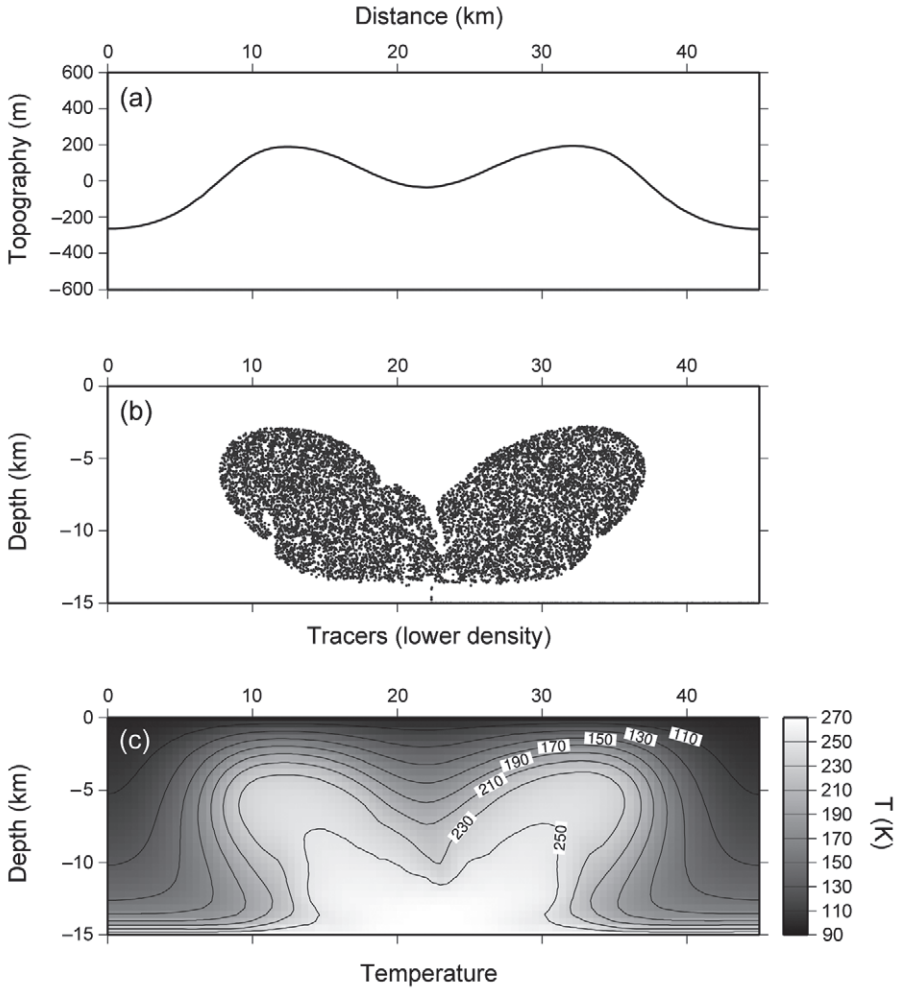


**Fig. 4.** **(a)** Topography, **(b)** composition, and **(c)** temperature for a numerical simulation of convection with salinity from *Han and Showman* (2005). Domain is 45 km wide and 15 km thick. Black dots in **(b)** are tracers marking the locations of salt-poor, low-density ice, which was initially near the bottom of the ice shell but experiences diapirism. White regions are salty, denser ice. The topography attains 200–300 m with widths of 15–20 km. This suggests that Europa's widest pits and uplifts can form from convection with salinity.

*al.,* 2003; see chapter by Bierhaus et al.) only for viscosity contrasts $<10^7$–$10^8$. For viscosity contrasts $>10^8$, pits and uplifts cannot form in timescales less than Europa's surface age. The implication is that compositional convection can only produce Europa's pits and uplifts if Europa's surface is weak. The simulated pits and uplifts were 10–30 km wide (see Fig. 4); explaining the many pits and uplifts with diameters <5 km is difficult.

As described above, matching the observed sizes of pits and uplifts remains a challenge. Pits and uplifts range in diameter from ~3 to 50 km (*Greenberg et al.,* 2003; *Spaun,* 2002; *Rathburn et al.,* 1998). Based on an early sampling of Galileo images, *Pappalardo et al.* (1998) suggested that a preferred diameter of ~10 km exists, which *Spaun* (2002) and *Spaun et al.* (2004) revised downward to ~4–8 km after performing an exhaustive survey of images that became available later in the mission. *Greenberg et al.* (2003) also performed an exhaustive survey and suggested that, when a preferred diameter exists at all, it is ~3 km and reflects the limits of image resolution rather than a physical peak. However, these divergent results may reflect differences in analysis methods rather than an actual discrepancy (see *Goodman et al.,* 2004, Appendix A; chapter by Collins and Nimmo). For our purposes, the main point is that, regardless of the preferred diameter, many pits and uplifts are small, with diameters of 3–10 km. Although convection (with salinity) can plausibly produce the largest of these features, explaining the smallest (3–5-km-diameter) features is difficult. It is plausible that multiple origins exist for pits and uplifts, with some of the larger features resulting from convection and the smallest features resulting from some other process.