Response to Reviewers' Comments on
JOSS-2970 : SAR tools: A QGIS plugin for generating SAR descriptors

This manuscript was submitted to The Journal of Open Source Software (JOSS-2970). As per the reviewers' suggestions, the plugin documentation, functionalities and interface are revised and updated.

The authors are indebted to the reviewer for constructive review comments, which has been instrumental in improving the technical quality of the plugin.

In the following we transcribe the comments in *gray italics*, and our responses in blue in a **response** section.

Associate Editor Remarks:

Just to clarify: the paper is supposed to be short in JOSS, but indeed the points 1 and 2 you bring should be in the paper. As for the new name, this could mean that repository name is changed and other side consequences, so I'll leave it to the authors PolSAR does sound better to me though (but I am not an expert in this field).

> The authors are thankful to the editor for constructive comments.
>
> We have addressed point nos—1 and 2 in our review comments. In the literature, the term "PolSAR" is more often used to indicate full or quad polarimetric SAR data. However, our plugin includes descriptors derived from dual and compact polarimetric SAR data. Hence, to generalize the utility of the tool for all polarimetric modes, we have chosen the name "SARtools". Moreover, changing the name will indeed affect the indexing, which will be complicated to manage. Therefore, we prefer to retain the title as "SARtools".

Reviewer 1

The plugin is clean and has a well defined purpose. The paper is short but well written, but it is missing several required parts. Additionally, please see my comments below.

> The authors are grateful to the reviewer for the kind appreciation of this work and thank for the encouraging words. We have addressed all the comments and made suitable changes.

(Point 1) *The purpose is to provide an easy procedure to compute a number of polarimetric indices (parameters) that may be of interest for the user. However, it requires the input data in a format that SNAP and PolSAR Pro delivers, and this SW combination already provides the functionality of deriving the indices that this plugin computes. Therefore, I am still wondering about the need for this plugin?*

> **Response:**
> Authors would like to thank the reviewer for pointing this issue in the package.
>
> We want to assure that the parameters and indices available in this package, are mostly not available in other SAR data processing software: PolSARpro, SNAP, ENVI etc. The polarimetric indices and decomposition techniques are recently published in various top tier peer-reviewed journals. They are rapidly gaining popularity for various remote sensing applications, viz., land cover classification, vegetation monitoring and snow cover mapping. Among these indices, the Radar Vegetation Index (RVI) is only available in PolSARPro. We can also obtain the degree of polarization (DoP) for dual polarimetric SAR data from PolSARpro, which is the same as "wave anisotropy". However, in this plugin, we have provided the Barakat degree of polarization for full polarimetric SAR data which is different from the conventional degree of polarization. Here we briefly describe the new functionalities which we have included in this plugin but are currently not available in any other remote sensing software:
>
> **Full Pol:**
>
> - **GRVI:** This functionality computes the generalized volume scattering model-based radar vegetation index from full polarimetric SAR data.
>
>   D. Ratha, D. Mandal, V. Kumar, H. Mcnairn, A. Bhattacharya and A. C. Frery, "A Generalized Volume Scattering Model-Based Vegetation Index From Polarimetric SAR Data," in IEEE Geoscience and Remote Sensing Letters, vol. 16, no. 11, pp. 1791-1795, Nov. 2019, doi: 10.1109/LGRS.2019.2907703.
>
> - **MF3CF:** This functionality computes the model-free 3 component scattering power decomposition from full polarimetric SAR data.
>
>   S. Dey, A. Bhattacharya, D. Ratha, D. Mandal and A. C. Frery, "Target Characterization and Scattering Power Decomposition for Full and Compact Polarimetric SAR Data," in IEEE Transactions on Geoscience and Remote Sensing, doi: 10.1109/TGRS.2020.3010840.
>
> - **PRVI:** This functionality computes the polarimetric radar vegetation index from full polarimetric SAR data. This functionality utilizes the degree of polarization and the cross-polarization backscatter coefficient
>
>   Chang, J.G., Shoshany, M. and Oh, Y., 2018. Polarimetric radar vegetation index for biomass estimation in desert fringe ecosystems. IEEE Transactions on Geoscience and Remote Sensing, 56(12), pp.7102-7108.
>
> - **DoP:** This functionality computes the 3D Barakat degree of polarization for full polarimetric SAR data.
>
>   R. Barakat, "Degree of polarization and the principal idempotents of the coherency matrix." Optics Communications 23, no. 2 (1977): 147-150.

Dual Pol:

- **DpRVI:** This functionality computes the radar vegetation index from dual polarimetric i.e., (HH — HV), (VV — VH) SAR data.

  Mandal, D., Kumar, V., Ratha, D., Dey, S., Bhattacharya, A., Lopez-Sanchez, J.M., McNairn, H. and Rao, Y.S., 2020. Dual polarimetric radar vegetation index for crop growth monitoring using sentinel-1 SAR data. Remote Sensing of Environment, 247, p.111954.

- **PRVI:** This functionality computes the polarimetric radar vegetation index from dual polarimetric (HH — HV), (VV — VH) SAR data. It utilizes the degree of polarization and the cross-polarization backscatter coefficient to estimate the amount of vegetation.

