

Evolution of the Po River plume during February 2003

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Abstract

The Po River plume formation and evolution is studied using satellite images of sea surface temperature (SST) and ocean color, and drifter data during February 2003. