Mimtpy Introduction

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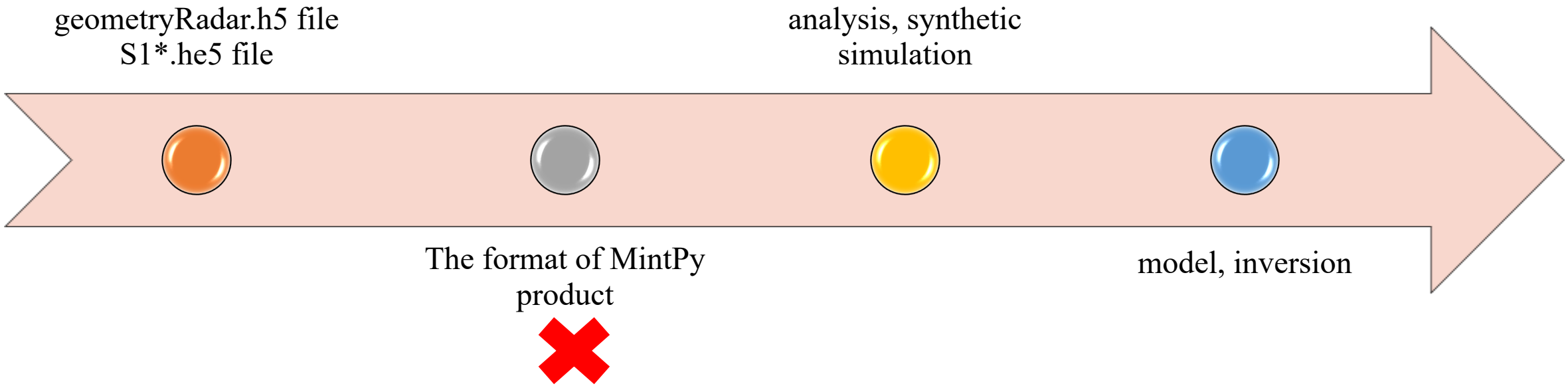
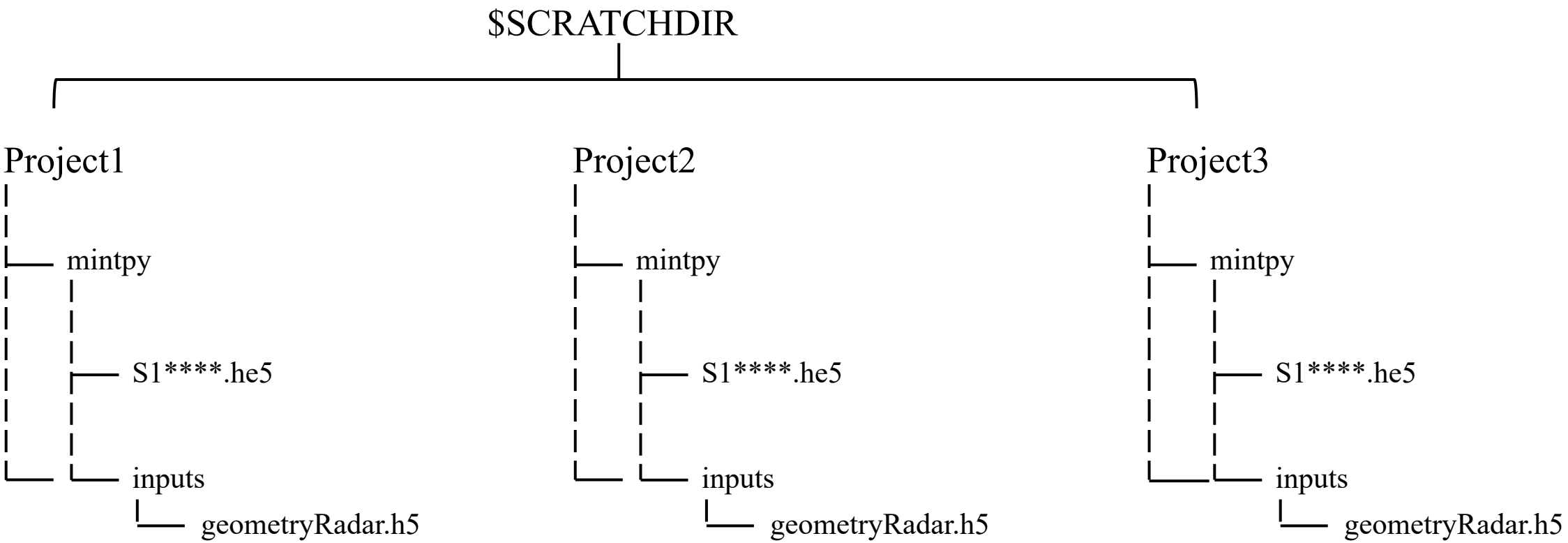
5 November 2020

Why MimtPy?

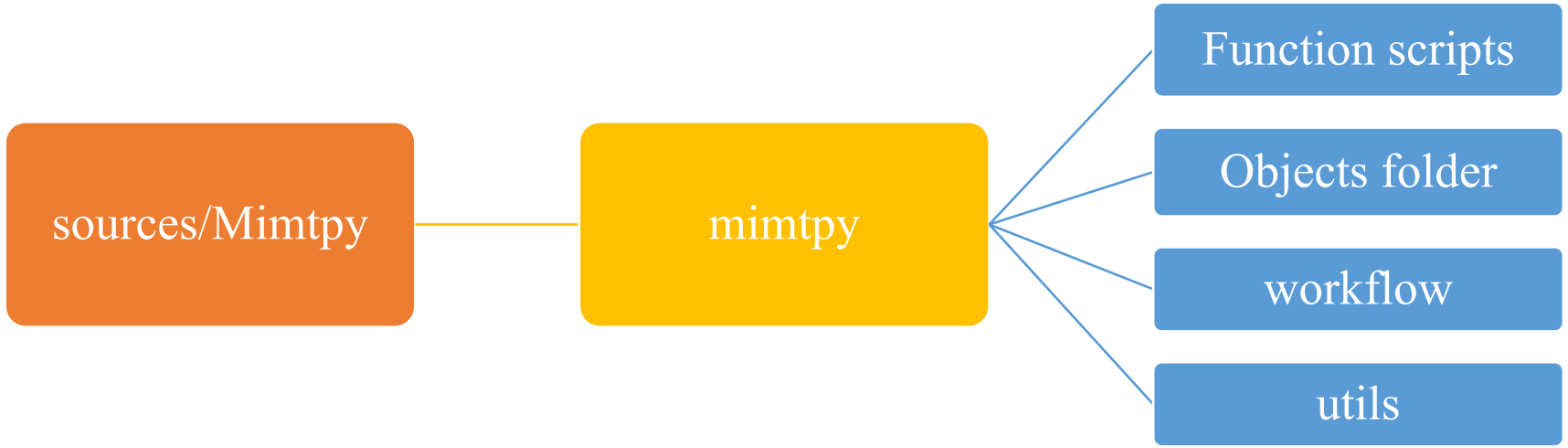

geometryRadar.h5 file
S1*.he5 file
analysis, synthetic
simulation
The format of MintPy
product
model, inversion

