Borehole logging and in-situ observatories: ID 6

DEPTH-DEPENDENT ICE CREEP AT PRINCESS ELIZABETH LAND, EAST ANTARCTICA

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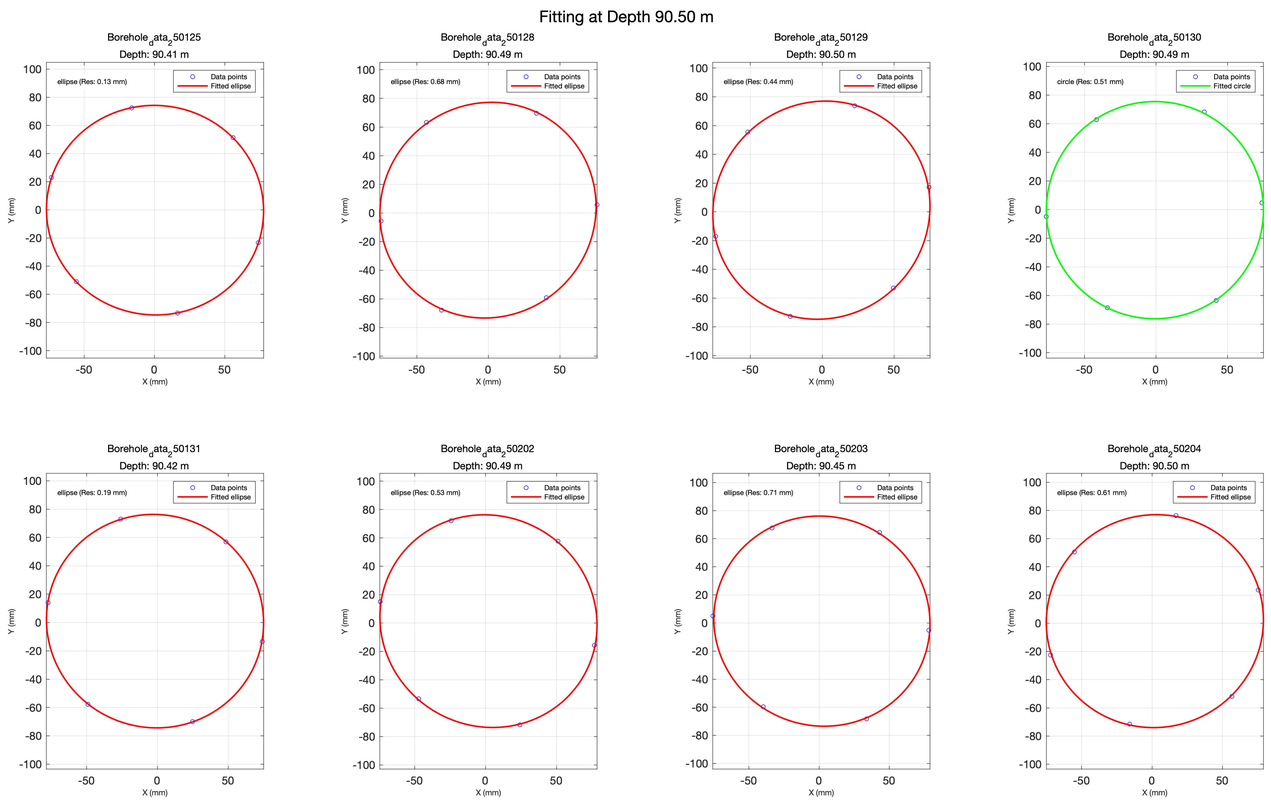
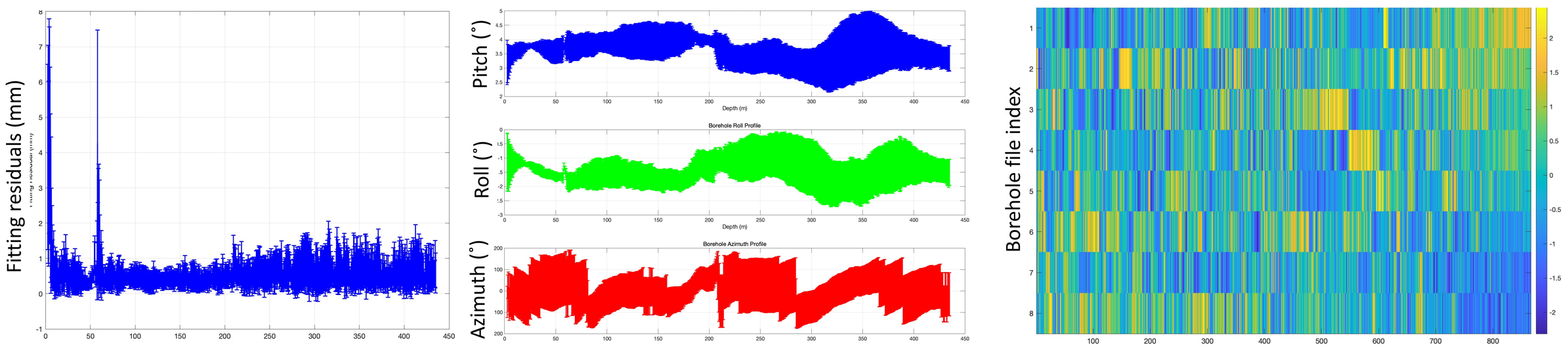
- **The 541 m borehole was drilled to base at IBED-2 site in Princess Elizabeth Land, East Antarctica in 2023-2024 Chinese antarctica expedition.** To study internal deformation processes, 10 months after drilling was completed, a borehole was logged to approximately 9/10 of total borehole depth, because the lower part of the borehole was plugged by ice chips. More info about drilling at oral session ID 4.
- **A multi-armed logger was deployed to measure borehole diameter, inclination, and temperature profiles from the surface to the base.** Between 9 January and 2 February 2025, a total of 11 logging campaigns were conducted, yielding a high-frequency time series of depth-resolved data that spans nearly one month. More info about the logger at poster session ID 11.
- **We present our preliminary results on borehole geometry, data quality analysis and Creep-rate profiles with depth of dry hole within 10 days.**

