

AMSTer : SAR & InSAR Automated Mass processing Software for Multidimensional Time series

Nicolas d'Oreye^{1,2}, Dominique Derauw^{3,4}, Sergey Samsonov⁵,
Delphine Smittarello¹, Maxime Jaspard¹, Gilles Celli¹

ndo@ecgs.lu
amster@ecgs.lu



1 European Centre for Geodynamics and Seismology (ECGS), 19 rue Josy Welter, L-7256 Walferdange, Luxembourg

2 National Museum of Natural History (NMNH), 19 rue Josy Welter, L-7256 Walferdange, Luxembourg

3 Centre Spatial de Liège (CSL), Avenue du Pré Aily, B-4031 Angleur, Belgium

4 SAREOS, 1 Rue des Violettes, 4557 Fraiture, Belgium

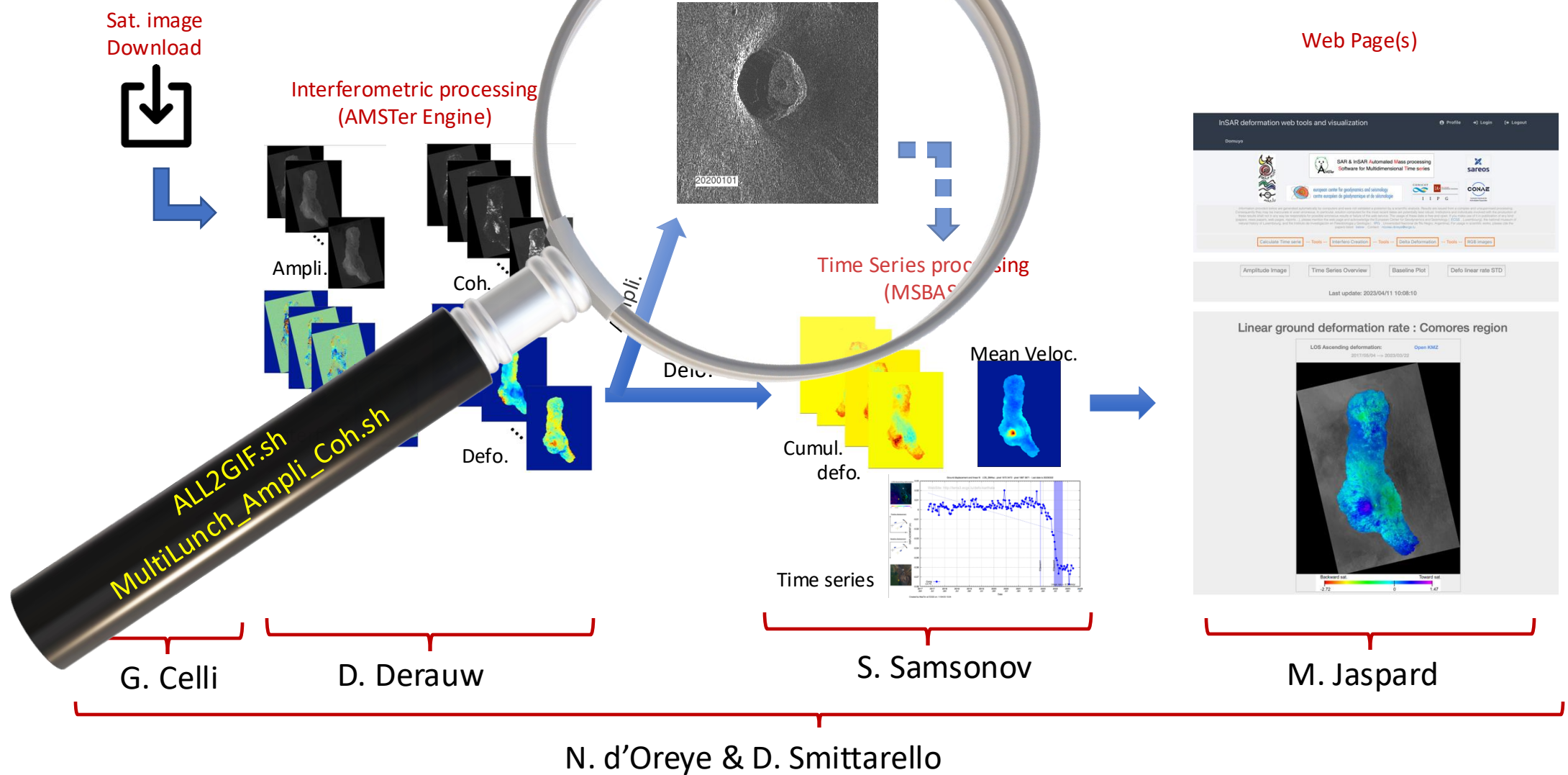
5 Canada Centre for Mapping and Earth Observation, Natural Resources Canada (NRCAN), 560 Rochester Street, Ottawa, ON K1A 0E4, Canada

Amplitude time series

Nicolas d'Oreye



Master Toolbox





Amplitude Time Series

Plan: Why amplitude (coherence) time series ?

Only the amplitude in Slant Range + gif animation tagged with date :

- ALL2GIF.sh
- Corner offset
- Pixel shape
- Warning : hard coded lines
- How geocode results

Amplitude and Coherence maps in slant range and geographical coord:

- MultiLaunch_Ampli_Coh.sh

Other scripts:

- For only one amplitude image: *MakeAmpliPlotSingleImg.sh*
- For time series of other products: *AllProd2GIF.sh*
- RGB composition:



Amplitude Time Series

Why amplitude (and/or coherence) time series ?

- Geomorphological changes
- Wild fires or inundations
- Land cover changes
- Height measurements from shadows
- Pixel tracking

Amplitude Time Series

Why amplitude (coherence) time series ?

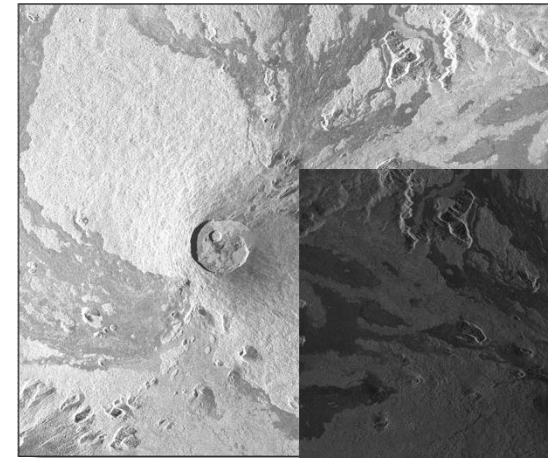
Only the amplitude in Slant Range + gif animation tagged with date:

- *ALL2GIF.sh*
 - Corner offset
- If some images cause problem, check [_List_Az_Rg_UpperLeft_coord.txt](#) for pairs whose Upper right range and azimuth coordinate are not as expected (that is not the same as in [_SizeOfCroppedAreaOfInterest.txt](#)).

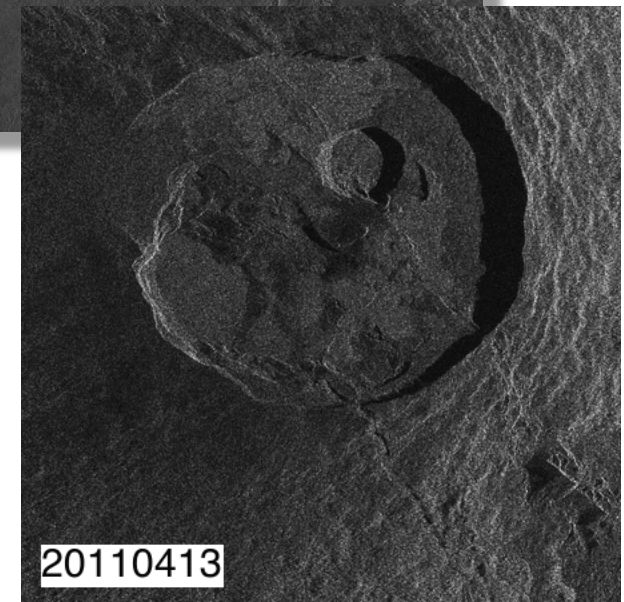
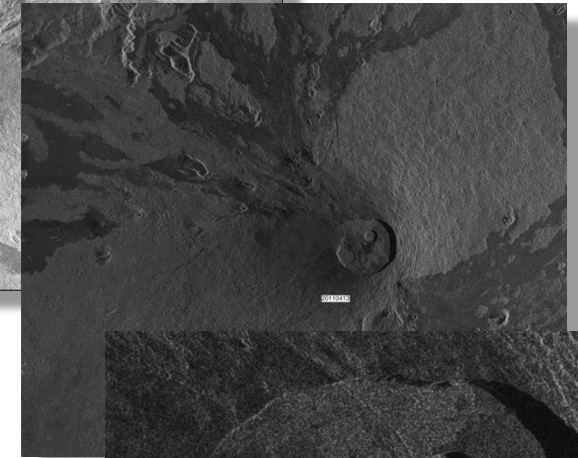
Either discard these wrong images or try to adjust the parameters

LLRGCO and LLAZCO in [LaunchMTparam.txt](#)

(See manual § 3.2)



CSK descending,
Nyamulagira volcano.



```

61
62 # INSAR
63 #####
64 DEFO      # PROCESSMODE, DEFO to produce DInSAR or TOPO to produce DEM (used only in SinglePair.sh)
65 VV        # INITPOL, For multi pol images; force polarisation at initInSAR for InSAR processing. If it does not exists it will find the first compatible MAS-SLV pol.
66 50        # LLRGCO, Lower Left Range coord offset for final interferometric products generation. Used in SinglePairNoUnwrap only for Shadow measurements
67 50        # LLAZCO, Lower Left Azimuth coord offset for final interferometric products generation. Used in SinglePairNoUnwrap only for Shadow measurements
68

```


Why amplitude (coherence) time series ?

Only the amplitude in Slant Range + gif animation tagged with date:

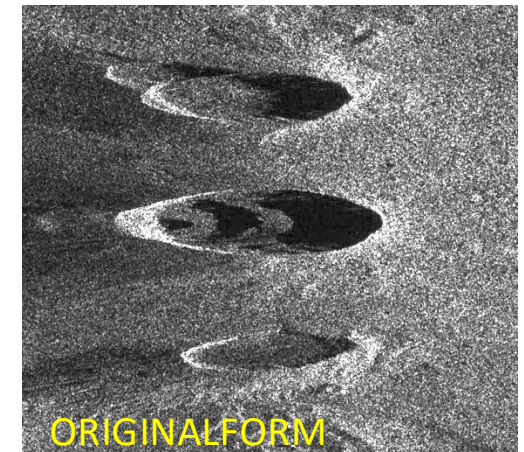
- ALL2GIF.sh
 - Corner offset
 - Pixel shape
- In [LaunchMTparam.txt](#), the parameter **PIXSHAPE** let you decide if you want
- to multilook your images in Range and Azimuth so that the final pixels look square, or
 - to compute your image while keeping the original form.
- **SQUARE** is easier to visualise
- **ORIGINALFORM**: pixel shape may allow to keep highest resolution e.g. for shadow length measurements

```

42
43 # AMPLITUDE
44 #####
45 4          # MLAMPLI, Multilooking factor for amplitude images reduction (used for coregistration - 4-6 is appropriate).
46             # If rectangular pixel, it will be multiplied by corresponding ratio.
47 SQUARE    # PIXSHAPE, pix shape for product : SQUARE, ORIGINALFORM, SQUAREUNITY or ORIGINALFORMUNITY
48 SIGMANO   # CALIBSIGMA, if SIGMAYES it will output sigma nought calibrated amplitude file (for S1 only)
49
50 # COARSE COREG
51 #####
52 64         # CCOUNTIN, Coarse coreg window size (64 by default but may want less for very small area). Can be set to 0 to skip

```

S1 Desc 21 flopped image
Nyiragongo crater



Why amplitude (coherence) time series ?

Only the amplitude in Slant Range + gif animation tagged with date:

- ALL2GIF.sh
- Corner offset
- Pixel shape
- **Warning** : hard coded lines

ALL2GIF.sh contains hardcoded lines:

- The destination of computed amplitude images:
ROOTTARGETDIR=\${PATH_1650}/SAR_SM/AMPLITUDES

```
45 echo " "
46
47 SUPERMASTERINPUT=$1      # Date of SuperMaster
48 PARAMFILE=$2              # parmeters file
49 LABELX=$3                 # position of the date label in jpg fig of mod
50 LABELY=$4                 # position of the date label in jpg fig of mod
51
52 # vvv ----- Hard coded lines to check --- vvv
53 source $HOME/.bashrc
54 # Setup disk paths for processing in Luxembourg. Adjust accordingly if you run several
55 ROOTTARGETDIR=${PATH_1650}/SAR_SM/AMPLITUDES
56
57 # See also case at the end
58 # ^^^ ----- Hard coded lines to check -- ^^^
59
```

- The size and position of the gif crop

```
129 # some crops as XxY size+X+Y offset (i.e. offset = upper left corner coord as displayed e.g. with Fiji)
130 # Adjust crop e.g. by testing on a jpg file as follow: convert 20160105.HH.mod.flop.jpg -crop 450x450+1435+1010 +repage 20160105.HH.mod.flopCROP.jpg
131 Cp_Ampli.sh ${TARGETDIR}
132 CheckAreaOfInterest_InAmplitudesDir.sh
133
134 cd _AMPLI
135 jpg2movie_gif.sh ${SAT} ${TRK} ${REGION}
136
137 # some crops as XxY size+X+Y offset (i.e. offset = upper left corner coord as displayed e.g. with Fiji)
138 # Adjust crop e.g. by testing on a jpg file as follow: convert 20160105.HH.mod.flop.jpg -crop 450x450+1435+1010 +repage 20160105.HH.mod.flopCROP.jpg
139 case "${SAT}_${TRK}_${REGION}" in
140     "S1_DRC_NyigoCrater_A_174_Nyigo_crater_originalForm")
141         convert _movie_${SAT}_${TRK}_${REGION}.gif -coalesce -crop 270x270+4175+130 +repage _movie_${SAT}_${TRK}_${REGION}_Crop_NyigoCrater.gif
142         rm -f _movie_${SAT}_${TRK}_${REGION}.gif ;;
143     "S1_DRC_NyigoCrater_D_21_Nyigo_Nyam_crater_originalForm")
144         convert _movie_${SAT}_${TRK}_${REGION}.gif -coalesce -crop 200x200+3580+950 +repage _movie_${SAT}_${TRK}_${REGION}_Crop_NyigoCrater.gif
145         rm -f _movie_${SAT}_${TRK}_${REGION}.gif ;;
146     "S1_DRC_NyamCrater_A_174_Nyam_crater_originalForm")
147         convert _movie_${SAT}_${TRK}_${REGION}.gif -coalesce -crop 260x280+4030+560 +repage _movie_${SAT}_${TRK}_${REGION}_Crop_NyamCrater.gif
148         rm -f _movie_${SAT}_${TRK}_${REGION}.gif ;;
149
```




Amplitude Time Series

Why amplitude (coherence) time series ?

Only the amplitude in Slant Range + gif animation tagged with date:

- ALL2GIF.sh
- Corner offset
- Pixel shape
- Warning : hard coded lines
- **How geocode results**

If you need to geocode your results, this can be performed using the script ***Geocode_from_ALL2GIF.sh***.

It must be launched in the [.../SAR_SM/AMPLITUDES/SAT/TRK/REGION/](#) directory with a parameter file containing the desired details of the geocoding.