Pre-requirement of MimtPy



How to use MimtPy

- The organization of MimtPy:



- Add environment settings in environment.bash file:
  - ✓ For Processing part:

    export MIMTPY_HOME=${RSMASINSAR_HOME}/sources/MimtPy
  - ✓ PYTHON part:

    export PYTHONPATH=${PYTHONPATH}:${MIMTPY_HOME}
  - ✓ PATH part:

    export PATH=${PATH}:${MIMTPY_HOME}/mimtpy

- New packages:
  - ✓ rasterio
  - ✓ geopandas
  - ✓ osgeo

The composition of MimtPy

Basic module	Extract different dataset type from single or multiple S1*.he5 files
Analysis module	Profiles; hz/up resolve; concatenation; subtraction; footprint;
Preprocess module	Geodmod; insamp; kite
Tools module	Tools for process
Relax module	Synthetic data; grid search; ramp removal approach

Basic module

mimtpyApp.py mimtpyApp.template

✓ Scripts structure:

mimtpyApp.py

- HDFEOS_to_geotiff.py
- plot_geotiff.py
- track_offset.py
- generate_horzvert.py

✓ Template options:

mimtpyApp.template

- mimtpy.velcumu: Extract velocity or displacement for a given time period/whole time period
- mimtpy.plot: Plot the velocity/displacement field with/without *.shp data
- mimtpy.concatenation: Concatenation two adjacent track
- mimtpy.horzvert: Generate horizontal and vertical based on descending/ascending track

