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EGU2020-6653
Session AS1.1
Development of Customized Variable-Resolution CPAS for Meteorological Simulation

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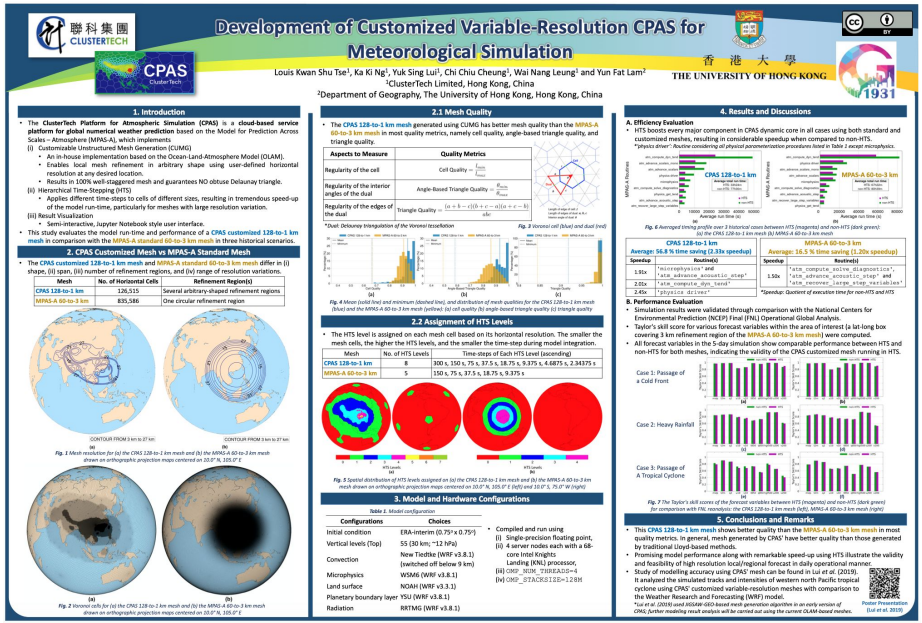
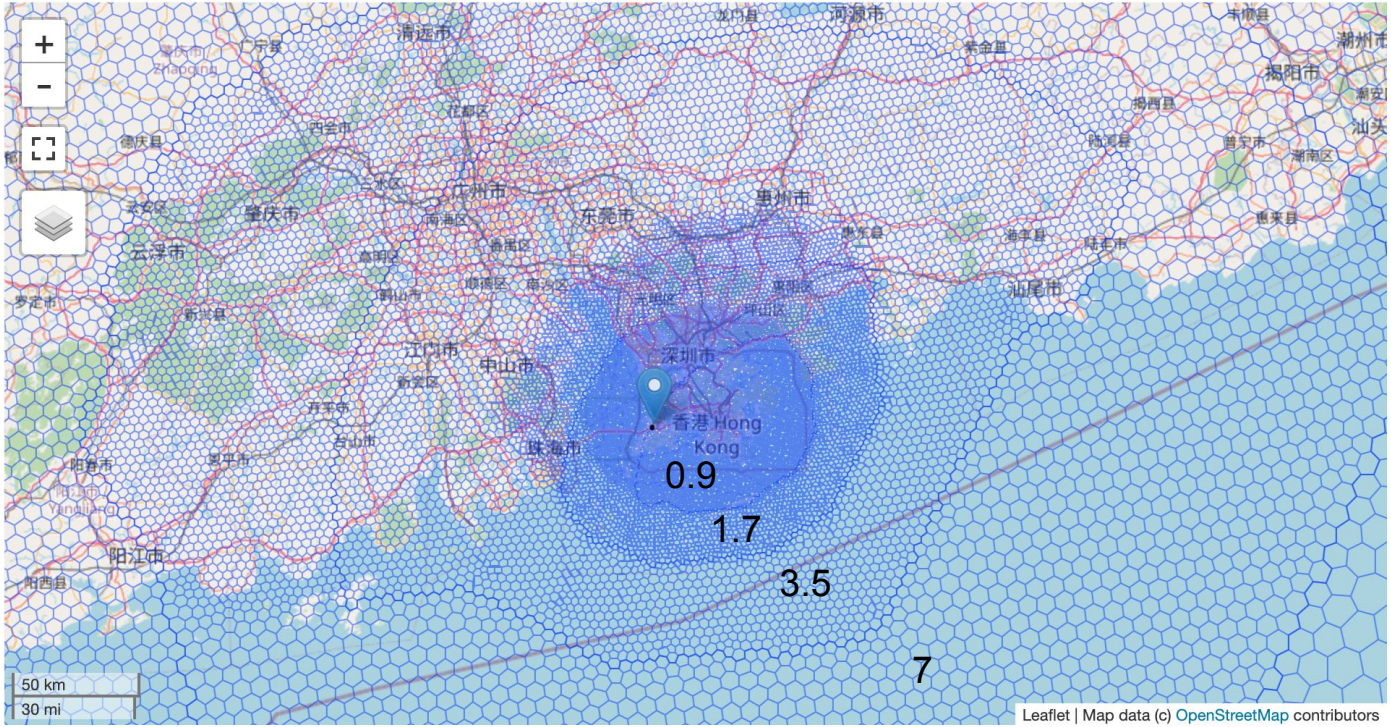
Poster

https://presentations.copernicus.org/EGU2020/EGU2020-6653_presentation.pdf



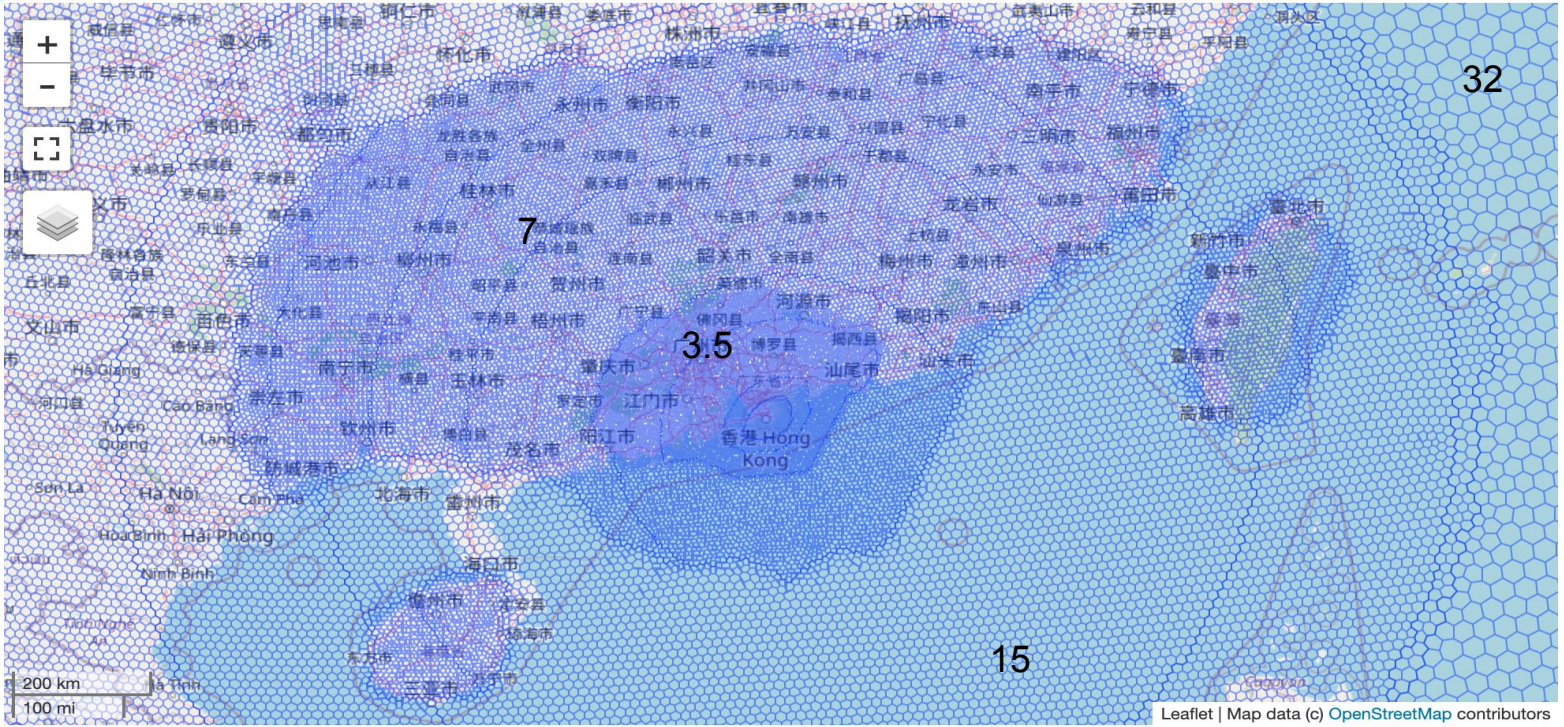
Customized mesh zoomed in near Hong Kong



Resolution finer than 60-3km mesh locally near Hong Kong

Numbers are resolution in km

Customized mesh near South China



Resolution coarser than 60-3km mesh except very near Hong Kong

Numbers are resolution in km

Demo of Result Visualization

Case 1: Passage of a Cold Front

Evaluate against observation data

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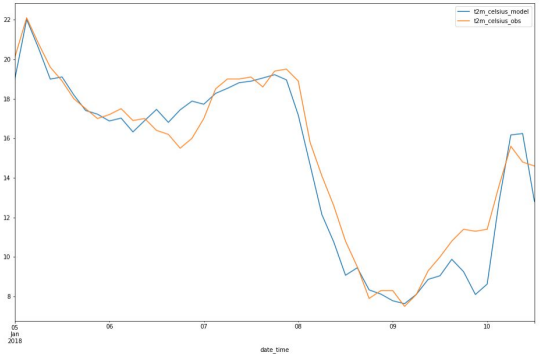
Hong Kong Airport weather station

5.1 Model evaluation against your observation data (sample code)

Free free to change the code for your observation data upload. See this blog article.

```
In [6]: import numpy as np
        import pandas as pd
        from datetime import timedelta
        from cpas.evaluation import ModelEvaluation, csv2df

        (my_lat, my_lon) = (22+18.534/60, 113+54.84/60)  # Naha airport
        local_time_header = 'Local time in Hong Kong (airport)'  # Column header in CSV file
        local_time_offset = 8
        my_csv = 'my_obs_data/45007.04.01.2018.13.01.2018.1.0.0.en.utf8.00000000.csv'

        raw_obs_df = csv2df(my_csv, sep=';', comment='#', index_col=False)
        obs_df = pd.DataFrame()
        obs_df['date_time'] = pd.to_datetime(raw_obs_df[local_time_header], format='%d.%m.%Y %H:%M
        (obs_df['lat'], obs_df['lon']) = (my_lat, my_lon)
        obs_df['t2m_celsius'] = raw_obs_df['T']

        me = ModelEvaluation(ui.mesh_ncfile, ui.diag_ncfile, obs_df)
        me.met_combine()
        comp = me.get_comparison()

        mask = ~np.isnan(comp['t2m_celsius_model'])
        filtered = comp[mask]
        filtered.xs(my_lat, level='lat').xs(my_lon, level='lon').plot(y=['t2m_celsius_model', 't2m

        Interpolating t2m......
        Interpolating q2......
        Interpolating ui0......
        Interpolating vi0......
        Interpolating msip.....
Out[6]: <matplotlib.axes._subplots.AxesSubplot at 0x7f3cb0a7ed90>
```



Customized 128km-1km mesh, 126,515 cells

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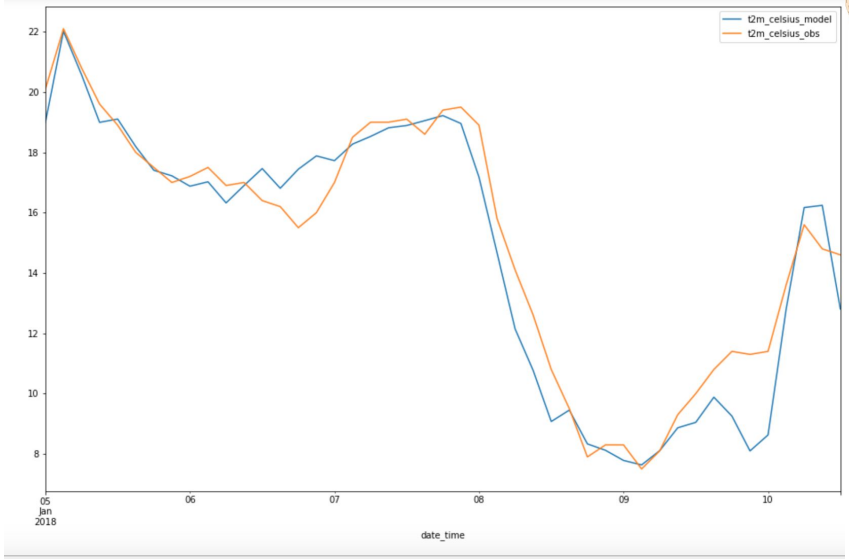
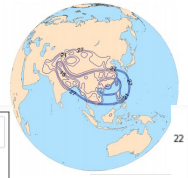
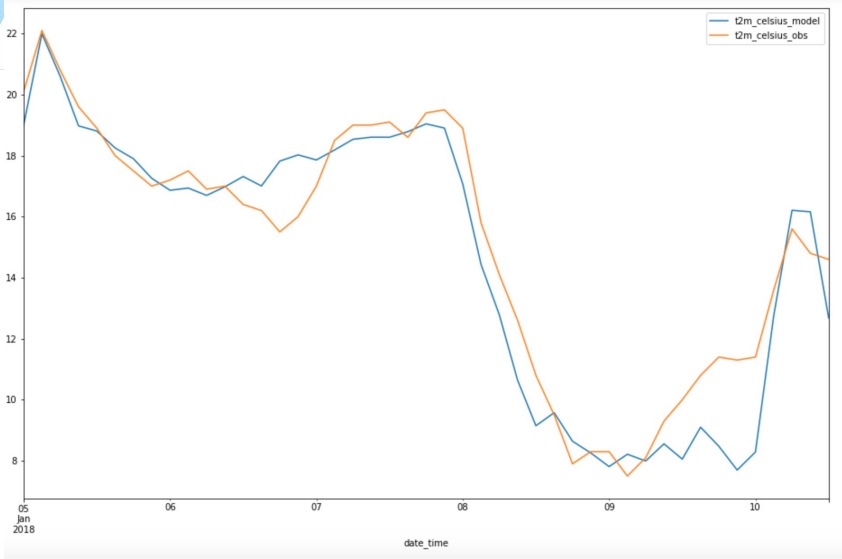
CPAS HTS

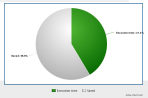




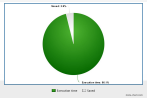
MPAS-A



Execution time:



Execution time:



Standard 60km-3km mesh, 835,586 cells

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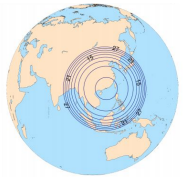
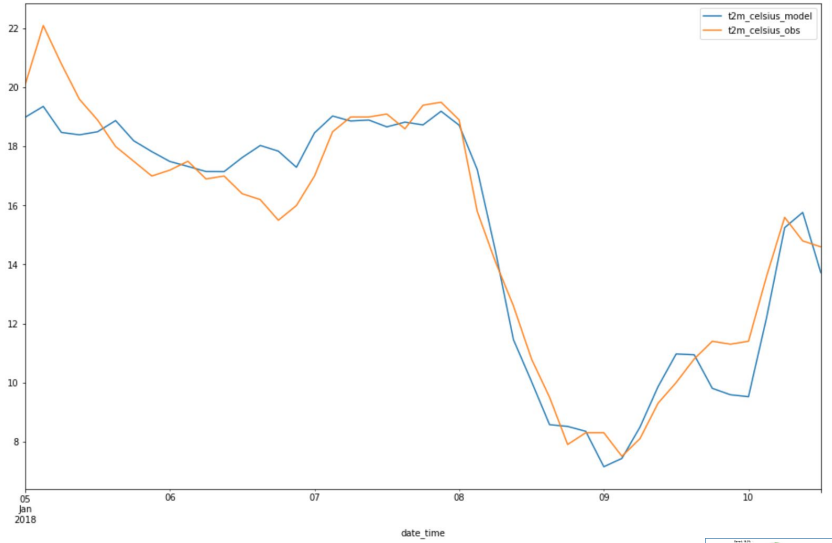
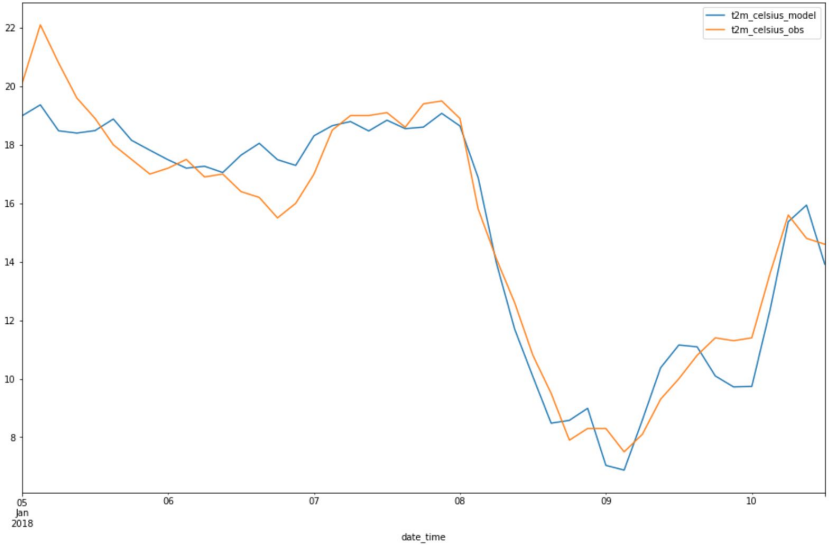
CPAS HTS



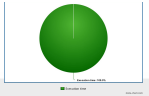


Execution time:

MPAS-A



Execution time:

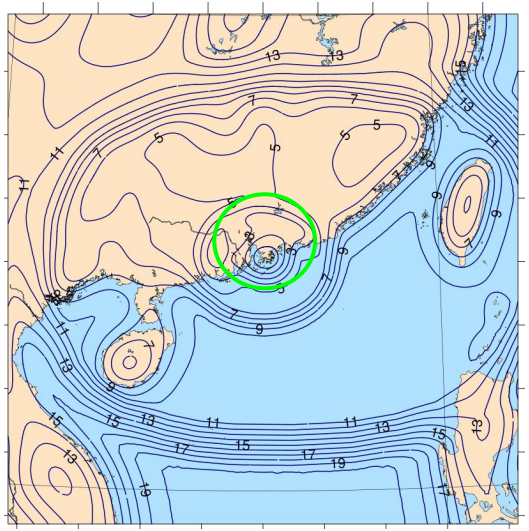


Comparison on resolutions

128km-1km mesh:

Small finer than 3km-resolution area

Most area much coarser than 3km



60km-3km mesh:

Large 3km-resolution area

More evaluation results

Whitepaper 2

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https://cpas.earth/technology/publications

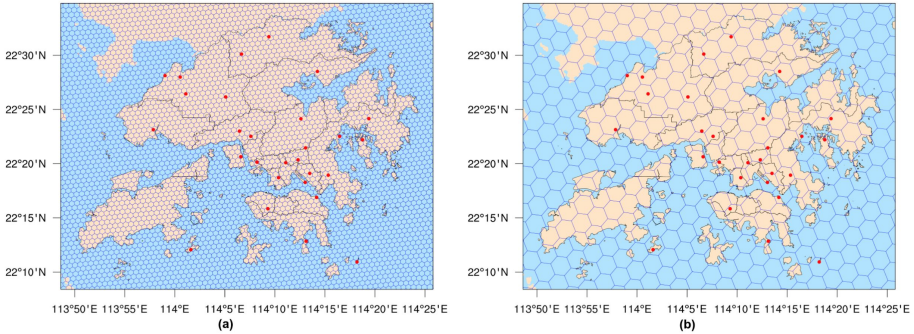


Figure 10: Geographic locations (red dots) of the 28 HKO stations for model evaluation, and the voronoi mesh for (a) the customized 128-to-1 km mesh and (b) the standard 60-to-3 km mesh

Better predictions in district (within city) length scale!

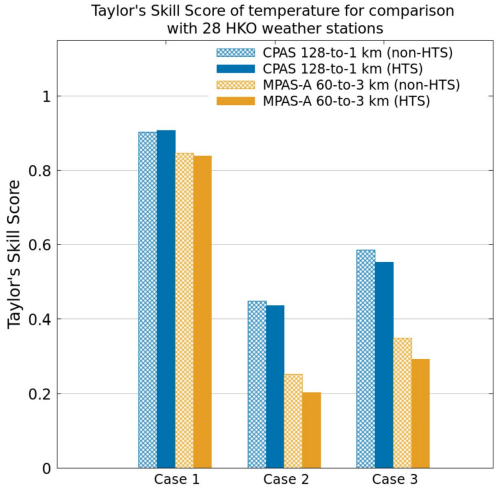
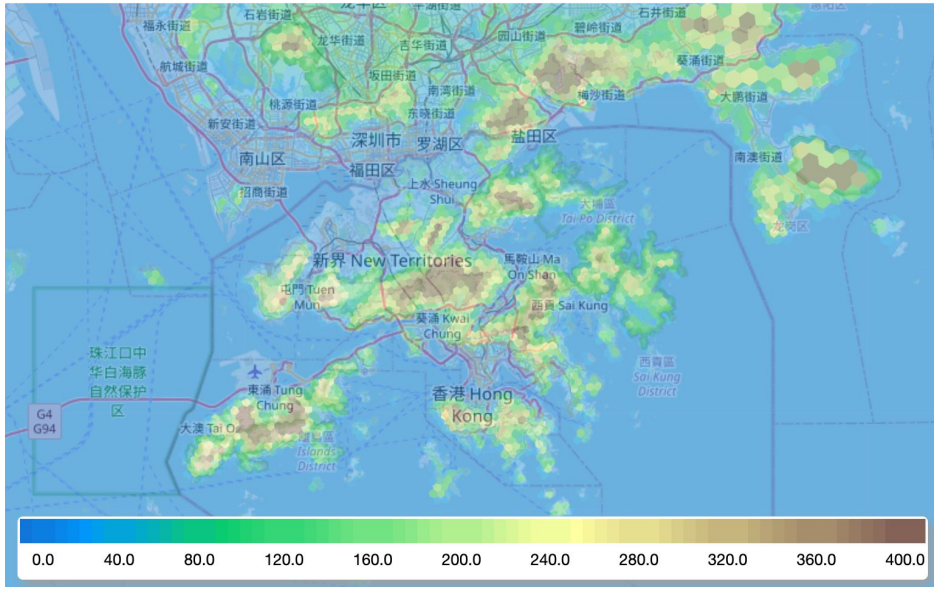
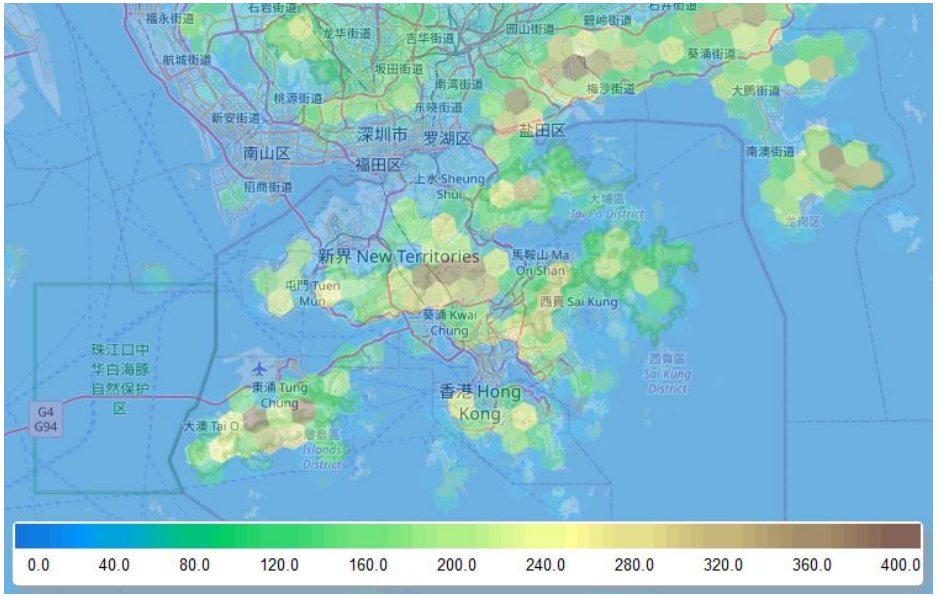


Figure 12: The Taylor's skill scores of temperature for comparison with 28 HKO weather stations

Better resolving of terrain



Terrain data in 1km resolution



Terrain data in 3km resolution

Sign-up cpas.earth to see demo data

https://cpas.earth/

jupyter

```
In [1]: from cpas.ui import UI
        ui = UI().select_job()
```

Select Data: My data | Demo data

Select Project:
2020-05-04 08:24:56Z EGU2020 HK_128-to-1km (generated by experimental OLAM-based algorithm; customized CPAS v0.4.0 experi
2020-04-07 01:25:10Z Customized 160km-1km mesh for Hong Kong (generated by Lloyd algorithm; MPAS-A v5.2 experiments)
2020-04-07 01:24:13Z Standard 92km-25km mesh centered at Hong Kong (downloaded from MPAS-A; CPAS v0.3.2 HTS experiments
2020-04-07 01:22:41Z Standard 60km-3km mesh centered at Hong Kong (downloaded from MPAS-A; CPAS v0.3.2 HTS experiments)

Select Mesh: 2020-05-04 03:10:19Z HK_128-to-1km #500 (experimental OLAM-based mesh generation algorithm)

Simulation | Shallow Water Test

Select Simulation:
2020-05-04 04:10:21Z 20180105 00Z Cold front (HTS)
2020-05-04 04:10:16Z 20180105 00Z Cold front (nonHTS)
2020-05-04 04:10:08Z 20180611 00Z Heavy rain (HTS)
2020-05-04 04:10:02Z 20180611 00Z Heavy rain (nonHTS)
2020-05-04 04:09:46Z 20180912 00Z Mangkhut (HTS)
2020-05-04 04:09:22Z 20180912 00Z Mangkhut (nonHTS)

```
Found data files:
 grid.nc | static.nc | mesh.nc | diag.nc
Ready to do plot_mesh() and visualize_mesh().
Ready to do plot_diag_contour() and visualize_sim().
```

Q&A / Discussion

Learn more &
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https://cpas.earth