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Studies of the Gulf Stream and Deep Western Boundary Current Where They Cross at Cape Hatteras

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13. ABSTRACT *(Maximum 200 words)*
It was proposed to analyze recent data obtained from the SYNOP Inlet Array, with focus on the interaction of the Gulf Stream and deep western boundary current (SWBC) at their crossover point. Two separate studies are described, both of which use 3 years of collected data.

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Pickart, R. S., 1995. Gulf Stream-generated topographic Rossby Waves. *Journal of Physical Oceanography*, **25**, 574–586.

An inverse ray-tracing model was used to determine the source of strong 40-day topographic Rossby waves observed in the mid-Atlantic Bight offshore of Cape Hatteras. It was shown that such waves are continually generated farther offshore by 40-day meanders of the Gulf Stream as they pass over a topographic bend in the continental slope near 71–72W. Satellite AVHRR data reveal that such 40 day meanders are the most frequently occurring of all meanders in this portion of the Gulf Stream. At the location of the topographic bend the strong bottom slope (topographic $\beta \gg$ planetary β) and large meridional orientation of the bathymetry (which tilts the Rossby wave dispersion curve) enables coupling between the eastward propagating meanders and topographic Rossby waves with eastward phase speed. This is significant, for it is a mechanism by which the Gulf Stream can efficiently radiate energy (note that eastward meanders cannot couple to planetary Rossby waves which have westward phase speed). The mechanism was first proposed by Rizzoli et al. (1994) based on their numerical simulations; the present study shows that this process does in fact occur in the Gulf Stream.

Pickart, R. S., 1994. Interaction of the Gulf Stream and Deep Western Boundary Current where they cross. *Journal of Geophysical Research*, **99**, 25,155–25,164.

This study investigates the premise that the Deep Western Boundary Current (DWBC) impacts the separation of the Gulf Stream, using a long-term array of bottom current meters and Inverted Echo Sounders deployed offshore of Cape Hatteras. It was motivated by Thompson and Schmitz's (1989) numerical modeling study which suggested that an increase in lower layer DWBC transport causes the upper layer Gulf Stream to separate from the continental shelf at a more southerly (and hence more realistic) latitude. At periods of less than than a year no relationship was found between the observed DWBC fluctuations in the bottom current meter records and variability of the upper layer Gulf Stream measured by the inverted echo sounders. By contrast, at periods of greater than a year there is a strong coupling between the two currents. However, it appears that the DWBC takes a more passive role in the crossover; *i.e.* the bottom-most flow simply responds to changes in the Gulf Stream rather than causes them, in contrast to the implications of Thompson and Schmitz (1989). Curiously, the mean orientation of the separating Gulf Stream is aligned precisely with the particle trajectories of the energetic topographic Rossby waves (discussed above). This is suggestive of a possible coupling between the wave field and Gulf Stream, which requires further investigation and is one of the topics of my present ONR contract.