  Chang, J.G., Shoshany, M. and Oh, Y., 2018. Polarimetric radar vegetation index for biomass estimation in desert fringe ecosystems. IEEE Transactions on Geoscience and Remote Sensing, 56(12), pp.7102-7108.

Compact Pol:

- **CpRVI:** This functionality computes the radar vegetation index from compact polarimetric SAR data.

  Mandal, D., Ratha, D., Bhattacharya, A., Kumar, V., McNairn, H., Rao, Y.S. and Frery, A.C., 2020. A Radar Vegetation Index for Crop Monitoring Using Compact Polarimetric SAR Data. IEEE Transactions on Geoscience and Remote Sensing, 58 (9), pp. 6321-6335.

- **MF3CC:** This functionality computes the model-free 3 component scattering power decomposition from compact polarimetric SAR data.

  S. Dey, A. Bhattacharya, D. Ratha, D. Mandal and A. C. Frery, "Target Characterization and Scattering Power Decomposition for Full and Compact Polarimetric SAR Data," in IEEE Transactions on Geoscience and Remote Sensing, doi: 10.1109/TGRS.2020.3010840.

- **iS − Ω**: This functionality computes the scattering powers from compact polarimetric SAR data. This is an improved decomposition technique based on the Stokes vector(S) and the polarized power fraction (Ω).

  V. Kumar, D. Mandal, A. Bhattacharya, and Y. S. Rao, 2020. Crop Characterization Using an Improved Scattering Power Decomposition Technique for Compact Polarimetric SAR Data. International Journal of Applied Earth Observations and Geoinformation, 88: 102052.

(Point 2) *An example of how the PI is used is still missing. Suggest to also tell the user about the sample data*

Response:
The authors would like to thank the reviewer for this suggestion.

We have updated the documentation with a use-case example utilizing the sample data provided along with the plugin. We have provided the sample data in the sample_data/ folder for all the polarimetric modes.

(Point 3) *I suggest changing the name from SAR Tools to PolSAR Tools, since they are related to polarimetric SAR, not SAR generally*

Response:
The authors would like to thank the reviewer for pointing this out.

The plugin indeed contains PolSAR parameters. However, in the literature, the PolSAR terminology is commonly used to indicate full or, quad polarimetric SAR data. However, our plugin includes descriptors derived from compact and dual-pol SAR data. Hence, the terminology, "PolSAR" may create confusion among users. Furthermore, keeping in mind the progress of this plugin with the inclusion of diverse modules in the future, we have used the generic term "SAR" instead of "PolSAR".

Some minor suggestions for improving the PI are listed here:

(Point 1) *change the name of "View data" to "Select data" or "Open file".*

Response:
The function of this button is to import the data into QGIS for visualization only (Eg. HH, VV intensity images). It is not connected to any core functionalities of the plugin.

(Point 2) *provide an information dialog about what happened when the files were generated (where they are located, and possibly also how to open them).*

Response:

By default, all the output files will be written to the input folder itself. Additionally, after the successful completion of any process, the output directory will automatically open. The user can now directly import the data into QGIS for visualization and further processing. Alternatively, the user can click the "view data" button to import the generated output files into QGIS for visualization.

(Point 3) *add option for selecting the output folder.*

Response:
Writing the output files into the input directory is common for many software (Eg. PolSARpro). This process is helpful, because if the user has multiple folders, e.g., C3/T3/C2/T2, the polarimetric descriptors computed from these matrices will be stored in their respective input data folders. It will be then easy for the user to locate the generated parameters for the particular matrix later.

The authors are thankful for this suggestion. We will add an option for custom output folder in our future releases.

(Point 4) *process bar not updating when computing an index.*

Response:

The progress will get updated for the currently running process (Eg. Computing RVI from Full-pol data), however, if the dataset is small (like the sample data set), you may not notice the update because the whole progress bar will be filled and emptied in less than a second.

(Point 5) *why is it necessary to both select a folder and a file, independent of each other? Insufficient error message to user if they are not matching.*

Response:
Only a valid matrix folder (C3/T3/C2) is sufficient to compute any descriptor using the plugin. If you refer to the "view data" button, it is used to import the data into QGIS for visualization and is not linked to the plugin's core functions.

(Point 6) *It is not possible to select the "folder" (for whatever use this is?), without first selecting an index. Would be helpful to provide this as information (in the gray folder path area) until an index is selected.*

Response:
We have updated the documentation with an example usage according to your suggestion.

(Point 7) *cannot change to T-matrix from the pre-selected C-matrix.*

Response:
In the previous release of the plugin, the descriptors require specific matrix folder as input (whichever is checked). For example, to compute GRVI from full-pol data, it requires T3 matrix and does not accept C3 matrix. But now we have updated this with an automatic matrix conversion thus avoiding the confusion of matrix selection. The user can now select either T3 or C3 as input.

(Point 8) *no information about what matrix that is expected (e.g., T3/C3) if wrong file is selected*

Response:
In the current release (V0.6.2), we have fixed this issue by accepting either of the matrices as input. Now the plugin will automatically convert T3 to C3 and vice-versa according to the descriptor to be computed.