Fimbulisen is the largest ice shelf in Dronning Maud Land (DML), Antarctica. It is fed by Jutulstraumen, the largest outlet glacier from DML, and it plays an important role in processes in the Weddell Sea area. Radar profiling with a ground-based FMCW radar with a center frequency of 350 MHz reveals that the bottom topography of the ice shelf is highly variable. Tidal bending at the hinge zone between grounded ice stream and ice shelf creates crevasses. Furthermore, tensile stresses exceeding a critical limit cause additional cracks. These features are transported down-stream and experience new load situations. Subsequently, surface accumulation, as well as basal processes affect the vertical structure. Radar data along the ice flow show that the ice thickness can vary sharply up to 100 m over distances less than 5 km. Local thinning of the ice shelf often aligns with locally higher accumulation. These sites are also visible in the TerraSAR-X mosaic in ScanSAR and stripmap mode. Strength of the radar reflection from the base of the ice shelf varies strongly, and is often lost at sites of local thinning. We discuss these findings in glaciological, fracture mechanical and oceanographic context with the aim to identify the origin of the local thinning.