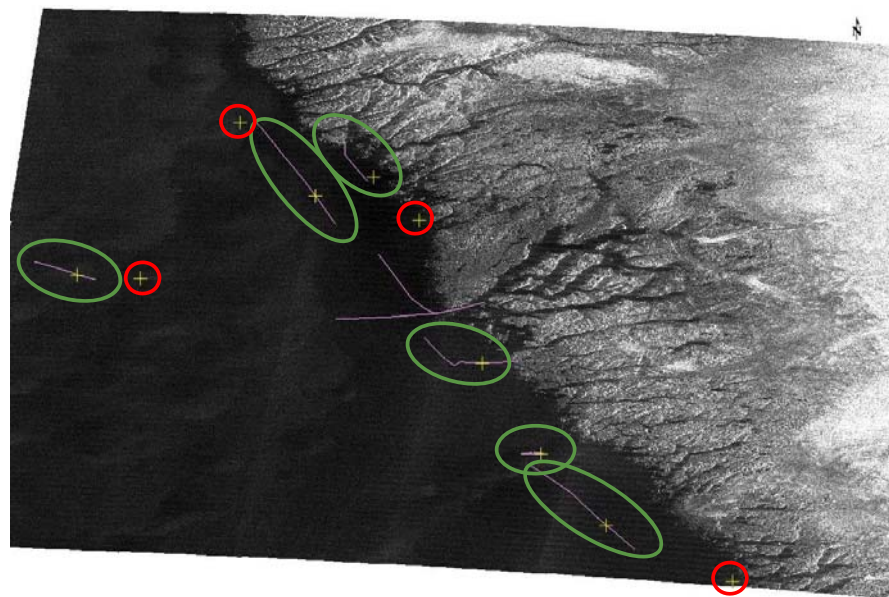


SAR, detected ships and AIS data

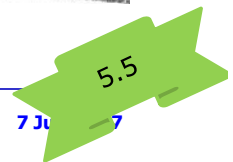


# 船舶検出

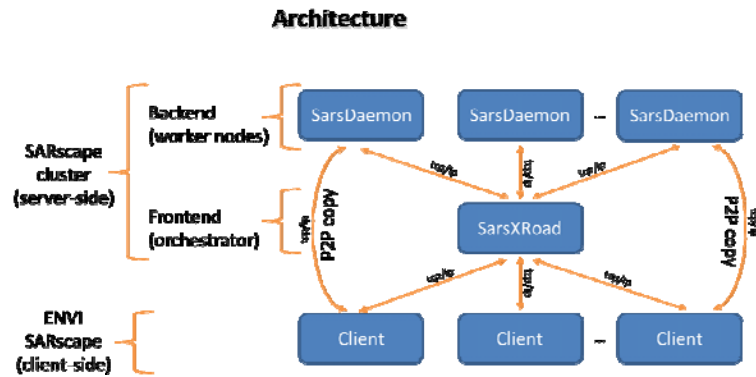
- + SAR
- AIS
- 照合
- ???????



SARで検出された船舶とAISデータ



## SARscape cluster

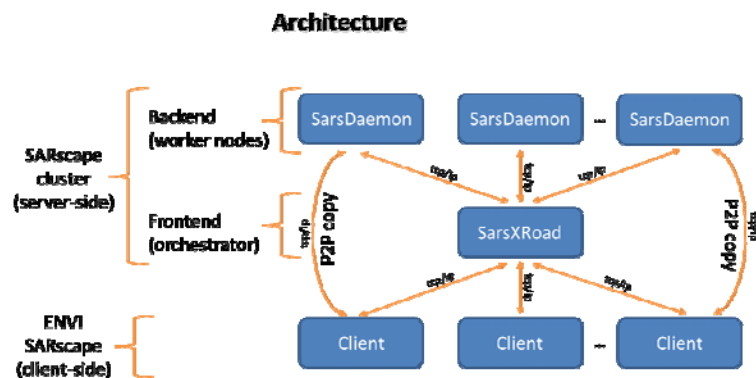


- SBAS
- CCD
- PS
- ITS
- ....

5.4.1

5.5

## SARscape クラスタ



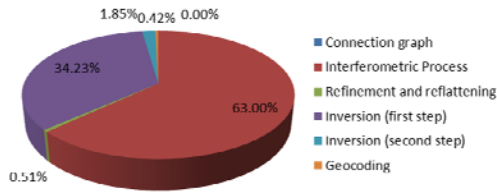
- SBAS
- CCD
- PS
- ITS
- ....

