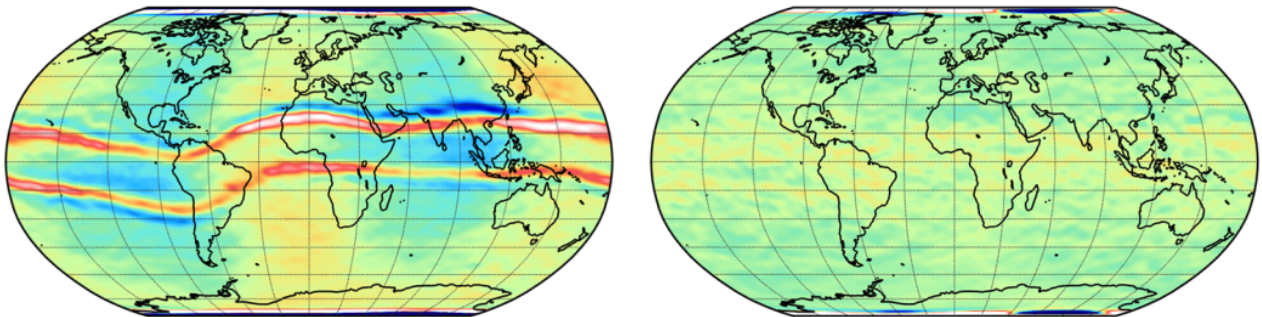


## Reprocessing of GOCE data

The satellite of the ESA mission Gravity Field and Steady-State Ocean Circulation Explorer (GOCE) orbited Earth between 2009 and 2013 on an extremely low trajectory (224-254 km) and mapped with its instruments – in particular with the first gradiometer on a satellite – the Earth's gravity field to unprecedented spatial resolution. For this mission, the AIUB was responsible for the computation of the precise satellite orbits from GPS measurements (so-called Precise Science Orbits). After the end of the GOCE mission, particular properties of the gradiometer instrument and certain problems in the gradiometry data were better understood. Due to that, ESA initiated a reprocessing campaign of the entire GOCE data. The AIUB was responsible for the re-computation of the satellite orbits and was tasked to pay particular attention to systematic errors in the orbit positions which are related to problematic GPS measurements during times of large solar activity. These errors caused marked artifacts along the geomagnetic equator in gravity field models which were derived from the GOCE orbits.

The meanwhile finished reprocessing of all GOCE data was a great success and led to significantly improved static Earth gravity field models. At the AIUB, numerous tests were performed in the frame of the reprocessing to find optimal strategies for handling GOCE GPS data collected under high ionospheric activity. It was successfully achieved to compute new orbit positions which suffer much less from the mentioned problems and the artifacts in the gravity field models could be greatly reduced. The new orbit positions were used for the latest official gravity field model EGM\_TIM\_RL06, which is based on GOCE data only. In addition, it could be shown that GOCE GPS data alone allows for a surprisingly good computation of time variations in Earth gravity. All details can be found in a recently published article: <https://doi.org/10.1007/s00190-023-01752-y>. Now it is probably at last "Rest in peace, GOCE".



Left: Map of Earth gravity field (so called geoid height differences compared to a reference field), which was derived from the old GOCE orbit data. The artifact along the geomagnetic equator is clearly visible. Right: Gravity field models derived from reprocessed orbit data virtually do not show the artifact anymore.