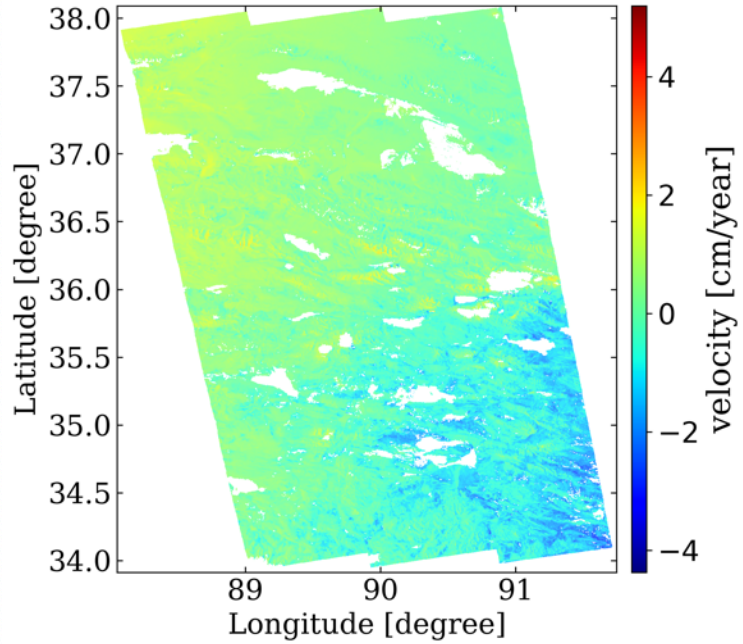
Single project

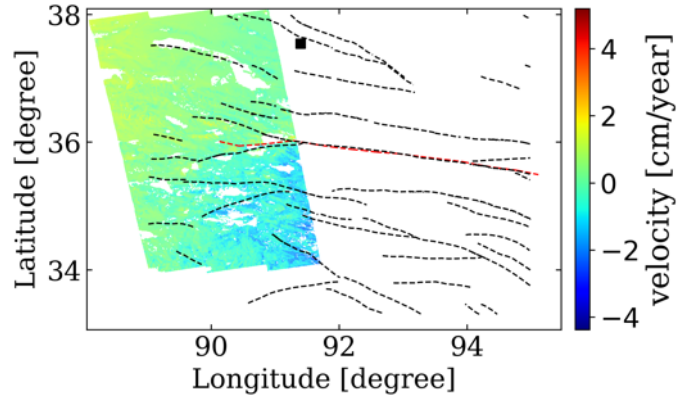
Multi projects

Basic module

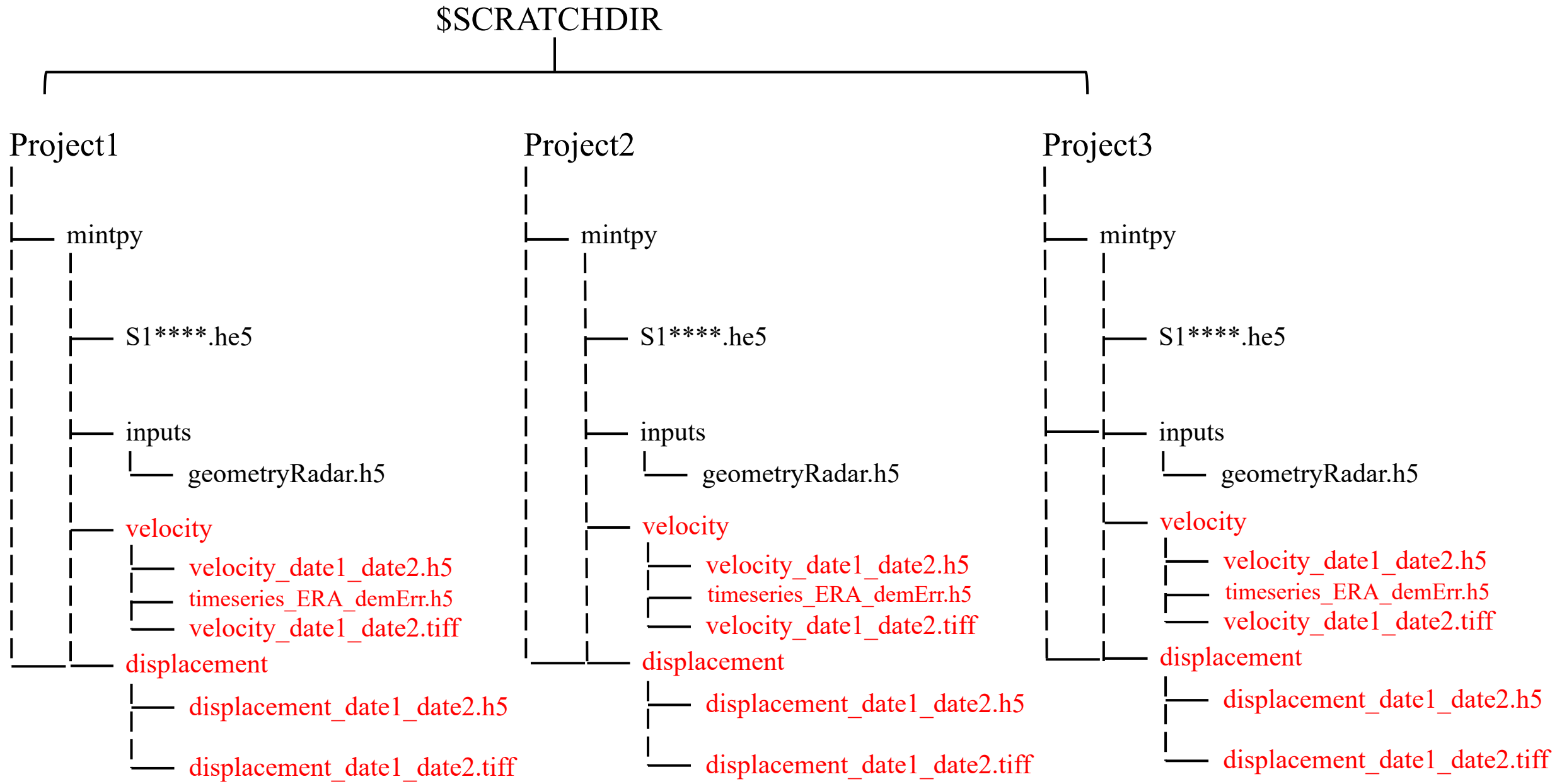
Single project

```
## processing template default setting
################################## velocity or cumulative Parameters ###################################
mimtpy.velcumu                          = no # yes or no
mimtpy.velcumu.DataSet                  = KokoxiliSenAT41
mimtpy.velcumu.type                     = velocity # velocity or displacement
mimtpy.velcumu.SNWE                     = None  # None or [34.2,35.2,45.0,46.3]
mimtpy.velcumu.startDate                = None # None or 20141012
mimtpy.velcumu.endDate                  = None # None or 20141012
mimtpy.velcumu.mask                     = y #y or n
################################## horz_vertParameters ###################################
mimtpy.horzvert                         = no # yes or no
mimtpy.horzvert.DataSet                 = KokoxiliSenAT70,KokoxiliSenDT150
mimtpy.horzvert.dataname                = velocity_20150205_20200714,velocity_20150131_20200627
mimtpy.horzvert.SNWE                    = 30.00,31.75,103.3,105.0 # None or [26.0,27.5,65.0,66.0]
mimtpy.horzvert.referencepoint          = 30.75,104  # None or 27.5,64.8
mimtpy.horzvert.azimuth                 = None # value or None
mimtpy.horzvert.outname                 = None  # None or [horizontal.h5,vertical.h5]
mimtpy.horzvert.outdir                  = $SCRATCHDIR/WenchuanSen/
################################## concatenation Parameters ###################################
mimtpy.concatenation                    = no # yes or no
mimtpy.concatenation.DataSet            = KokoxiliSenAT143,KokoxiliSenAT41
mimtpy.concatenation.dataname           = displacement_20141015_20200727,displacement_20141020_20200813
mimtpy.concatenation.rewrite            = n # y or n
mimtpy.concatenation.plotpair           = n #y or n
mimtpy.concatenation.azimuth            = 11 # degree, range:[0,pi)
mimtpy.concatenation.outname            = displacement_201410_202008 # None or name
mimtpy.concatenation.outdir             = $SCRATCHDIR/KokoxiliSenAT/
################################## plot Parameters ###################################################
mimtpy.plot                             = yes # yes or no
mimtpy.plot.type                        = velocity #[velocity/displacement]
mimtpy.plot.shpdir                      = /data/lxrtest/Kokoxili/shp/    # a dir or no
mimtpy.plot.fault                       = kokoxili_fault.shp,nearby_faults.shp
mimtpy.plot.fcolor                      = r,b          # r:red; b:black, y:yellow,o:orange;m:magenta
mimtpy.plot.fstyle                      = d,d              # d or s, d: dash s: solid
mimtpy.plot.refpoi                      = refpoi_AT.shp
```





Basic module



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mimtpy.plot.fcolor                          = r,b          # r:red; b:black, y:yellow,o:orange;m:magenta
mimtpy.plot.fstyle                          = d,d              # d or s, d: dash s: solid
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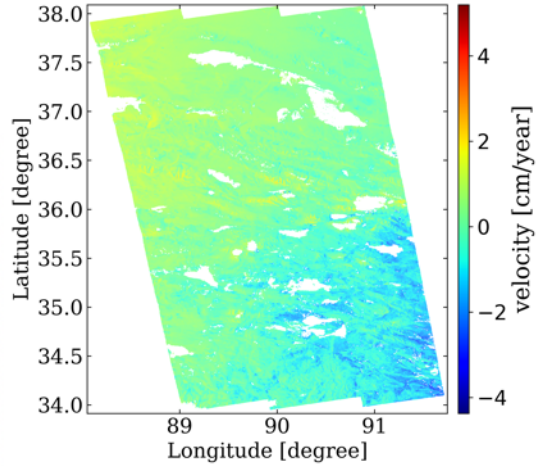

