PySolo: A Python package to run Solo II, a radar editing software.

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Introduction

- **Solo II** is a display and hand-picked editing software program for radar observations, initially developed in the late 1980s in C
- A radar data file is broken up into many rays, with each ray representing a 1 dimensional array of values. Solo II's functions perform data manipulation on a single ray at a time.
- Solo II is used by many students, businesses and researchers. However, Solo II is a dated software and does not work out of the box for current computers.
- There is a newer radar editing program in development called Hawkeye. It seeks to incorporate and build upon current Solo II functionality.
- This brings the need to transform Solo II into a more dynamic, accessible, and extensible environment.

Objectives

- Run Solo II directly from a Python script by calling its C-functions directly.
- Hide the details of calling C-functions from Python by building a high-level importable package.
- Make package importable from a repository via pip.
- Test package with unit tests and real radar data from NetCDF files.
- Make Solo II platform independent, as originally, Solo II was limited to Mac/Linux computers.

Tools Used:

Py-Art

Results

- Introducing **PySolo:** A python interface for Solo II.
- Allows for users to run Solo II functions in a more simplified, pythonic way, with python built-in types.
- This package is uploaded to the PyPI public repository.
- Can perform operations over a 2D region, as compared to original Solo II functions, which were refined in a 1D space.
- Can be used alongside PyArt, a Python Radar toolkit to visualize radar data, to quickly display Solo II functions.
- Below are examples of two functions: ring zap and despeckle. Over 20 other functions are included.
- PySolo is adaptable to future changes in the Solo II source code.

Next Steps

- The mystery of missed unfolds: the developers of PyArt have been working on their own de-aliasing code and have run into issues with certain datasets. PySolo has its own dealiasing code from Solo II, allowing us to experiment if Solo II can overcome the issues present in PyArt.
- We have brought up the idea of potential integration of PySolo into PyArt.
- Implementation of reading "boundary masks" files into PySolo. Boundary masks allows for users to create a shape for a region in which they desire to modify the enclosed data.
- Using the PySolo package to further interface with the Solo II library, as Hawkeye seeks to build upon Solo II aspects.

Ring Zap

This function removes a ring in the data, centered around the radar. PyArt is used to read a radar file. Next, **from_km** and **to_km** are assigned to 25 and 30, respectively. The **km_between_gates** is obtained from the radar data file. Finally, the PySolo function **ring_zapped_mask** is executed, which takes field data "reflectivity" from the file, and variables assigned earlier. This returns an array which can then be graphed into a plot.

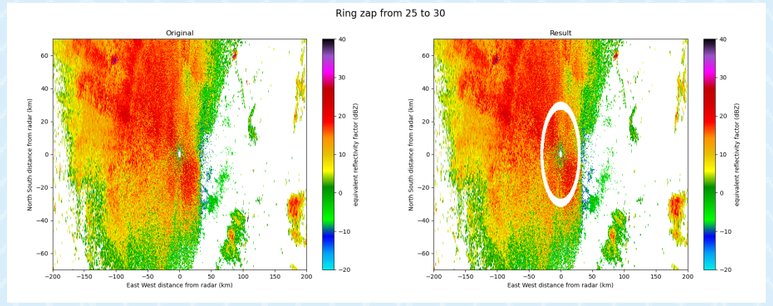
Code

```python
import pyart
import pysolo_package as solo
import matplotlib.pyplot as plt

radar = pyart.io.read(path_to_data)

from_km = 25
to_km = 30
km_between_gates = radar.range["meters_between_gates"] / 1000
ring_zapped_mask = solo.ring_zap_masked(
    radar.fields["reflectivity"]["data"],
    from_km, to_km, km_between_gates
)
```

Graph



Despeckle

This function removes noise from a radar file. Using this function follows the same procedure as ring zap. Import the packages, and then read from the radar file. Then, define a number to **a_speckle**. The larger a_speckle is, the more noise will be removed. However, this comes at the cost of removing potentially valid data.

From there, **despeckle_mask** is executed, taking in data from the field 'reflectivity,' and a_speckle

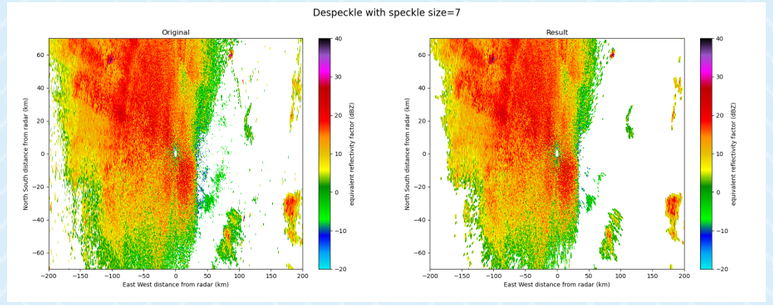
Code

```python
import pyart
import pysolo_package as solo
import matplotlib.pyplot as plt

radar = pyart.io.read(path_to_data)

a_speckle = 7
despeckle_mask = solo.despeckle_mask(
    radar.fields["reflectivity"]["data"],
    a_speckle
)
```

Graph



Install

```
pip install pysolo
```

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Install the package from **PyPI**, test it on **Google Colab**, or contribute to the project from **GitHub**

GitHub