The data base from "National Snow & Ice Center" describes the Greenland ice sheet as 301 x 501 cuboids having a square of 5 km x 5 km as base. These squares together form the rectangle surrounding Greenland which is displayed in Figure 1.

It is seen that quite a few of the squares making up the rectangle are positioned outside the ice sheet. Of the 168861 ice cuboids 103136 are in fact assigned a height of zero!

The model for the gravitational field caused by the ice that is used here is the gravitational field of 301 x 501 mass points positioned in the middle of each of these 5 km x 5 km squares with a mass equal to the mass of the ice cuboid. Of these 168861 mass points 103136 have mass zero because corresponding ice cuboid has heigth zero being positioned outside the ice sheet!

Already at a distance of say 10 - 20 km from the ice edge this is a very accurate approximation for the true gravitational field of the ice mass

If

$G = 6.6740810^{-20} km^3 kg^{-1} s^{-2}$ is the general gravitational coefficient

m_k is the mass of mass point k

r_k is the distance from point (x, y, z) to mass point k

$\mu_k = G\ m_k$

then the gravitational potential corresponding to these 301 x 501 mass points approximating the gravitational potential of the Greenland ice at a point (x, y, z) of the Earth surface is

$$p(x, y, z) = -\sum_{k=1}^{N} \frac{\mu_k}{r_k}$$

where N = 301 x 501 = 150801

If

$$P(x, y, z)$$

is the gravitational potential corresponding to the entire Earth **WITHOUT** the Greenland ice the sea level in the **ABSENCE** of the Greenland ice would correspond to an equipotential-surface

$$P(x, y, z) = C$$

where C is some constant.

If g is the gravitational force per unit mass at sea level and $(x^{'}, y^{'}, z^{'})$ is the point displaced vertically upwards away from the sea surface

with the amount $\frac{1}{g}\sum_{k=1}^{N}\frac{\mu_k}{r_k}$

the point $(x^{'}, y^{'}, z^{'})$ is at the equipotential surface

$$P(x^{'}, y^{'}, z^{'}) + p(x^{'}, y^{'}, z^{'}) = C$$

corresponding to the full gravitational potential of the Earth **INCLUDING** the Greenland ice.

But this equipotential surface

$$P(x^{'}, y^{'}, z^{'}) + p(x^{'}, y^{'}, z^{'}) = C$$

for the gravitational field of the Earth with the Greenland ice included is not the equipotential surface corresponding to the sea level.

To find the right (lower) equipotential surface corresponding to the sea level one has to compute the surface integral of the height increase

$$I = \frac{1}{g}\int\sum_{k=1}^{N}\frac{\mu_k}{r_k}dA$$

over the surface of all oceans where dA is the surface element.

If then

$$A = \int dA$$

is the total sea area and

$$c = \frac{I}{A}$$

the water level change caused by the Greenland ice is

$$y = \frac{1}{g}\sum_{k=1}^{N}\frac{\mu_k}{r_k} - c$$

where a positive value means a higher water level and a negative value a lower water level

To numerically compute the integrals

$$I = \frac{1}{g}\int\sum_{k=1}^{N}\frac{\mu_k}{r_k}dA$$

$$A = \int dA$$

over the water surface of the Earth the entire Earth surface was divided into 416 surface elements and each of these surface elements were assigned to be either "land" or "water". The number of "water" surface elements was 295 and the number of "land" surface elements was 121

In figures 2a and 2b the "water elements" that are visible from two different directions are displayed. It is seen in the figures that many elements are partly covering sea and partly covering land and corresponding assignment is somewhat crude. Still the sum of all areas assigned to be "water" elements is 358906332 square kilometer, a value quite close to the correct value 361132000 square kilometer for the total water surface of the Earth

If the areas of the 295 "water" surface elements are

Δ_l for l=1,..,295

a surface integral $\int F dA$ of a function F is evaluated as

$$\sum_{l=1}^{295} F_l \Delta_l$$

where F_l is the value of function F in the middle of the surface element.

In this way the value of $c = \frac{I}{A}$ is computed to be 2.431 meter