Spatial representation with the Python Basemap and PyNGL libraries

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May 10, 2019

Description

The Basemap library is the mapping extension of the standard graphic library

Pros

- It is now quite easy to install by using Anaconda
- Very simple to use
- Multiple map backgrounds can be used (from TIFF image for instance)
- Comes with usefull tool (distance calculations, etc.)

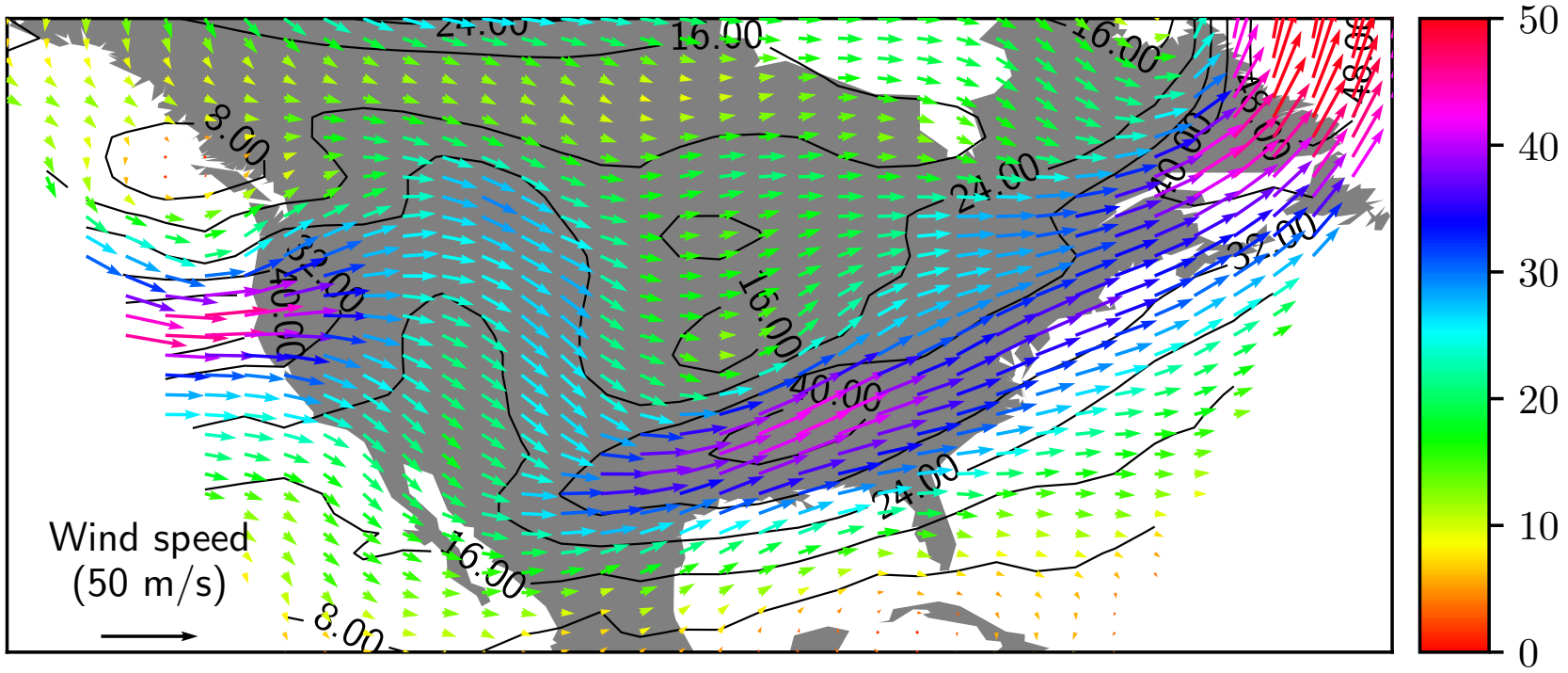
Cons

- Rendering is not always perfect
- No Masked Lambert Conformal projection
- Need to switch from geographical to map coordinates
- Need to navigate between Matplotlib and Basemap methods/functions

Example

```
1  import matplotlib.pyplot as plt
2  from mpl_toolkits.basemap import Basemap
3
4  # map initialisation
5  m = Basemap(llcrnrlon=np.min(lon), llcrnrlat=np.min(lat),
6              urcrnrlon=np.max(lon), urcrnrlat=np.max(lat),
7              projection='cyl', resolution='c')
8
9  # conversion from geo. to map coordinate
10 lon2d, lat2d = np.meshgrid(lon, lat) # needs 2D coord. arrays
11 x, y = m(lon2d, lat2d)
12
13 # map background using basemap function
14 m.fillcontinents(color='gray', lake_color='gray')
15
16 # drawing contour lines using Basemap function
17 cs = m.contour(x, y, z, colors='k', linewidths=0.5)
18 plt.clabel(cs, fmt='%.2f')
19
20 # drawing quiver plot USING PYPLOT FUNCTION!
21 q = plt.quiver(x, y, u, v, z, cmap=plt.cm.get_cmap('hsv'), scale=1000, zorder
       =1000)
22 q.set_clim(0, 50)
23
24 # drawing colorbar using basemap function
25 cb = m.colorbar(q)
26
27 # adding quiver key USING PYPLOT FUNCTION!
28 keys = plt.quiverkey(q, -131, 21, 70,
29         'Wind speed\n(50 m/s)', coordinates='data')
```

Example



Description

The NCAR Graphic library is a very powerfull library for graphics, especially mapping. It is available in Python through the PyNGL library.

Pros

- It is now quite easy to install by using Anaconda
- Very nice rendering
- The drawing of velocity fields is very easy (curlyvectors, etc.)
- Many examples are provided in the gallery

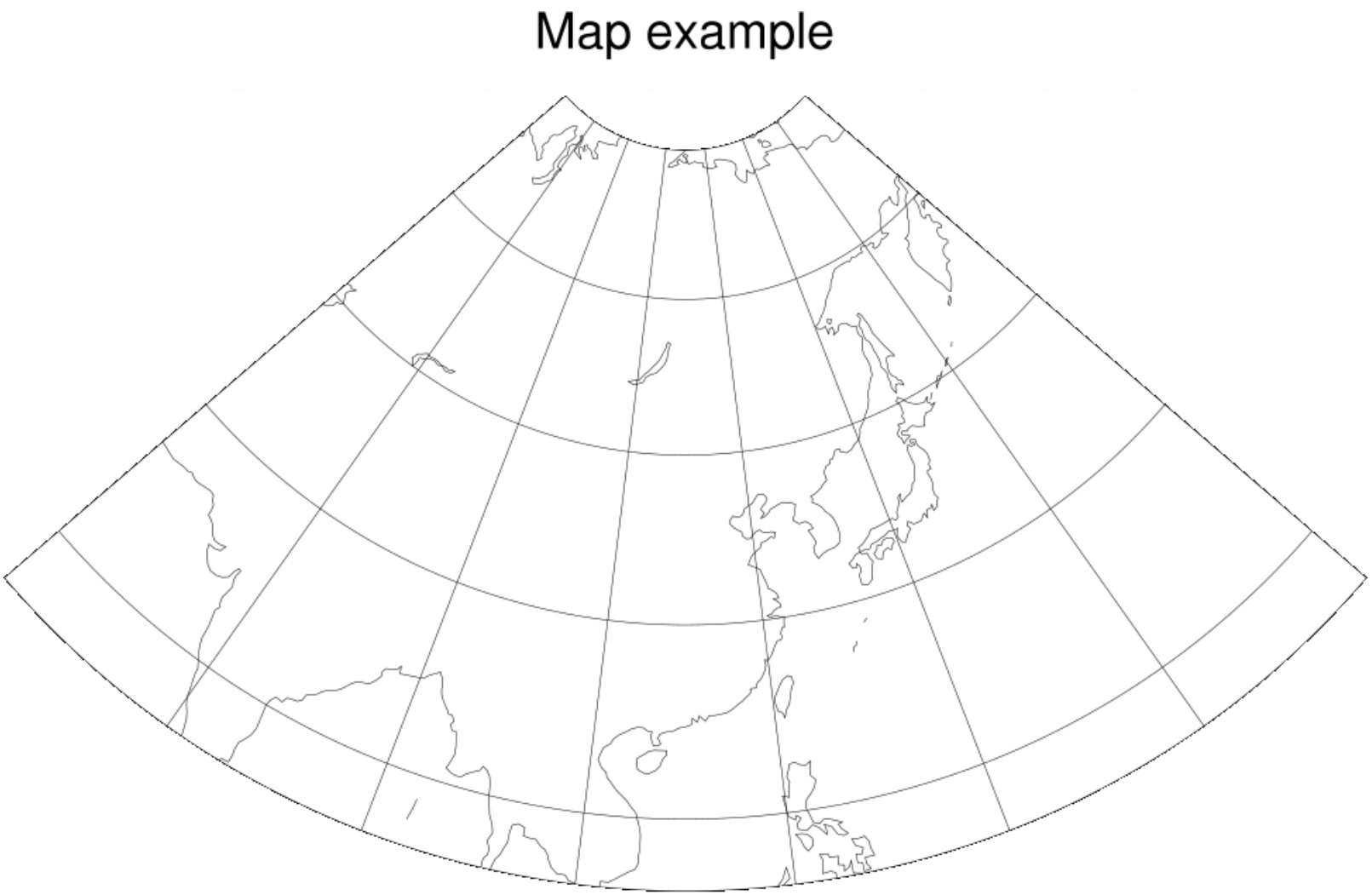
Cons

- Not compatible with the default Python graphic library Matplotlib
- Heavy code! To use only for paper plots (not for working material)
- Only 256 colors can be used

Simple map

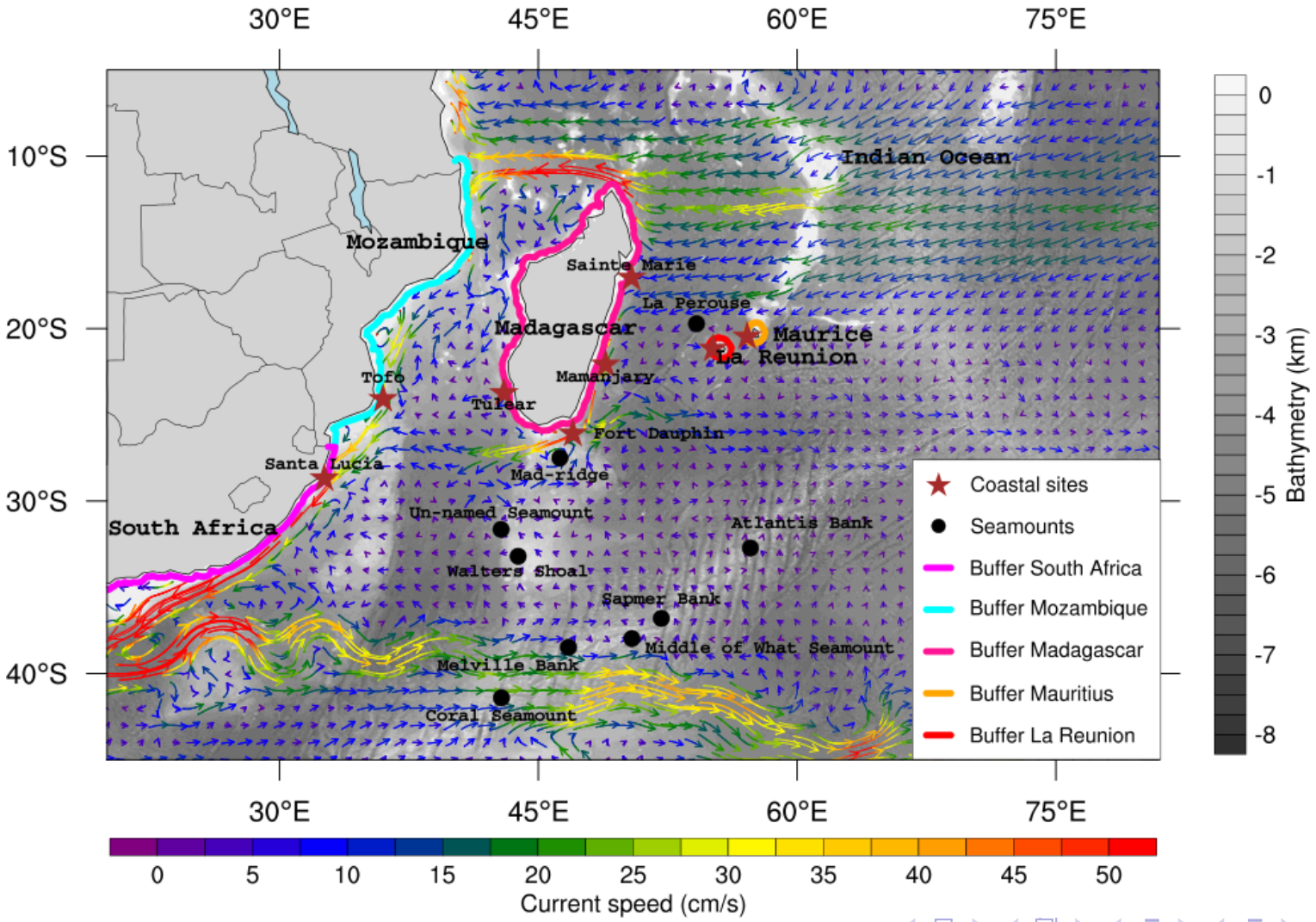
```
1  import Ngl
2
3  wks_type = "png"
4  wks = Ngl.open_wks(wks_type, "conmasklc")
5
6  res = Ngl.Resources()
7
8  res.nglDraw = False
9  res.nglFrame = False
10
11 res.mpProjection        = "LambertConformal"
12
13 res.mpLimitMode         = "LatLon"     # limit map via lat/lon
14 res.mpMinLatF           =  10.         # map area
15 res.mpMaxLatF           =  75.         # latitudes
16 res.mpMinLonF           =  60.         # and
17 res.mpMaxLonF           = 165.         # longitudes
18
19 res.nglMaskLambertConformal = True
20 res.nglMaskLambertConformalOutlineOn = True
21
22 res.tiMainString         = "Map example"
23 res.tiMainFontHeightF    = 0.010
24
25 map = Ngl.map(wks,res)
26
27 Ngl.draw(map)
28 Ngl.frame(wks)
```

Simple map



More complicated example

366 lines of code later (cf. `plot_currents_pyngl.py`)...



Usefull links

PyNgl Gallery: https://www.pyngl.ucar.edu/Examples/gallery.shtml
Ncl Gallery: https://www.ncl.ucar.edu/Applications/
Matplotlib Gallery: https://matplotlib.org/basemap/users/examples.html
My Gallery: www.nicolasbarrier.fr/gallery.html