This parameter file has a structure slightly different from [LaunchMTparam.txt](#) files.

See template in [___V20200812_LaunchParamReGeocAmpli.txt](#).

However, note that the script we will see next is doing it directly...

Why amplitude (coherence) time series ?

Only the amplitude in Slant Range + gif animation tagged with date

Amplitude and Coherence maps in slant range and geographical coord:

- **MultiLaunch_Ampli_Coh.sh**
- Unlike ***ALL2GIF.sh***, which computes all the images with the Global Primary (Super Master), the script will run a series of ***SinglePair.sh*** using a list of pairs (several list formats are possible – [see manual §3.5](#))
- It will compute **amplitude** and (masked or unmasked) **coherence** images in **slant range** and in **geographical coordinates**
It will create
 - Amplitude images as Real32 binary matrix (+ ascii header) in radar geometry, stored in
_ALL_COH_SLANTRG
_ALL_AMPLI_SLANTRG (and/or **_ALL_AMPLI_SIGMA_SLANTRG** for S1 IW)
 - Amplitude images as Real32 binary matrix (+ ascii header) in radar geometry , stored in
_ALL_COH_GEOC
_ALL_AMPLI_GEOC (or **_ALL_AMPLI_SIGMA_GEOC** for S1 IW)
- See [manual §3.5](#) for syntax etc...



Amplitude Time Series

Why amplitude (coherence) time series ?

Only the amplitude in Slant Range + gif animation tagged with date

Amplitude and Coherence maps in slant range and geographical coord

Other scripts:

- For only one amplitude image: **MakeAmpliPlotSingleImg.sh**
 - **MakeAmpliPlotSingleImg.sh** allows to create an amplitude images for only one image, e.g.
 - if only one image is available (no pair possible),
 - if no coregistration on a Global Primary (Super Master) is required, or
 - if speed is important, as it skips all processes other than what is needed to just compute the amplitude.
 - It requires a slightly different [LaunchMTparameter.txt](#). See template in [___V20220719_LaunchParamAmpli.txt](#)
 - See [manual § 3.6](#) for more information



Amplitude Time Series

Why amplitude (coherence) time series ?

Only the amplitude in Slant Range + gif animation tagged with date

Amplitude and Coherence maps in slant range and geographical coord

Other scripts:

- For only one amplitude image: *MakeAmpliPlotSingleImg.sh*
- For time series of other products: *AllProd2GIF.sh*

➤ *AllProd2GIF.sh* allows to create a gif animation with the geocoded product:

- Coherence maps
- Residual interferograms
- Deformation maps
- Amplitude

from all the pairs in the current directory.

➤ See **script** for more information



Amplitude Time Series

Why amplitude (coherence) time series ?

Only the amplitude in Slant Range + gif animation tagged with date

Amplitude and Coherence maps in slant range and geographical coord

Other scripts:

- For only one amplitude image: *MakeAmpliPlotSingleImg.sh*
- For time series of other products: *AllProd2GIF.sh*
- **RGB composition:**

- ***AmpAmpAmp.sh*** allows to create a RGB composition by combining 2 amplitude maps (amp1 amp2 amp2) using Fiji.
It requires amplitude images in ENVI format.
- ***AmpAmpCoh.sh*** allows to create a RGB composition by combining 2 amplitude maps and a coherence image (amp1 amp2 coh) using Fiji.
It requires amplitude images in ENVI format.
- These are useful tools to track changes occuring between images such as flooding, lava flows emplacements etc...

Amplitude Time Series

Plan: Why amplitude (coherence) time series ?

Only the amplitude in Slant Range + gif animation tagged with date :

- ALL2GIF.sh
- Corner offset
- Pixel shape
- Warning : hard coded lines
- How geocode results

- DONE ! -

Amplitude and Coherence maps in slant range and geographical coord:

- MultiLaunch_Ampli_Coh.sh

Other scripts:

- For only one amplitude image: *MakeAmpliPlotSingleImg.sh*
- For time series of other products: *AllProd2GIF.sh*
- RGB composition: