Explanation of mascon files

The files contained in this directory include files with information on the geometry and spatial patterns of the mascons used in our GRACE/GRACE-FO analysis.

mascons_stage5_V006_200km

- Contains information on the primary and ternary mascons used, including:
  - Coordinates of centre of mass
  - Area of mascons
  - Density of water used for each mascon
  - Topology of ternary/primary mascons

mascons_stage5_V0010_200km

We made minor modifications to our V006 mascon pattern to rectify some issues that were occurring in the analysis:

- We broke the eastern lobe of the Caspian Sea (Garabogazkio Basin) into its own mascon, then reshaped the other Caspian Sea mascons
- We reconfigured the land mascons in southeastern Australia so that they did not span Bass Strait between Tasmania and Victoria
- We separated Thurston Island (West Antarctica) from continental Antarctica since satellite altimetry measurements show that this particular region is increasing in mass, despite the nearby regions losing significant mass. We reshaped the nearby land mascons.

The numbering of the primary mascons changed significantly as a result of these geometrical modifications to our mascon field. The RL02 solution refers to the mascon geometry of mascons_stage5_V010_200km

The mascon file is provided in hdf5 format. The following python function permits users to read the mascon geometry information into a class structure:

```
def read_mascons_h5(self):
  with File(self._fname, 'r') as hf:
    self.Pn = hf['mascons/P/idx'][:]
    self.Plat = hf['mascons/P/lat'][:]
    self.Plon = hf['mascons/P/lon'][:]
    self.Pradius = hf['mascons/P/R'][:]
    self.Parea = hf['mascons/P/area'][:]
    self.Palt = hf['mascons/P/alt'][:]
    self.Pgeod = hf['mascons/P/geod'][:]
    self.Pdensity = hf['mascons/P/density'][:]
    self.Pdesc = hf['mascons/P/desc'][:]
    self.Pdesc_label = hf['mascons/P/description_label'][:]

    self.Tnum = hf['mascons/T/idx'][:]
    self.Tlat = hf['mascons/T/lat'][:]
```

```
self.Tlon = hf['mascons/T/lon'][:]
self.Tradius = hf['mascons/T/R'][:]
self.Tarea = hf['mascons/T/area'][:]
self.Talt = hf['mascons/T/alt'][:]
self.Tgeod = hf['mascons/T/geod'][:]
self.Tdens = hf['mascons/T/density'][:]
self.pnum = hf['mascons/T/primary'][:]
self.desc = hf['mascons/T/desc'][:]
```

Additional information will be added to this file whenever the mascon geometry used in the ANU analysis is modified/updated.

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References

Allgeyer, S., P Tregoning, H. McQueen, S.C. McClusky, E.-K. Potter, J. Pfeffer, R. McGirr, A.P. Purcell, T.A. Herring and J.-P. Montillet (2022), ANU GRACE data analysis: Orbit modelling, regularisation and inter-satellite range acceleration observations, Journal of Geophysical Research, https://doi.org/10.1029/2021JB022489.

McGirr, R., P. Tregoning, H. McQueen and A.P. Purcell, Significant local sea level variations caused by continental hydrology signals, Geophysical Research Letters, https://doi.org/10.1029/2024GL10839, 2024

Tregoning, P., McGirr, R., Pfeffer, J., Anthony, P., McQueen, H., Allgeyer, S., & McClusky, S. (2021). ANU GRACE data analysis: Characteristics and benefits of using irregularly shaped mascons. Journal of Geophysical Research - Solid Earth, https://doi.org/10.1029/2021JB022412