APPROACH OF OCEANIC CURRENT DIRECTIONS INSIDE EUROPA. A. Mizser[1], A. Kereszturi[2] ([1]Hungarian Astronomical Association, H-1461 Budapest, Pf. 219, Hungary (mzs@mcse.hu), [2]Department of Physical Geography, Eötvös Loránd University of Sciences, H-1117 Budapest, Pázmány sétány 1/C., Hungary (krub@freemail.hu))

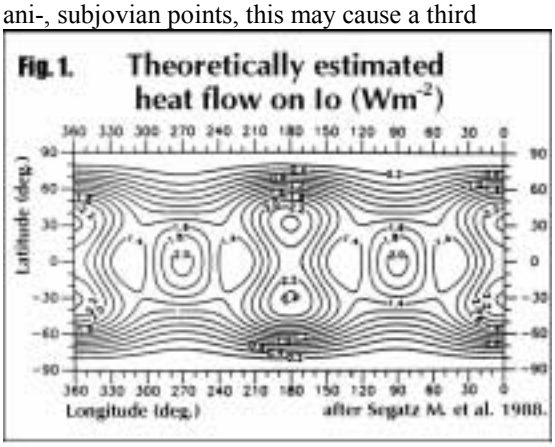
Introduction: This work summarizes some factors regarding to the possibile directions of the subsurface water currents inside moon Europa. Based on the results in the last years below the ice crust there is an 50-150 km deep ocean [1,2] which is heated by tidial friction inside the moon Based on the example of Io and theoretical reasons (Fig. 1.) [3,4] the heat flux on a tidally heated body is greater at smaller than at higher latitude and concentrated into hot spots. If we suspect higher heat flux on Europa around the equator near belt this latitudinal difference may has consequences on the currents inside the european ocean.

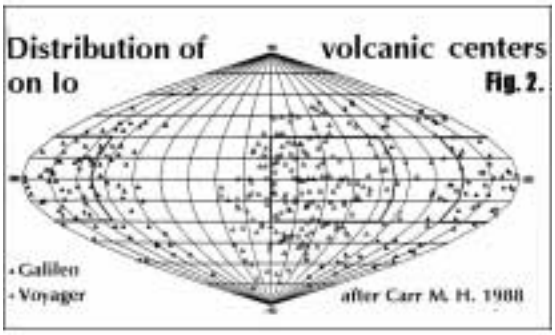
Theoretical bases: On Io the distribution of the volcanic centers shows preferred locations at smaller than higher latitudes (Fig. 2.) [5]. In this belt the heat transfer occurs mostly in the volcanic centers so the surface heat flux varies greatly on Io. If we suppose that the transfer of the tidal induced heat production realizes on a similar latitudinal distribution on Europa as on Io, we can expect higher heat flux on the equatorvard parts of Europa. The probable heat sources are volcanic centers on the top of the silicate crust, at the bottom of the ocean. At these places we can expect higher water temperature and greater concentration of volcanic elements which influence the current system. Around the volcanic centers there can form local/regional currents and based on the theory of the latitudinal heat flux distribution, near to the equator the water has greater average temperature and its smaller density can cause global Hadley-like circulation.

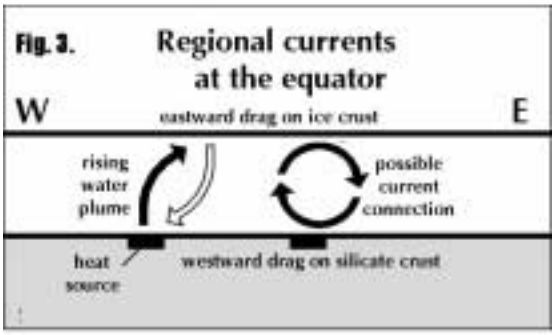
The circulation: The dimension of the global circulation depends on *1. The heat flux*: Theoretical models based on the tidal heating suggest a global heat flux on Europa around 10^{12} W [6] *2. The dimension and distribution of the heat sources*: We can look as an analogy on Io for the volcic centers' size and distribution. The surface structures: lenticulae, maculae and chaotic regions are the manifestation of submarine heat sources on the surface. Their size and location distribution can help either. *3. The heat escape* depends on the heat insulator capacity ot the ice, its thickness, structure and inhomogenities. The differences in the thickness can be studied with surface topography and Airy-isostasy. At the chaotic terrains the smaller ice thicknes may lead to higher heat escape which causes stronger circulation at that place. *4. The dimensions of the ocean*: indirect measurements suggest around 50-150 km deep continuous ocean below the icecrust. *5. The physical-chemical characteristics of the volcanically influenced water*: The water density excluding the temperature depends on the mixed elements, which content depends on the volcanically released matters, on the condensation out of these elements from the water, and on the freezing of the water at the base of the icecrust. The relation between the maximum density of the water and the freezing point depends on the salt content and on the pressure, the later factor is not well understood. If the water because of the decrease of its temperature reach the maximum density before the freezing point, it can sink downward from the bottom of the cold ice crust. Deeper the temperature rise and the density decrease below the maximum. This effect can cause a mixing layer below the ice crust somewhat similar to the 50-100 m thick upper "Ekman-layer" in the oceans of Earth caused mostly by salt-density currents. *6. The tides*. *7. The Coriolis-force.* The rotation of Europa is 3,55 days, the Coriolis-force depends on the angular rotation speed, on the radius of the body and on the latitude. We can devide the force into three components according to the three directions. On the Earth the vertical component if often neglected because of strong gravity. We hadn't estimated the exact situation on Europa with physical model yet but based on the parameters in this article we can approach the consequences of the Coriolis-force on the following.

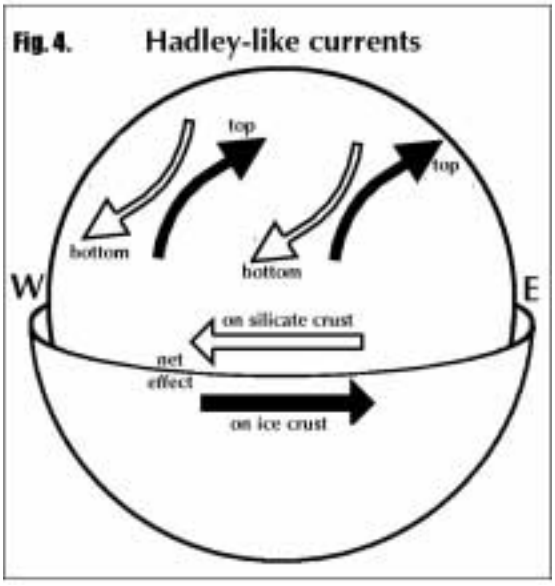
Consequences of the Coriolis-force: The regional currents above the volcanic centers because of the Coriolis-force gain westward speed component during rising and eastward speed component during sinking. During the vertical rise in an idealized case at the equator without viscosity the water plumes devitaes about four km toward that direction. This effect possible cause currents with opposite shear on the bottom of the icecrust (westward) and on the subwater silicate surface (eastward) (Fig. 3.). If there are global currents because of the higher heat flux at lower than higher latitude the meridional currents will have eastern and western speed components too. In the one cell model the upper and poleward moving current has eastward speed component and the lower equatorward moving current at the bottom of the ocean has westward speed component. These processes cause eastward shear on the icecrust and westward shear on the silicate surface (Fig. 4.). The two upper mentioned possible current systems cause differently oriented shear on the icecrust relative to the silicate interior. Above all if there can be

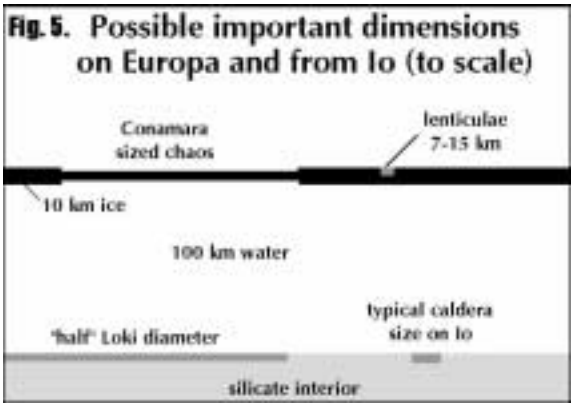
preferred locations of the heat sources respect to the ani-, subjovian points, this may cause a third component of the current system. Unfortunately we have no physical models of the currents yet, so we can't discuss their net effect, but it is possible that they take part in the origin of the supposed nonsynchronous rotation of the ice crust. Some inportant dimensions are visible on Fig. 5. for comparison.











Future work: In the future we would like to collect possible evidences for the surface maifestation of the supposed current systems. If there will be more accurate estimations on the currents it will be possible to analyze the effect of the shear between the water and the ice crust. We would like to make physical models on the currents and looking for other researchers working on water current modelling.

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