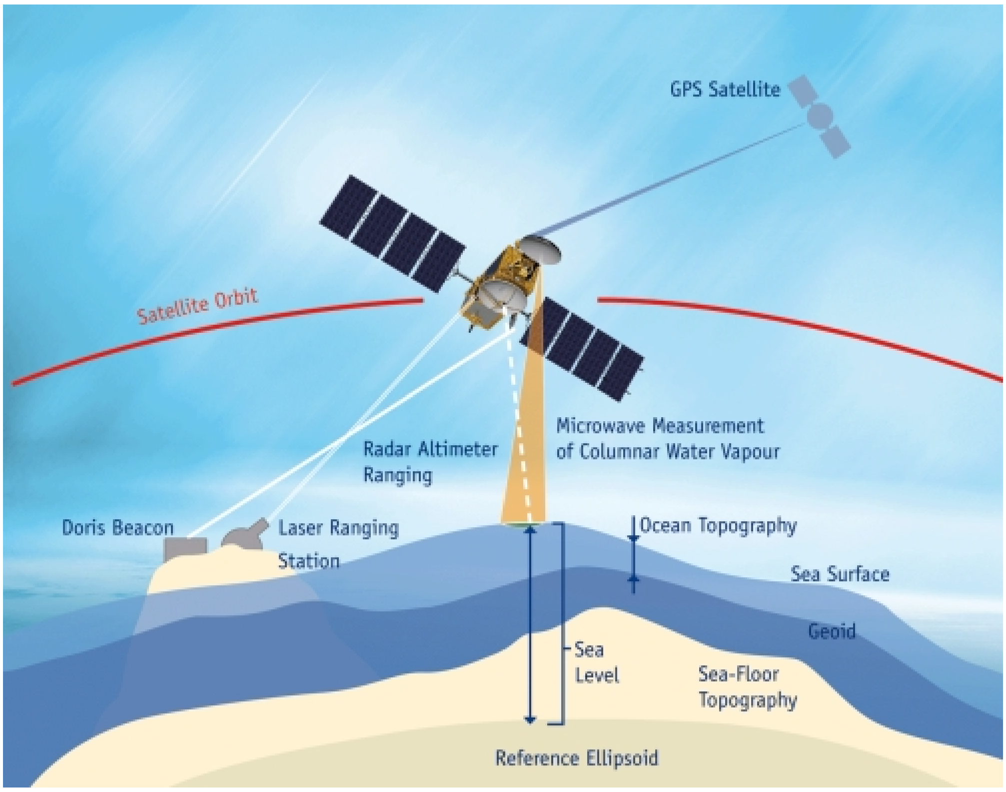
Satellite Altimetry

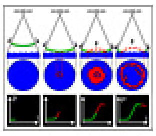


Satellite radar altimetry measures the time it takes for a radar pulse to travel from the satellite antenna to the surface and back to the satellite receiver. Apart from the surface height, this measurement yields a wealth of other information that can be used for a wide range of applications.

As we know, the sea surface is not smooth and flat, it is a surface that is in constant movement. This moving surface is what we call a dynamic topography. If we want to measure the sea surface height, we must measure it relative to a defined, constant surface. This theoretical surface is called the reference ellipsoid. It is a rough approximation of Earth's surface, a sphere flattened at the poles. Since the sea depth is not known accurately everywhere, this reference is the best way of providing accurate, homogeneous measurements.

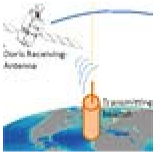
The satellite flies in an orbit at a certain altitude **S** from the theoretical reference ellipsoid. The altimeter on board the satellite emits a radar wave and analyses the return signal that bounces off the surface. The time it takes for the signal to make the trip from the satellite to the surface and back again, defines the satellite-to-surface range **R**. In other words, the range is the actual distance between the satellite and the moving sea surface. The sea surface height (**SSH**) at any location or point in time is a deviation from the stable reference ellipsoid. The sea surface height is thus defined as the difference between the satellite's position with respect to the reference ellipsoid, and the satellite-to-surface range. That is, **SSH** = **S** – **R**.

ADDITIONAL FACTORS



Waveforms and Frequencies

Apart from sea surface height, by looking at the return signal's amplitude and waveform, we can also measure wave height and wind speed over the oceans, and more generally, backscatter coefficient and surface roughness for most surfaces off which the signal is reflected. The Poseidon-3 altimeter on board Jason-2 emits in two frequencies, and by comparing the signals with respect to the frequencies used, interesting information can be extracted (e.g. rain rate over the oceans, detection of crevasses over ice shelves, etc).



Orbital Positioning and Interference

An extremely precise knowledge of the satellite's orbital position is necessary in order to obtain measurements accurate to within a few centimetres over a range of several hundred kilometres. Thus three locating systems are carried onboard Jason-2. Any interference with the radar signal also needs to be taken into account. Water vapour and electrons in the atmosphere, sea state and a range of other parameters can affect the signal round-trip time, thus distorting range measurements. With the help of the measurements of the Advanced Microwave Radiometer (AMR) we can correct for these interference effects on the altimeter signal.

Altimetry thus requires a lot of information to be taken into account before being able to use the data. Data processing is also a major part of altimetry, producing data of different levels optimised for different uses at the highest levels. For more information on the instruments aboard the satellite, take a look at the **Jason-2 Instruments** page. More information on the data processing can be found in the **Jason-2 Services** page.