Borehole Geometry



- **Using 8 dry hole logging datasets collected by the six-arm logger, a total of 6,928 borehole cross-sectional ellipses were fitted within the common logging depth interval of 2.5–435.5 m at 0.5-m intervals, for the analysis of borehole geometry and creep properties.**
- **A two-stage approach combines algebraic equation initialization and geometric distance LM optimization to enhance ellipse fitting accuracy.**
- **Intelligent Model automatically identifies circular features via axis ratio (a/b > 0.95), triggers circle fitting, compares residuals with ellipse fitting, and outputs a unified ellipse model.**
- **Data corrects coordinates using ZYX rotation matrices (error ≤1e-3mm) and deduplicates to retain ≥6 points.**

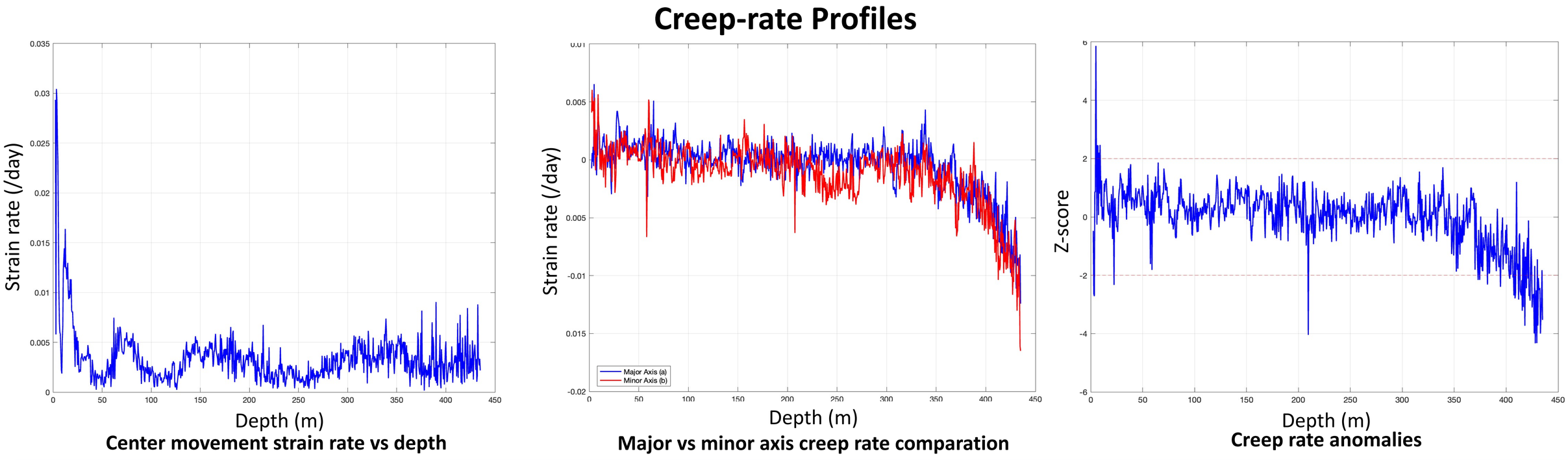
Data Quality Analysis



Ellipse Fitting Residuals with depth | **Borehole pitch, roll and azimuth vs depth** | **Z-scores of major axis length**

- **Elliptical fitting residuals are primarily concentrated within 0–2 mm at most depths, indicating stable data quality and good alignment between elliptical fitting and actual borehole cross-sectional data. However, residuals increase significantly (exceeding 7 mm) at shallow depths (near 0 m) and around 50 m, suggesting potential local data anomalies, which aligns with the actual drilling fluid depth at 60 m.**
- **The pitch, roll, and azimuth angle curves are generally smooth without severe/irregular fluctuations, reflecting stable instrument posture during measurement. The heatmap shows uniform color distribution without extensive extreme-value regions (e.g., dark colors indicating large absolute Z-scores).**
- **The overall data quality is satisfactory and meets the basic requirements for elliptical fitting and subsequent analysis of borehole geometry and creep characteristics.**

Creep-rate Profiles



Center movement strain rate vs depth | **Major vs minor axis creep rate comparation** | **Creep rate anomalies**

- **Significant noise in shallow depth (>60m): Strain rates and Z-scores show intense fluctuations within 0–60m, indicating noise-dominated data with low reliability; recommended for exclusion.**
- **Middle depth (60–325m): Stable ice structure with strain rates of 0.005–0.015 1/day on the central axis, synchronized small-amplitude oscillations of major/minor axis strain rates, and Z-scores stable within -2 to 2, ensuring reliable data quality.**
- **Bottom depth (325–450m): Small fluctuations in central axis strain rates; major/minor axis strain rates decrease to ~-0.02 1/day in the late stage, with intensified Z-score fluctuations (|Z| > 2), potentially linked to deep structural activity or long-term creep accumulation, requiring further validation.**

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