TOWARDS LONG-TERM FORECAST OF THE NORTHERN ADRIATIC WINTER CONDITIONS

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Abstract
Winter geostrophic circulation patterns in 2000 and 2001 in the northern Adriatic, as a result of bottom density distribution, were different. Formed earlier in autumn under different atmospheric forcing, they remained stable even in conditions of above average surface heat losses. This suggests that forecast of the northern Adriatic geostrophic circulation patterns is attainable several months in advance.
Keywords: Adriatic Sea, Circulation

Introduction
The northern Adriatic is influenced by the Po River, one of the largest in the Mediterranean basin. In winters termed as type A, bottom density is higher in the eastern than in western part of the northern Adriatic, while for winters of type B the situation is opposite (1). The Po River waters more likely spread across the northern Adriatic in winters of the type A (in preparation). As a consequence, large phytoplankton production in the entire northern Adriatic is expected to occur in A winter types, whereas dense water formation characterizes the B ones. In this work winter oceanographic conditions of type A and type B, for 2001 and 2000 respectively, were analyzed.

Data and methods
Data collected during six large oceanographic cruises at three transects (45 stations; Fig. 1) in the northern Adriatic were used to plot distributions of temperature, salinity, density and geostrophic currents relative to 30 dbar surface (Oct 1999, Jan 2000, Feb 2000, Oct 2000, Dec 2000, and Feb 2001). Daily values of meteorological data and surface fluxes in the region, as well as the Po River flows were also analyzed for the periods Oct 1999 - Feb 2000 and Oct 2000 - Feb 2001.

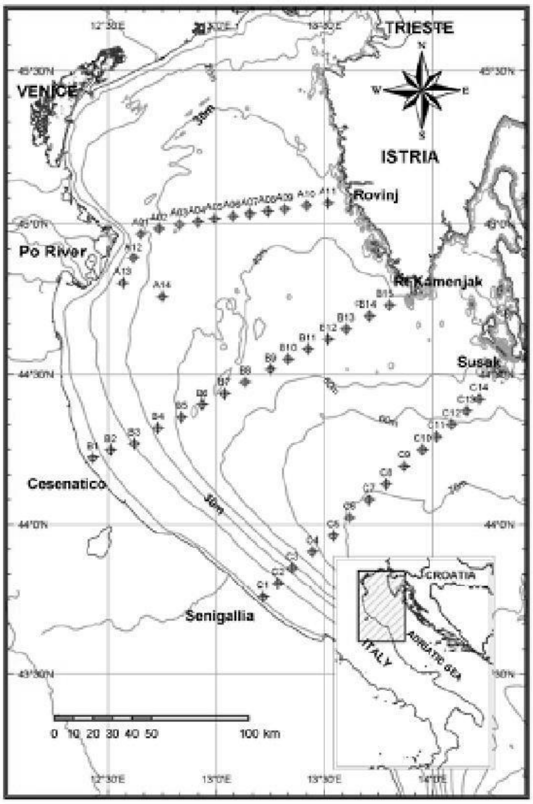

Fig. 1. Map of the northern Adriatic with position of stations

Results
Winter geostrophic circulation patterns in both 2000 and 2001 remained stable between the two subsequent cruises (Jan and Feb 2000; Dec 2000 and Feb 2001). In the winter of 2000 there was a cyclonic gyre off the Po River delta while in the winter of 2001 in the same area an anticyclonic gyre was present (Fig. 2). The differences in circulation patterns were due to differences in bottom density distribution (Fig. 2). Monthly values of northern Adriatic surface heat losses for both Jan 2000 and 2001 were above their long-term means (not shown). Bottom density fields were already formed in late autumn, starting from October (not shown). The autumn of 1999 was characterized by many bora episodes and very large surface heat losses while in 2000 by strong sirocco events and moderate surface heat fluxes.

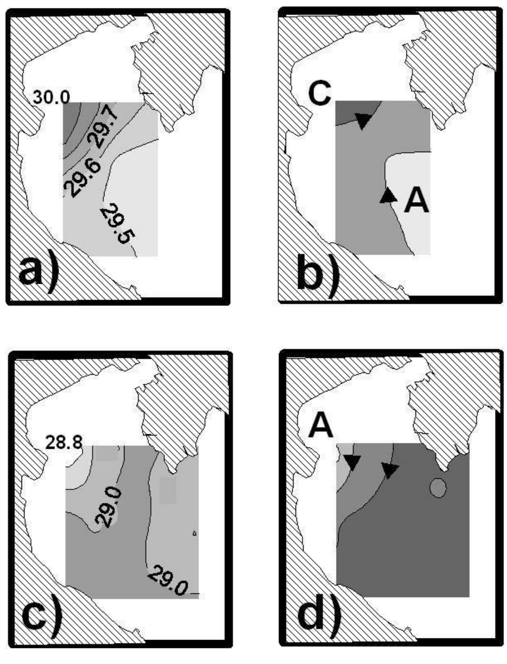

Fig. 2. Distribution of bottom density and of surface geostrophic currents relative to the 30 dbar surface in February 2000 (a and b) and February 2001 (c and d). A and C represent anticyclonic and cyclonic sense of rotation, respectively

Conclusion
The results strongly support the hypothesis that autumn conditions determine the next winter geostrophic circulation patterns, allowing us to forecast the northern Adriatic winter hydrographic conditions.

References
1 - Supic N. and Vilibic I., 2006. Dense water characteristics in the northern Adriatic in the 1967-2000 interval with respect to surface fluxes and Po River discharge rates. *Estuar. Coast. Shelf. S.*, 66: 580-593.