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Volume Transport and Variability at Windward Passage

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The Gulf Stream system is fed via Atlantic inflow through the passages of the Bahamas and the Caribbean. In contrast to the large amount of research focusing on the downstream components of this system (Florida Current, Gulf Stream, Gulf Stream extension), far fewer measurements of Atlantic inflow into the Caribbean Sea through the Caribbean passages have been made. Of all of the major Caribbean passages, the volume transport and variability through Windward Passage is probably the least well understood, even though it is recognized as an important inflow channel.

Between October 2003 and February 2005, a moored current meter array was deployed across the shallowest part of Windward Passage, and four hydrographic and lowered-ADCP surveys were conducted in the region. Stations were located along sections at Windward Passage and passages upstream, including passages between Cuba and Great Inagua, and Haiti and Great Inagua, and selected passages through the southern Bahamas and Turks and Caicos. Sections were also occupied downstream of Windward Passage across the axis of the Cayman Basin. The transport entering Windward Passage is highly variable, including reversals to net outflow. Transports measured during the cruises ranged from -0.3 Sv (outflow) to 9.4 Sv (inflow), with an average inflow of 3.8 Sv. Corresponding transports derived from the current meter array range from approximately -5 to 15 Sv, with an average inflow of 3.6 Sv. On average there is net inflow in the surface and thermocline layers (above ~600 m), net outflow in the intermediate layer (~700-1200 m), and a deep inflow just above the bottom.

Data gathered from lowered and hull-mounted instrumentation during these surveys have helped to resolve the vertical and horizontal structure of the flow through the passage and will be used in conjunction with the hydrographic data to quantify the volumes of the different water masses flowing through the passage and their regional pathways.