Title

Geometry of the ridges on Jupiter's moon Europa

Abstract

The surface of Europa is covered in a large network of intersecting ridges, believed to form as tidal stress builds up, causing the surface ice to crack. I have measured the angle between intersecting ridges in order to investigate if the angle at which the ice breaks could be related to the crystal structure of ice. Furthermore, I have modelled the surface tidal stress eld and used it to predict crack azimuths to see if a model could predict the same azimuth patterns I have observed.

After measuring 3996 intersections, I found that the ridges predominantly intersect at an angle of 90º and have a preferred orientation in the NE-SW and NW-SE directions. However, these are only the preferred orientations when looking at the entire globe, because when looking at smaller surface areas the results were not conclusive. From these results I could conclude that the structure of ice crystals does not have an influence on the way the ice breaks.

I tested five different tidal stress scenarios one where the stress is generated purely form NSR, one with stress from only eccentricity, and three cases with stress from eccentricity and obliquity with SPD at 0º, 90º, and 270º. For all five cases I assumed that the ice breaks at an angle perpendicular to the maximum principal stress. Comparing the predicted azimuths from all five cases to my observed angles, I found that they were all anti-correlated. I could hereby conclude that none of the models tested, at the failure criteria I used, are able to reproduce the observed patterns in ridge azimuths.