

## PyCAMA - Feature #35721

### Speed up get\_profiles and get\_temperature by numba

03/19/2022 04:52 PM - Xin Zhang

<b>Status:</b>	Resolved	<b>Start date:</b>	03/19/2022
<b>Priority:</b>	Normal	<b>Due date:</b>	
<b>Assignee:</b>	Maarten Sneep	<b>% Done:</b>	100%
<b>Category:</b>		<b>Estimated time:</b>	0.00 hour
<b>Target version:</b>			

#### Description

### Issue

The for loop in both functions slows down the script a lot. I have tried to speed it up by numba.

### Solution

```
from numba import jit
```

```
@jit(nopython=True)
```

```
def calc_field(weights, spatial_index_lat, spatial_index_lon,
              surface_pressure_external, surface_pressure, field,
              result_field, result_pressure, hya, hyb):
    for pix_idx in range(weights.shape[1]):
        if surface_pressure_external is not None:
            ps = surface_pressure_external.flat[pix_idx]
        else:
            ps = 0.0
        for i in range(4):
            if surface_pressure_external is None:
                ps += (weights[i, pix_idx] *
                     surface_pressure[spatial_index_lat[i, pix_idx],
                                       spatial_index_lon[i, pix_idx]])
            result_field[:, pix_idx] += (weights[i, pix_idx] *
                                         field[:, spatial_index_lat[i, pix_idx],
                                               spatial_index_lon[i, pix_idx]])

        result_pressure[:, pix_idx] = hya + ps * hyb

    return result_field, result_pressure

def get_temperature(self, surface_pressure_external=None):
    .....
    result_field, result_pressure = calc_field(self.weights, self.spatial_index_lat, self
    .spatial_index_lon,
                                             surface_pressure_external, surface_pressure, field,
                                             result_field, result_pressure, hyam, hybm)

def get_profiles(self, surface_pressure_external=None):
    .....
    result_field, result_pressure = calc_field(self.weights, self.spatial_index_lat, self
    .spatial_index_lon,
                                             surface_pressure_external, surface_pressure, field,
                                             result_field, result_pressure, hyai, hybi)
```

Note that I don't use the jitclass which needs to specify all variables of class.

I just put the jit function outside the class and use it directly.

# Test

And the execution time of the loop in `get_profiles` decreased from ~ 470 seconds to ~ 2.5 seconds.

For my case, the maximum differences between current slow loop and numba are  $3.5527137e-15$  and  $9.1552734e-05$  respectively for `no2_vmr` and `temperature`.

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## History

### #1 - 03/21/2022 08:48 AM - Maarten Sneep

Hi, if you don't add watchers, or don't assign the issue then this won't get picked up. It is by chance that I see this. I'll see if I can include this in a way that is compatible with an installation without numba.

### #2 - 03/21/2022 09:40 AM - Xin Zhang

- Assignee set to Maarten Sneep

### #3 - 03/21/2022 09:43 AM - Maarten Sneep

- Status changed from *New* to *Resolved*

- % Done changed from 0 to 100

The new script will be included in the next PyCAMA (intermediate) release.