Salinity and Water Cycle; Aquarius/SAC-D Satellite Mission Early Results

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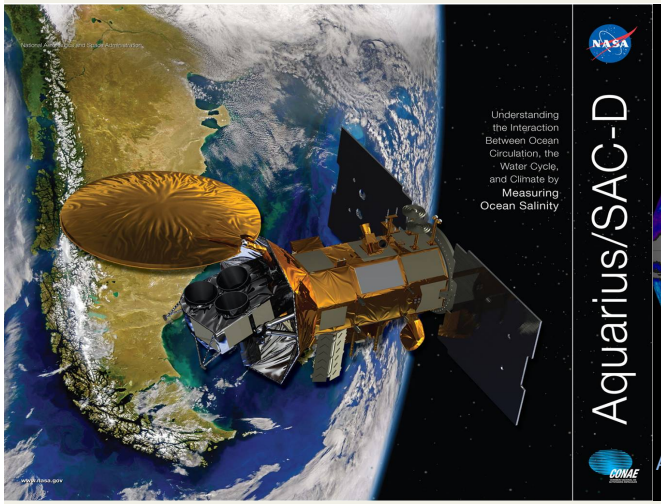
Abstract

The **Aquarius/SAC-D satellite mission** measures sea surface salinity (SSS) and other parameters to address the links between circulation, the global water cycle, and climate change. The satellite was launched on 10 June 2011. This poster shows early results of the salinity retrievals, and validation with surface oceanographic observations. The primary mission objective is to measure SSS over the global ice-free ocean for at least three years with 0.2 pss uncertainty, 150 km resolution, on a monthly average. Pre-launch simulations indicate that the actual measurement errors will be smaller, especially in the tropical and mid latitudes. Aquarius/SAC-D will resolve the mean SSS field, especially in remote regions where in situ data are sparse, and measure seasonal and interannual SSS variations. Other measurements on this international space observatory include ocean winds, precipitation, sea ice, surface temperatures, soil moisture, nighttime imaging, GPS occultation and space environment. Aquarius/SAC-D is a USA-Argentina partnership with participation also from Italy, France, Canada and Brazil.



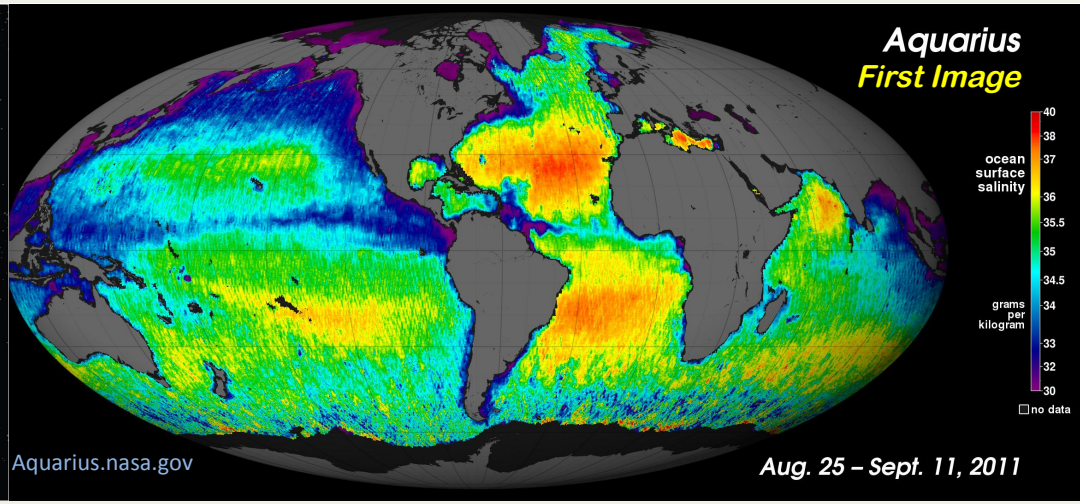
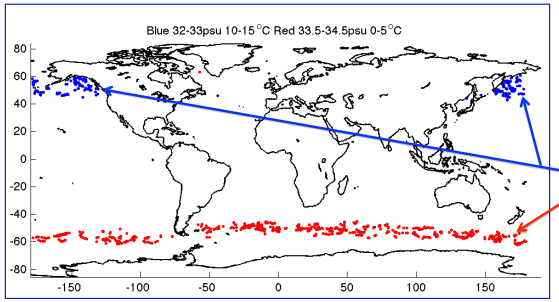
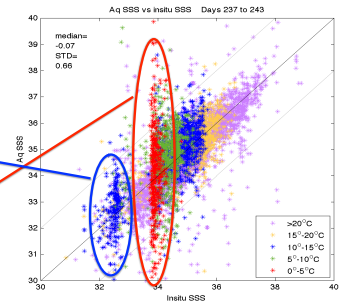
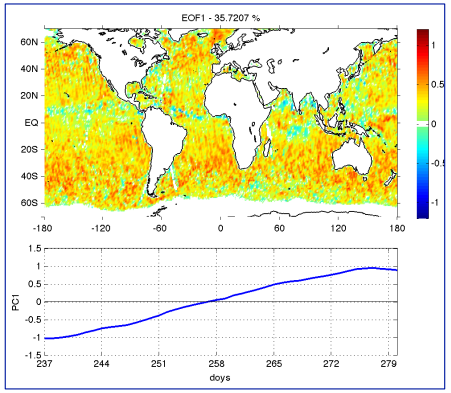