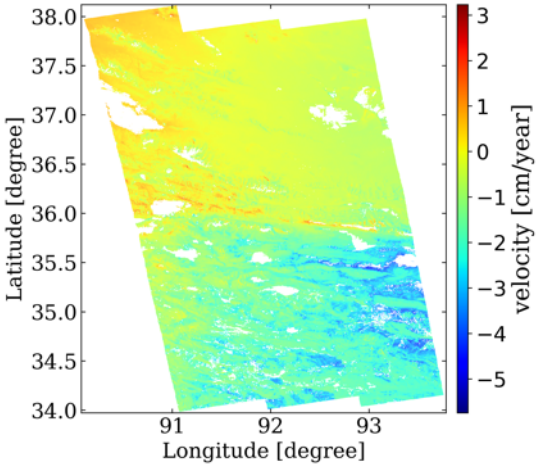

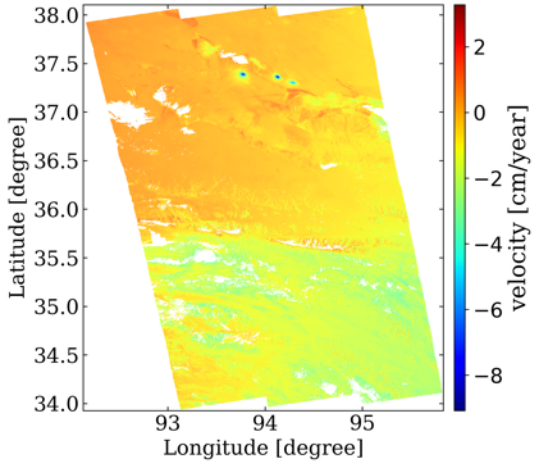

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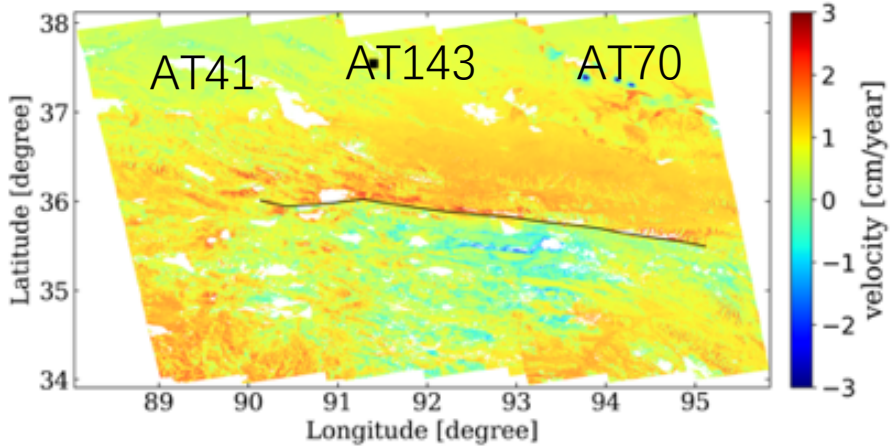
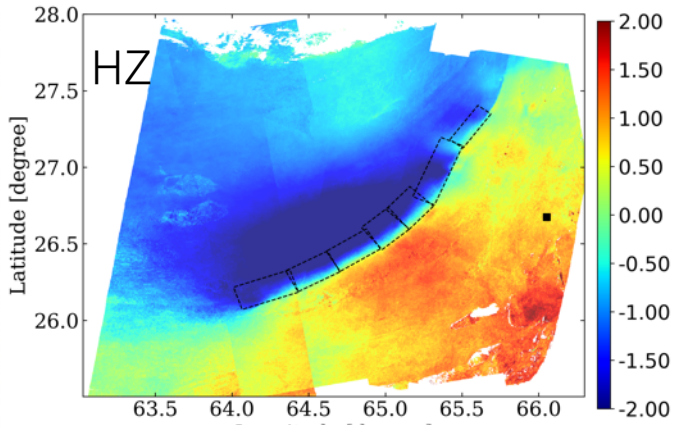
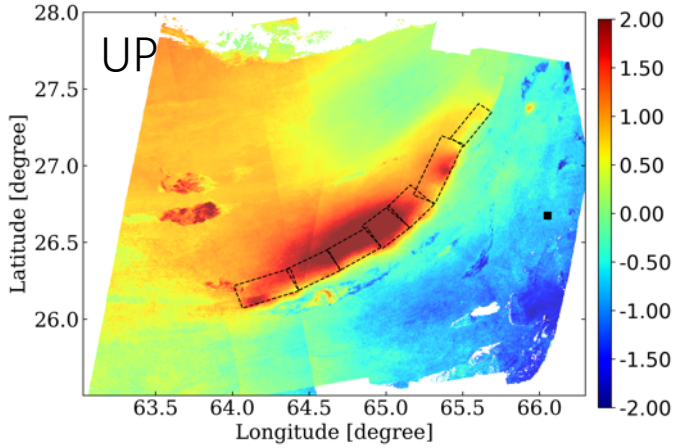
```





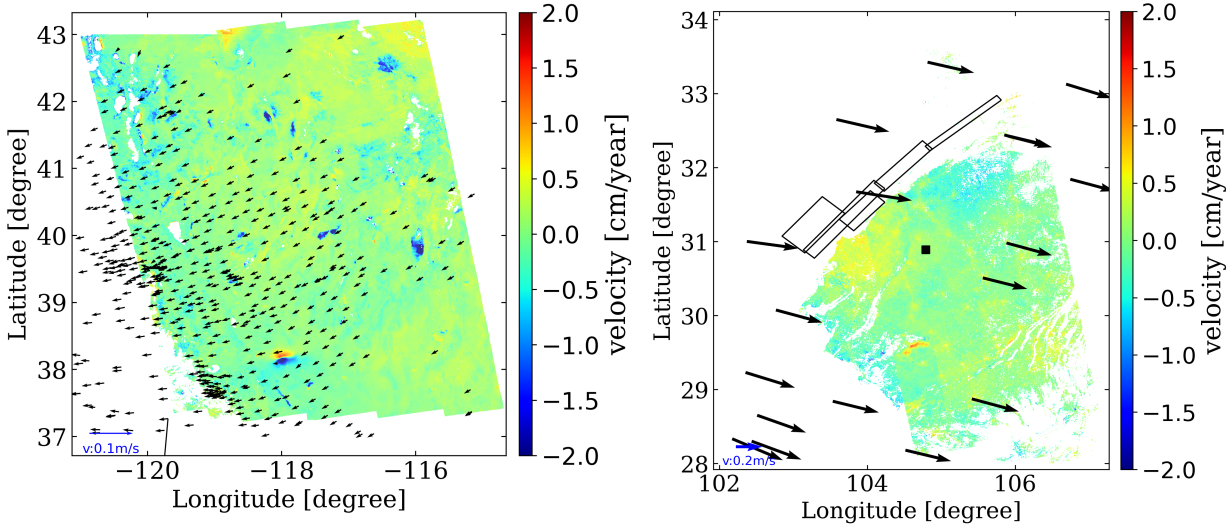


Concatenation: only for two tracks now;
Hz/up: for single track or concatenated tracks

Basic module

☐ plot_geotiff.py

- ✓ Choose whether plotting GPS data in the figure;
  - ➢ GPS data can be pointed by site name or plot all sites in the given spatial range;
  - ➢ GPS dataset comes from NGLStation or China GPS station, the latter can only not be used for other persons except people from Deqing Lab



☐ HDFEOS_to_geotiff.py

Besides velocity/displacement, other attributes in S1*.he5 file can also extracted using this script. The extracted data will be put into the directory:

Project/mintpy/Attribute_name/

Project1

- mintpy
  - ……
  - mask
    - mask.h5
  - velocity
    - velocity_date1_date2.h5
    - timeseries_ERA_demErr.h5
    - velocity_date1_date2.tiff

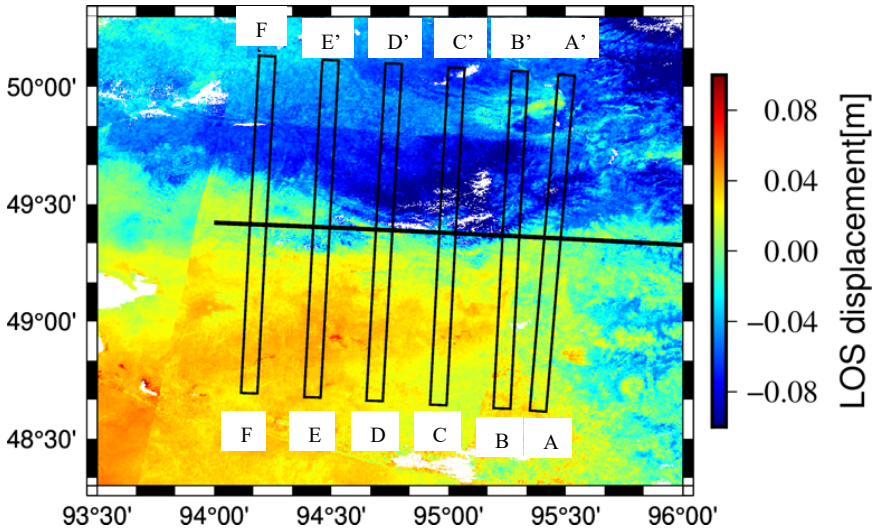
Analysis module

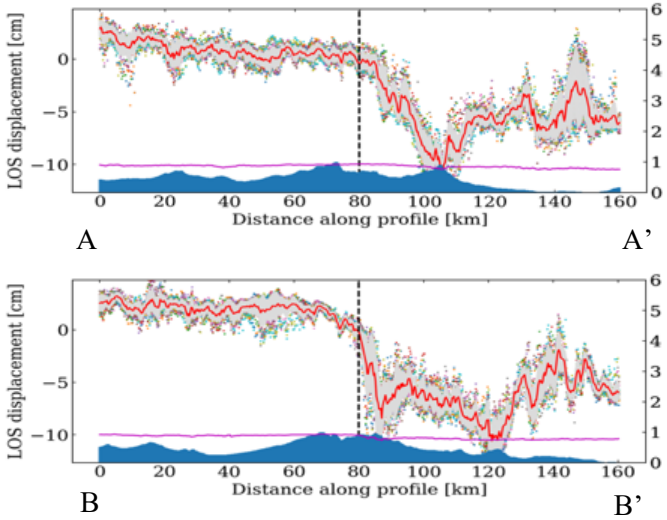
✓ Scripts

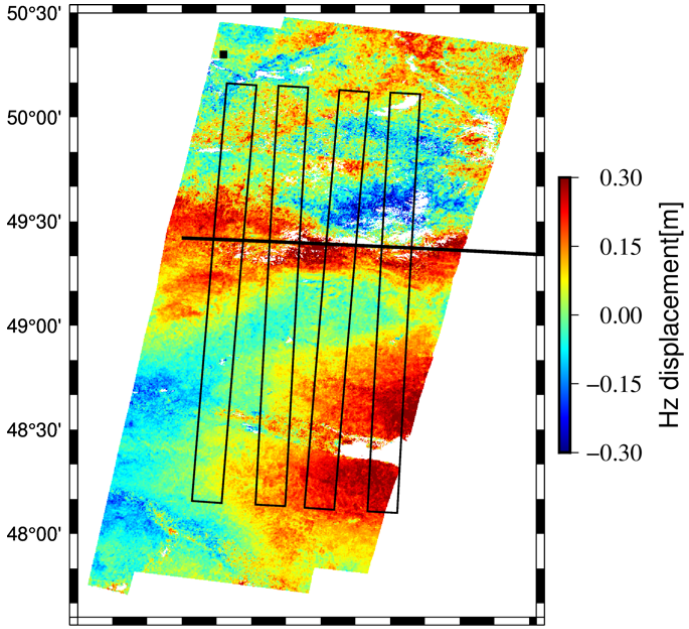
- multi_transects.py → Extract data along the profiles which are perpendicular to the fault
- overlap2horz_vert.py → Calculate horizontal and vertical value from the overlap region between adjacent tracks
- track_offset.py → Plot data of overlap region to compare the difference between adjacent tracks

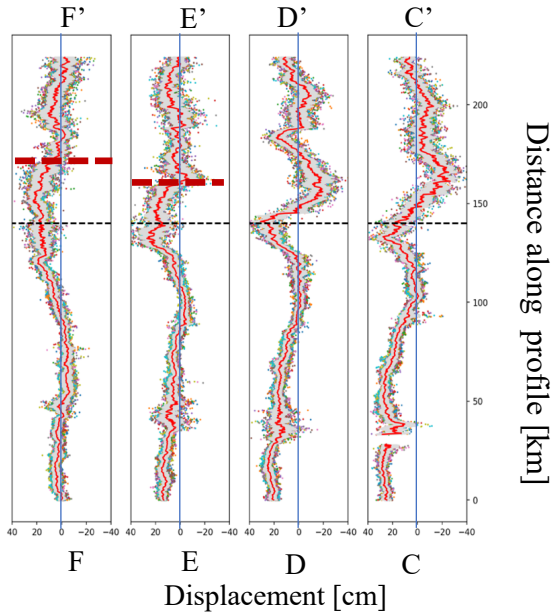
Analysis module

- ✓ multi_transects.py





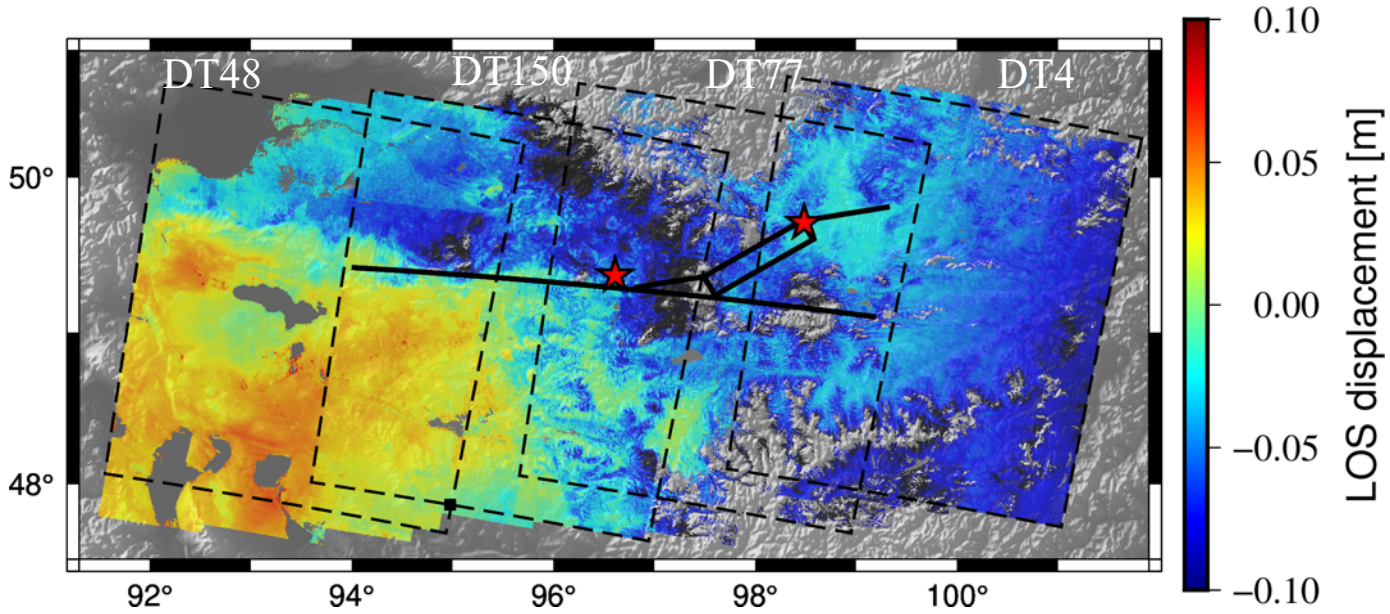


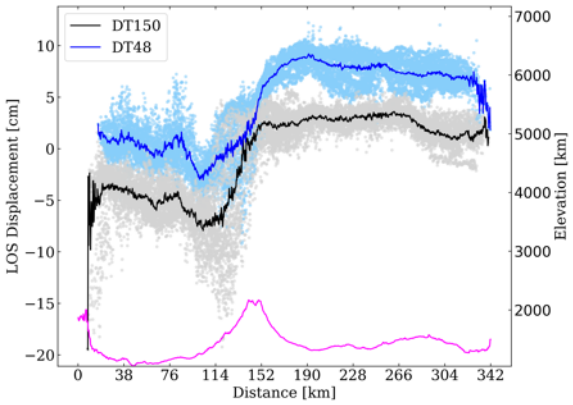


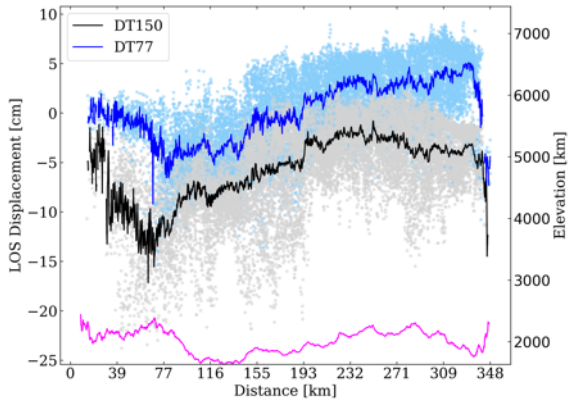
Data
Topography
Temporal coherence

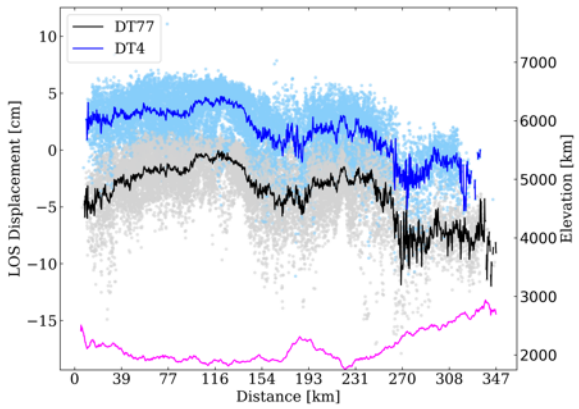
Analysis module

- ✓ track_offset.py



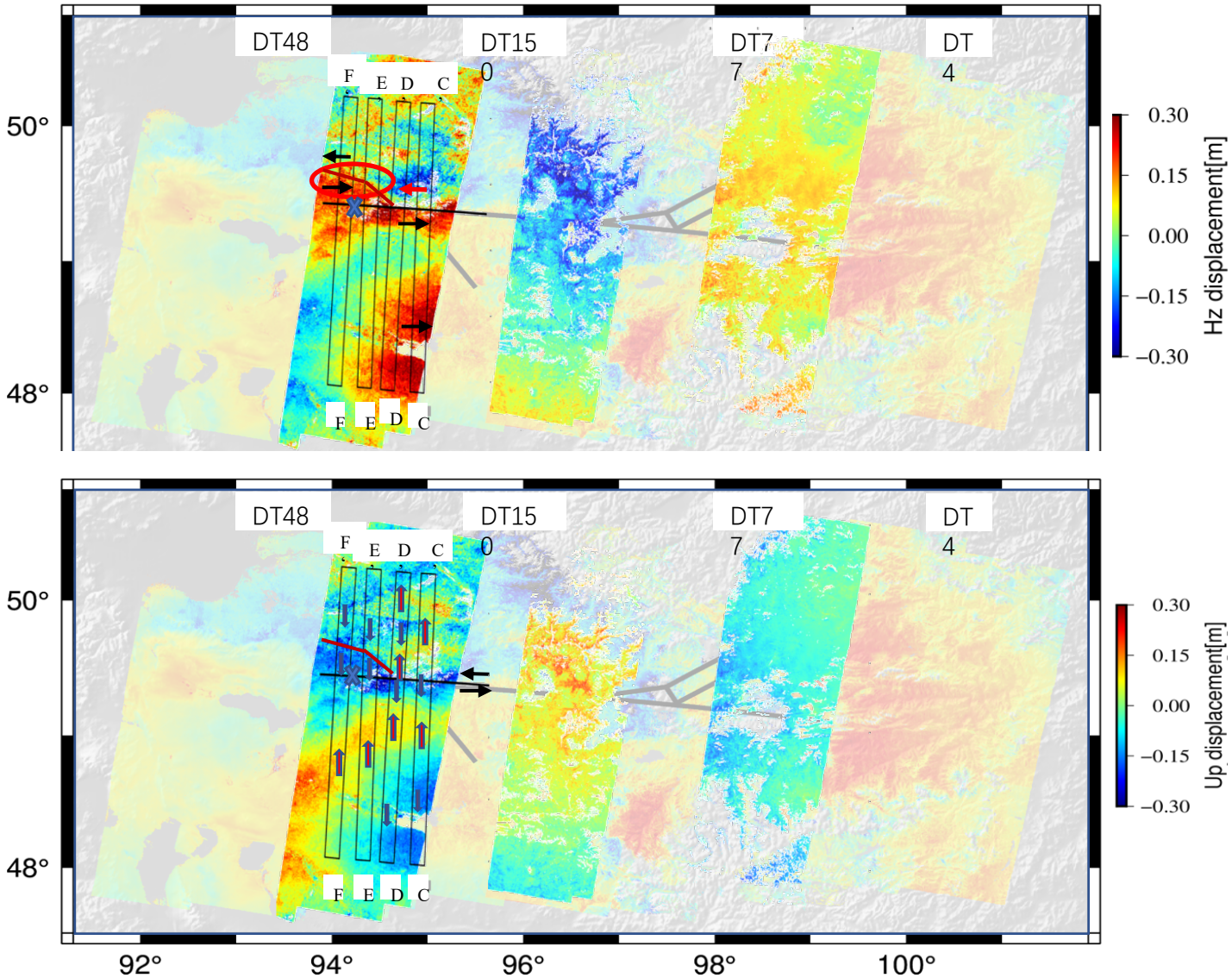






Analysis module

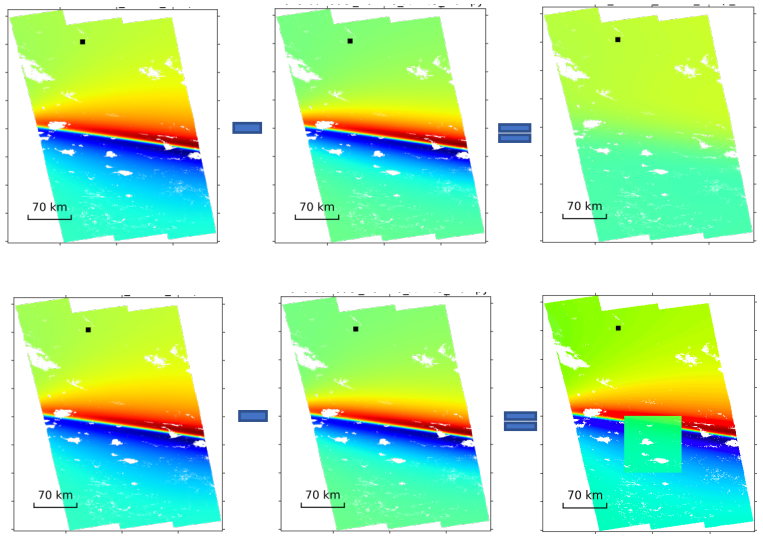
✓ overlap2horz_vert.py

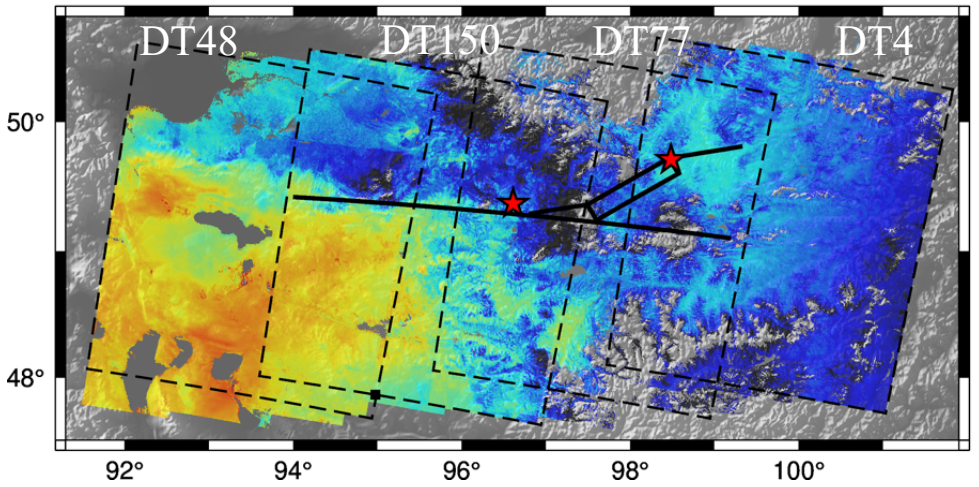


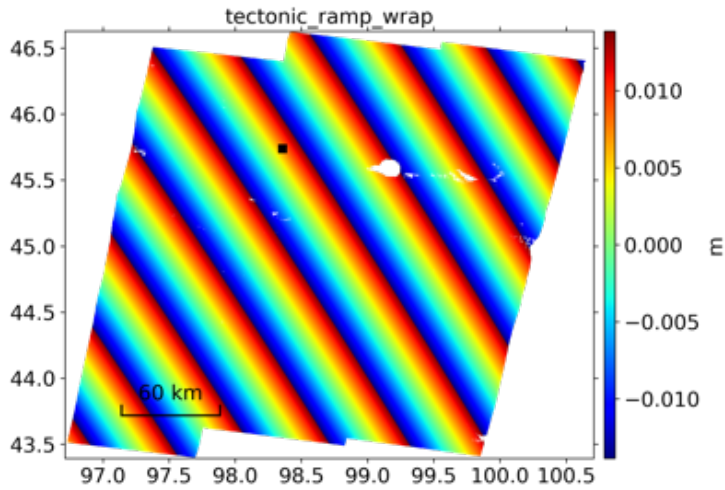
Tools module

✓ Scripts

subtract_h5.py	Subtract one data from the other data
generate_track_polygon.py	Get the footprint scene of each project
H5UNW_to_geotiff.py	Convert *.h5/*.unw file to *.geotiff file
generate_timeseries_from_HDFEOS.py	Extract timeseries.h5 file from S1*.he5 file
synthetic_S1.py	simulate linear ramps







Preprocess module

✓ Scripts

- save_geodmod.py → Prepare data for geodmod software
- save_kite.py
  quadtree_kite.py → Prepare data for Kite software and doing quadtree downsampling
- save_insamp.py → Prepare data for insamp software based on ROIPAC format

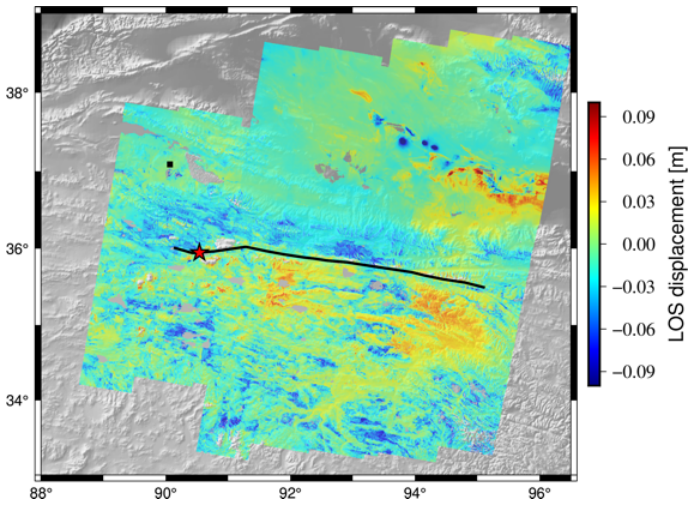
Relax module

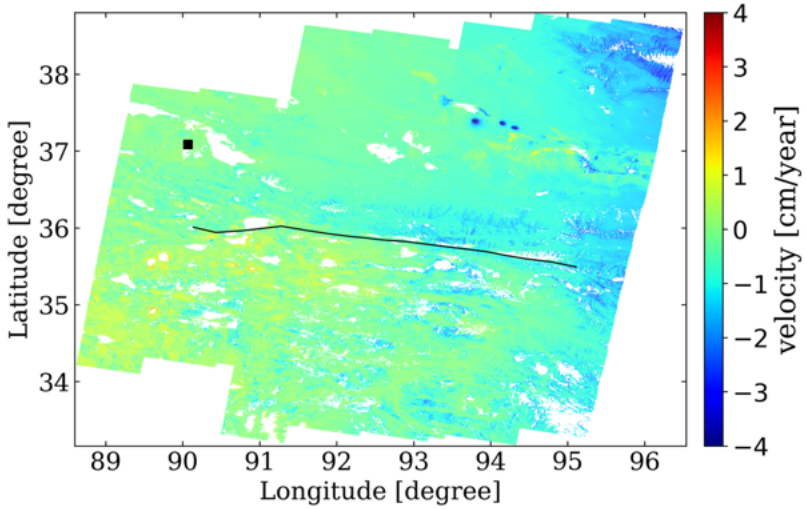
✓ Scripts

- generate_script_RELAX_V2.py → Generate script for Relax software
- gridsearch_ramps_batch_relax.py → Inverting optimal parameters using grid search algorithm with estimating ramps; using rms as judging index
  - gridsearch_ramps_relax.py
  - subtract_h5.py
- grid_search_RELAX.py → Inverting optimal parameters using grid search algorithm for down-sampling points; using misfit as judging index

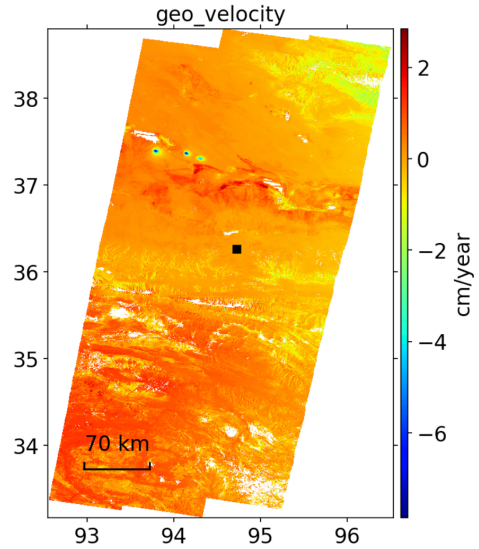
To do list

- ✓ Use pygmt package and covert the gmt bash scripts to python scripts.
- ✓ Combine RELAX post-process bash scripts and python scripts together.
- ✓ Add calculating horizontal and vertical displacement of overlapping region function to template.
- ✓ Add simulating quadratic ramps function.



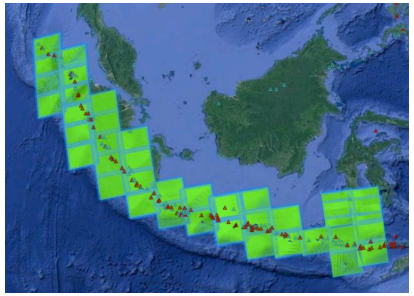


Other items to discuss



- InSAR time series product depend on manually-selected latitude range (`topsStack.boundingBox = 19.1 19.9 ...`), and on name (KilaueaSenAT128). How to make independent of choices?
  option A: use ASF frames
  option B: 1-degree latitude ranges: `boundingBox =34.0 35.0`
  `boundingBox = 35.0 36.0`
  `boundingBox = 36.0 37.0`

  use MimtPy for concatenation. (need to checkout ARIA, LicsSAR)

