



Forced and chaotic variability of the Gulf of Mexico and surrounding regions.

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The Gulf of Mexico (GoM) is a basin with a strong turbulent activity, dominated by the large anticyclonic eddies shed by the Loop Current. Some authors attribute the variability in the basin to the atmospheric forcing, while others affirm that the system is mainly chaotic. Determining the respective contributions of the oceanic chaos and of the atmospheric forcing in this region is an important question for societal and economic reasons, and is relevant for ocean forecasting. Our objective is to understand the interplay between the intrinsic/chaotic variability in the GoM and the atmospheric forcing, using a $1/4^\circ$ ocean/sea-ice 50-member ensemble simulation of the North Atlantic performed in the framework of the OCCIPUT project. The daily SSH 1997-2012 variability is analyzed probabilistically using ensemble PDFs and entropy-based metrics. We identify regions (Loop Current, central GoM, Caribbean Sea) where the oceanic variability is mainly chaotic, distinguishing between short timescales (weekly to monthly) and longer ones (annual to interannual). The temporal modulation of the ensemble dispersion and entropy allows us to identify regions where the oceanic "chaos", which spontaneously emerges from mesoscale turbulence, is counteracted by the atmospheric variability; examples include hurricanes which drive storm surges within all ensemble members, atmospherically-forced entropy minima which propagate at lower frequencies across the domain, etc. We also investigate the relationships between the chaotic and forced variability of the LC extension (and the eddy shedding) with the transport fluctuations through the Yucatan Channel (YC) and the Florida Straits (FS). We found high coherence between the LC extension and the YC deep transport, around the period of 270-365 days, with a phase around 45° , meaning that the YC transport lags the LC. This probabilistic investigation sheds light on the actual constraint exerted by the atmosphere on the turbulent ocean, the predictability of the GoM circulation, and is in line with operational oceanography objectives.