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Wintertime buoyancy forcing produces two different circulation systems in the Adriatic

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The presentation is based on data collected in the framework of the East Adriatic Coastal Experiment (EACE) between November 2002 and June 2003. Meteorological (solar and net radiation, air temperature, humidity, precipitation, air pressure, wind speed and direction) and oceanographic (sea temperature) data were collected at station Veli Rat. CTD profiling was done at a network of 21 stations off Veli Rat on seven occasions. Currents were measured at two stations in the network using barny-mounted ADCPs. The central finding of the experiment is that – contrary to the expectations – the East Adriatic Current (EAC), which inflows to the Adriatic along the east coast, peaked in January/February 2003 and again in May 2003. EAC was concentrated close to the coast in winter whereas it was more widespread in spring, and it stretched over the whole water column throughout the measurement interval. The first maximum corresponded with the considerable cross-shore variability of hydrographic properties, the cold, fresh water prevailing close to the coast, the warm, saline water dominating the open sea. The second current maximum coincided with the massive intrusion of warm, saline water along the east Adriatic coast. Meteorological data showed that the forcing was anomalous over the EACE interval: during winter 2003 the cooling was exceptionally strong, during spring 2003 the warming was very pronounced as was the surface water loss. Hydrological data, supplied by routine stations in the area, revealed that the winter 2003 river outflows were higher than the averages, and that the spring 2003 values remained one standard deviation below them. In order to interpret the two EAC maxima we have developed a simple

numerical model of the Adriatic-Mediterranean system. We have found that the first maximum could be related to the coastal freshwater input and offshore evaporation in the Adriatic area, and that the second maximum was probably due to the surface cooling of the Adriatic while warmer conditions prevailed above the east Mediterranean. Thus, two circulation systems developed, one inside the Adriatic (marginal-sea system), the other between the Adriatic and the east Mediterranean (negative inter-basin system), and they differed not only in spatial but also in temporal scales, therefore supporting the occurrence of two distinctive EAC maxima. The marginal-sea circulation is a proper winter phenomenon, the negative inter-basin circulation starts in winter but may persists in spring and thus interfere with other processes that are characteristic for the warmer part of the year. Most important of these is positive inter-basin (or estuarine-type) circulation, which usually appears in spring when the Adriatic rivers inflow to the stratified sea. In spring 2003, however, the latter circulation system was weakly developed, due to the anomalous meteorological and hydrological conditions, and thus we have observed the negative inter-basin circulation in an almost pure form. It may be expected that in a more typical year surface outflow related to the positive inter-basin circulation would oppose surface inflow due to the negative inter-basin circulation and that EAC would peak only in winter – in agreement with traditional views on the Adriatic dynamics.