Figure 1 (Above Left): The Aquarius/SAC-D Satellite artist's conception in orbit over Patagonia. The satellite is in a polar sun-synchronous (6pm/6am) orbit that provides global coverage every 7 days.
Figure 2 (Above Right): The initial Aquarius SSS image is a composite of the first two and a half weeks of data after the Aquarius salinity sensor became operational on August 25 2011. The numerical values are on the practical salinity scale (PSS-78), and approximate the surface salt concentration in parts per thousand by mass. The average SSS on the map is about 35. The image reveals well-known prevailing ocean salinity features, such as higher salinity in the subtropics, higher average salinity in the Atlantic Ocean compared to the Pacific and Indian Oceans, and lower salinity in rainy belts near the equator, in the northernmost Pacific Ocean and elsewhere. These features are related to large-scale patterns of rainfall and evaporation over the ocean, river outflow and ocean circulation. Aquarius will monitor how these features change over time and study their link to climate and weather variations. To produce the map, the Aquarius team performed a preliminary calibration of the initial measurements using ocean surface salinity reference data. The re-calibrated data still contain a number of uncertainties (Figures 3&4), and considerable calibration and data validation work remains. Measurements in the southernmost ocean regions are not yet reliable as they have large uncertainties associated with high winds and low surface temperatures. In addition, low salinity values immediately adjacent to land and ice-covered areas are biased due to proximity to coastlines or ice edges, which introduces errors into the data that will require additional analyses to correct.
Figure 3 (Below center and left): The scatterplot of Aquarius salinity versus *in situ* Argo buoys shows the good overall fit, but with a large number of outliers clustered around SSS 34 and 32.5 within certain temperature ranges. The map at left shows the red dots (~34 pss, 0-5°C) are all clustered along the sub polar front and/or near the ice edge in the southern ocean. The blue dots (~32.5 pss, 10-15°C) are all clustered across the northern N. Pacific. The sources of these regional errors are likely related to cold surface temperatures, high winds, eddies, radio interference, or land/ice proximity and are being investigated. Excluding outliers >2 pss, the rms difference is ~0.66.
Figure 4 (Below right): The Aquarius sensor presently has a calibration drift indicating a false upward salinity trend, as evident if the EOF of the first 45 days of data. The team is now testing a time-varying calibration correction algorithm that will be implemented to reprocess the entire data set in the coming weeks.







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