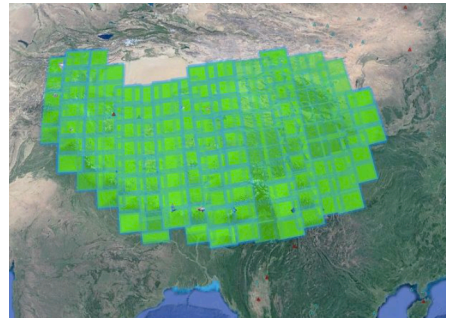


- How to handle different look sets:

```
topsStack.resolution = standard
```

```
topsStack.azimuthLooks = 7
topsStack.rangeLooks   = 19
topsStack.filtStrength = 0.2
mintpy.geocode.latStep = 0.0008
mintpy.geocode.lonStep = 0.0008
```

```
topsStack.resolution = veryHighRes, highRes, standard, lowRes, veryLowRes
```



Jetstream:

```
/data/HDF5EOS/standard/KilaueaSenAT124
/data/HDF5EOS/highRes/KilaueaSenAT124
```

```
/data/HDF5EOS/Sentinel/A124/34/standard
/data/HDF5EOS/Sentinel/A124/34/highRes
/data/HDF5EOS/Sentinel/A124/35/standard
/data/HDF5EOS/Sentinel/A124/36/standard
```

- How to avoid data download from our Jetstream server?
  option A: data products in database auto-cached on your local machine (more advanced than ERA5)
  option B: pangeo-type environment (use our own pangeo-type services on another Jetstream server?)
  (option C: ASF' s OpenSARLab on AWS)

Thank you!

Highly appreciate for your suggestions and contributions！