5.4.1

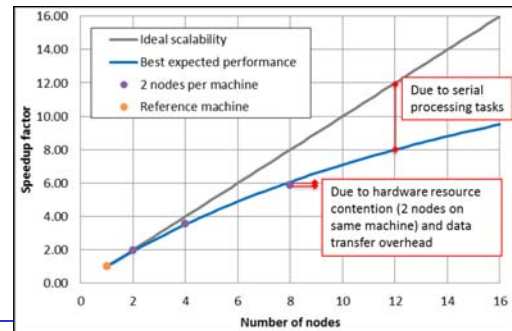
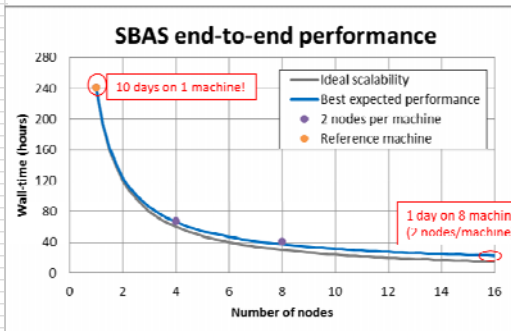
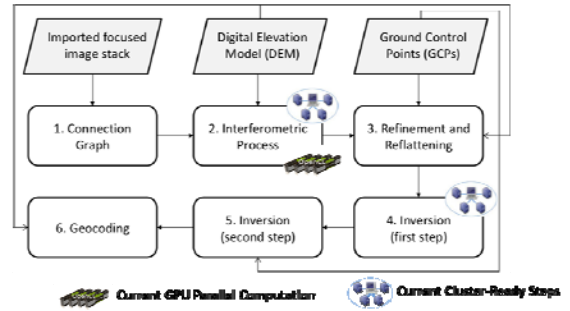
5.5

# SBAS cluster

## SBAS sequential processing time breakdown

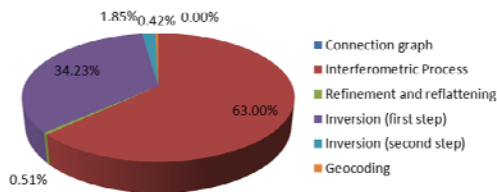


## Architecture

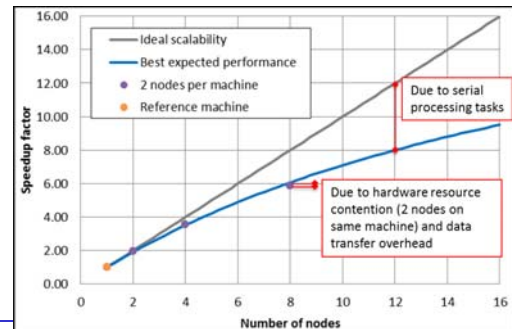
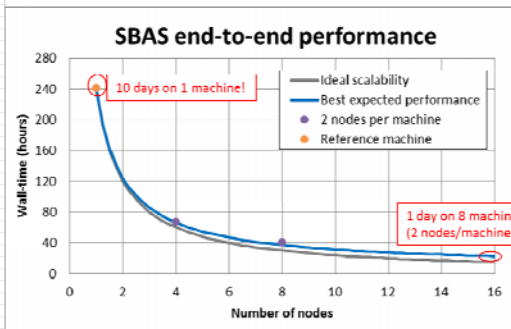
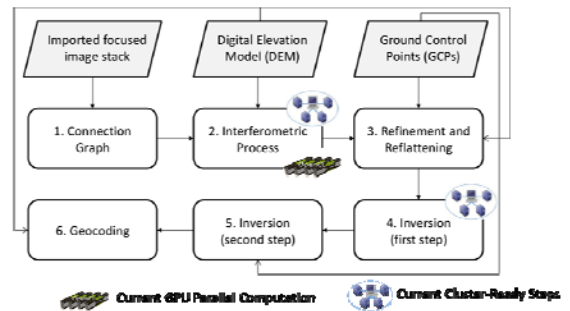


# SBAS クラスタ

## SBAS sequential processing time breakdown

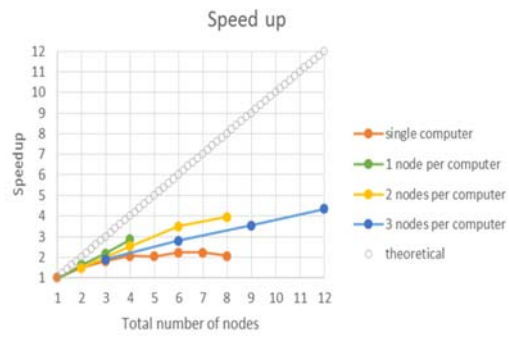
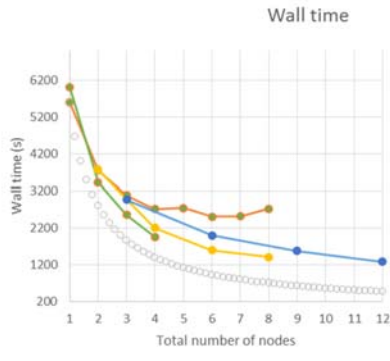
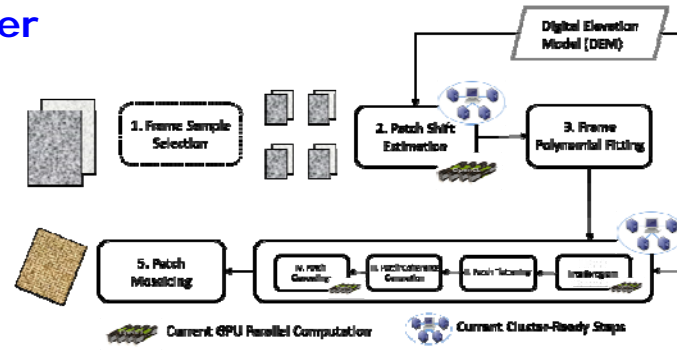


## Architecture

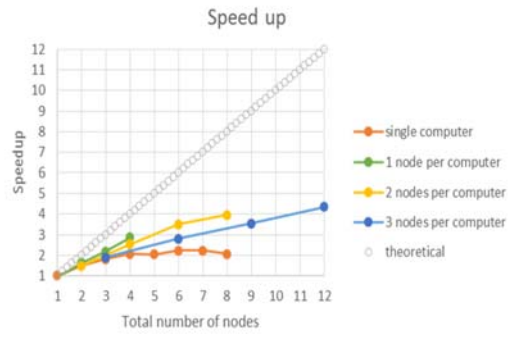
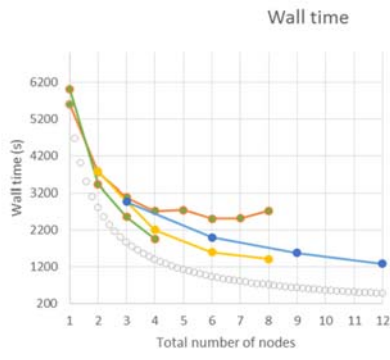
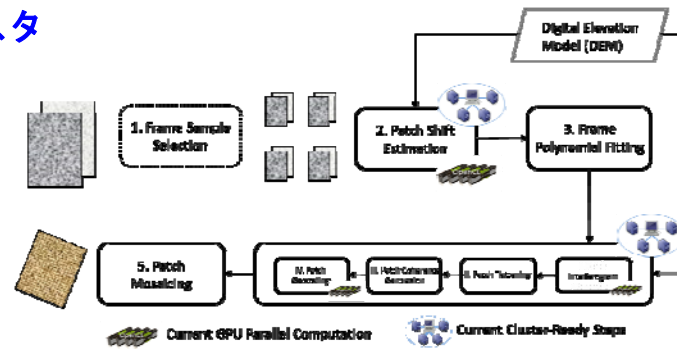




# CCD cluster

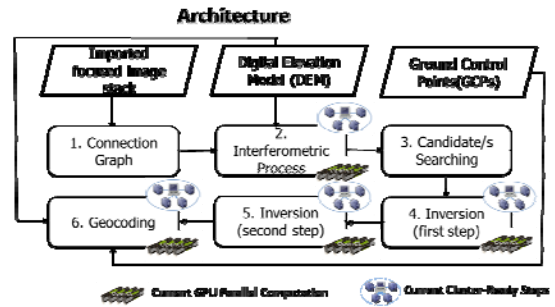
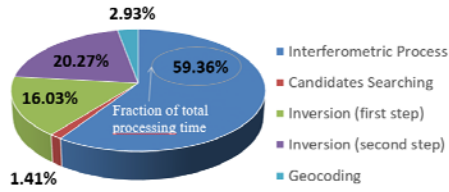


# CCD クラスタ

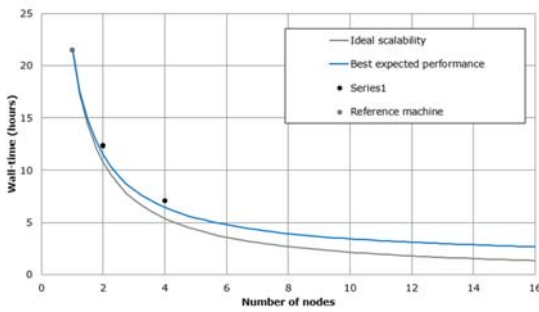


# PS cluster

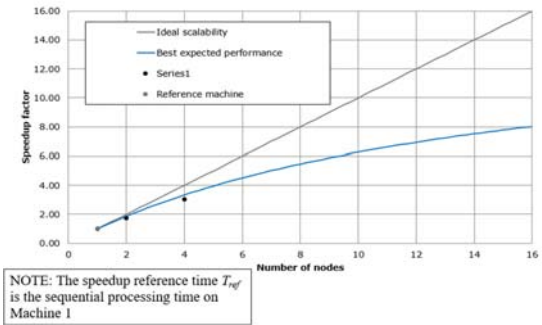
SBAS sequential processing time breakdown



PS end-to-end performance

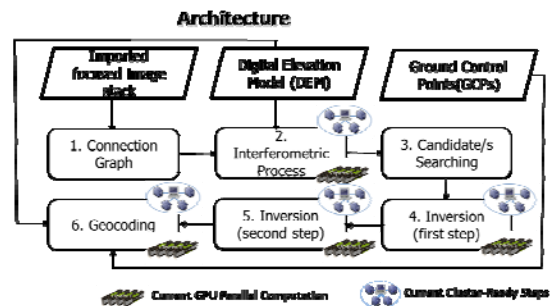
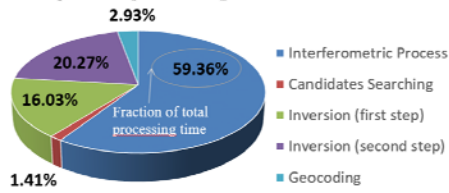


PS end-to-end performance

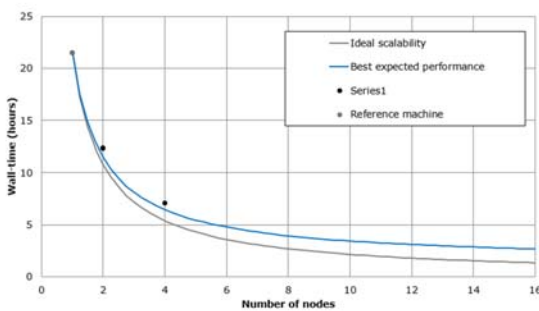


# PS クラスタ

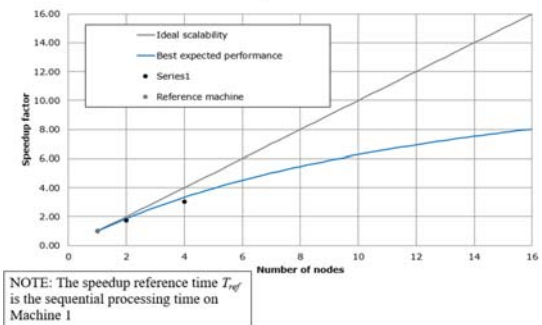
SBAS sequential processing time breakdown



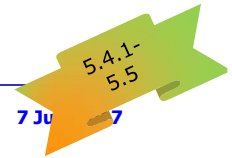
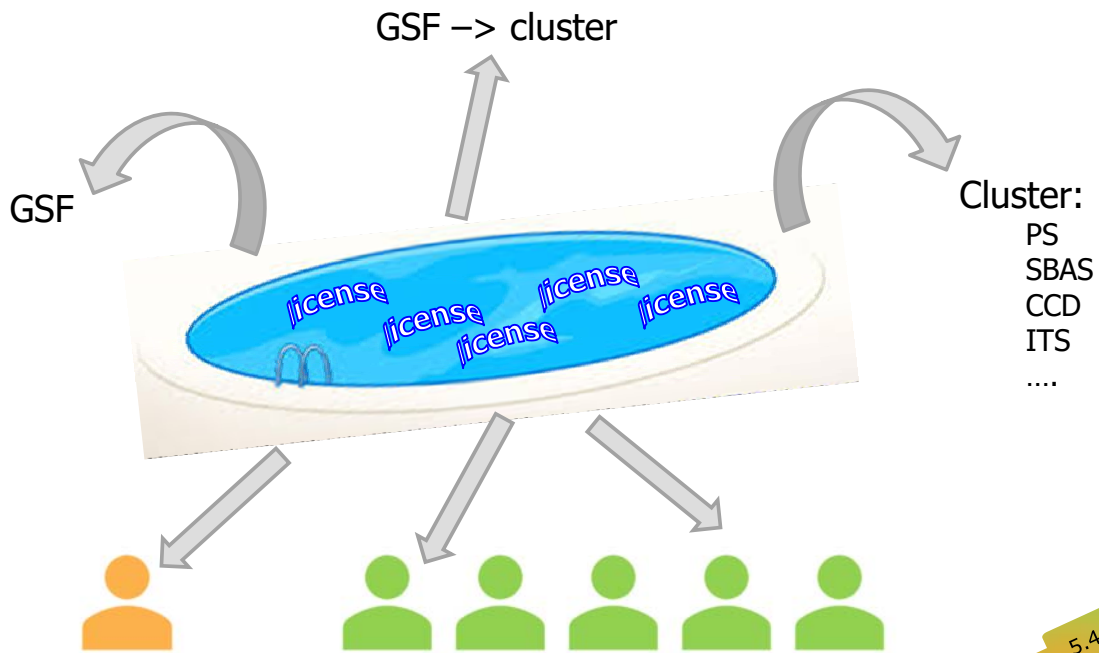
PS end-to-end performance



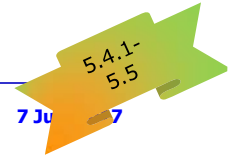
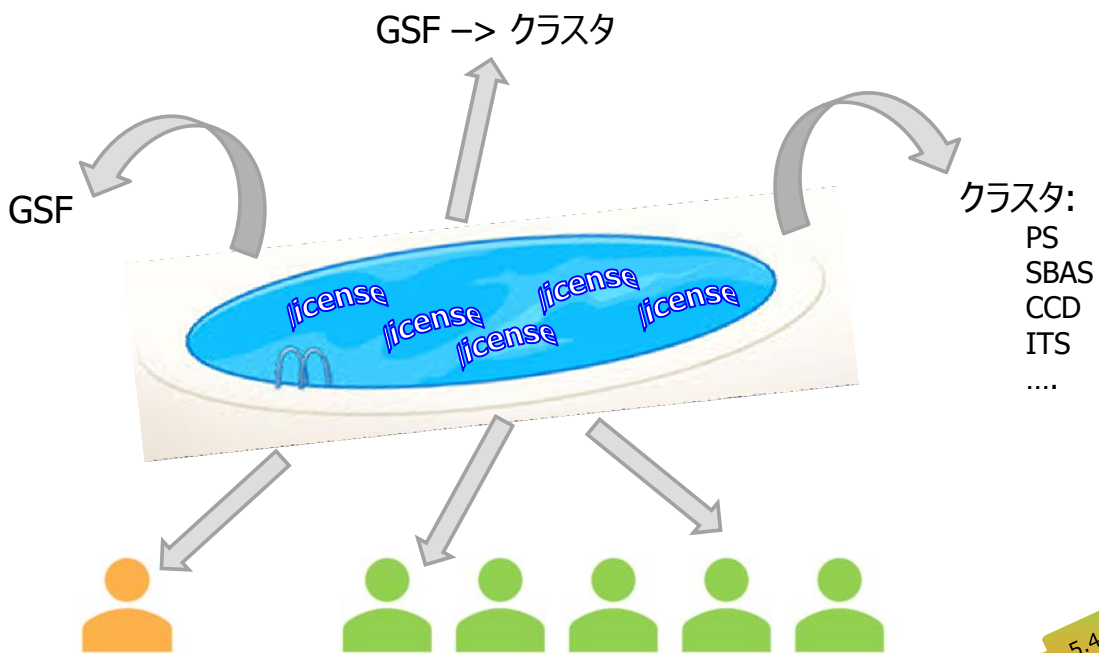
PS end-to-end performance



## Cluster – GSF computing licenses pool



## クラスタ – GSF 演算ライセンスプール



# 有難う 御座います!!

# 有難う 御座います!!