Ice Motion Over Lake Vostok

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In order to better understand the past trajectories of the ice recently cored at Vostok Station, we have examined satellite and airborne radar data. Repeat-pass Synthetic Aperture Radar (SAR) data with spatial and temporal baselines suitable for interferometric analysis were used to observe the motion field over Lake Vostok. These data were collected by the European Remote Sensing Satellite in early 1996. A repeat-pass interferometer provides only line-of-sight motion measurements, thus only one component of the vector field is observed. Our dataset consists of five datatakes with the radar look vector directed along the long axis (North-South) of the lake. The sensitvitiy of the interferometer to ice motion, with the 70-day temporal baselines used here, is better than 0.05 m/a. The motion field shows that the lake exerts considerable control over the regional ice dyanmics. As the ice flows pass the grounding line, there is a pronounced southward motion with a profile which increases slowly at northern tip of the lake and then rather rapidly starting approximately at 100 km along the length of the lake. At a point 30 km north of Vostok Station, the N-S motion of the ice at the center of the lake is 2.2 m/a. Near Vostok Station, the E-W profile of the southward ice motion shows a characteristic parabolic shape with the peak centered on the lake. Assuming a steady-state motion field, we can construct a motion trajectory and determine the approximate origin of the ice at the present day location ofVostok Station. Depending on the magnitude of the easterly motion, preliminary analysis show that the ice at Vostok Station was grounded between 30-60 ka before present. When we include airborne radio echo sounding data, taken with the preliminary identification of more that 200 m of accretion ice at Vostok, numerous interesting questions are raised concering thermal and mechanical processes inthe ice sheet.

American Geophysical Union Abstract Form

Reference # 0000
Session 0.00

1. 1998 Fall Meeting
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5. (a) All
   (b) 1827
   (c) Climate and Global Change
6. N/A
7. 0% published elsewhere
8. $50
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10. No special instructions
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Date received: September 2, 1998
Date formatted: September 2, 1998
Form version: 1.5

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