Geophysical Research Abstracts
Vol. 12, EGU2010-268, 2010
EGU General Assembly 2010

Normal Isocurvature Surfaces and Special Isocurvature Circles (SIC)

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An isocurvature surface of a gravity field is a surface on which the value of the plumblines' curvature is constant. Here we are going to study the isocurvature surfaces of the Earth's normal gravity field. The normal gravity field is a symmetric gravity field therefore the isocurvature surfaces are surfaces of revolution. But even in this case the necessary relations for their study are not simple at all. Therefore to study an isocurvature surface we make special assumptions to form a vector equation which will hold only for a small coordinate patch of the isocurvature surface. Yet from the definition of the isocurvature surface and the properties of the normal gravity field is possible to express very interesting global geometrical properties of these surfaces without mixing surface differential calculus.

The gradient of the plumblines' curvature function is vertical to an isocurvature surface. If P is a point of an isocurvature surface and "" is the angle of the gradient of the plumblines' curvature with the equatorial plane then this direction points to the direction along which the curvature of the plumbline decreases / increases the most, and therefore is related to the strength of the normal gravity field. We will show that this direction is constant along a line of curvature of the isocurvature surface and this line is an isocurvature circle. In addition we will show that at each isocurvature surface there is at least one isocurvature circle along which the direction of the maximum variation of the plumblines' curvature function is parallel to the equatorial plane of the ellipsoid of revolution. This circle is defined as a Special Isocurvature Circle (SIC). Finally we shall prove that all these SIC lye on a special surface of revolution, the so – called SIC surface. That is to say, a SIC is not an isolated curve in the three dimensional space.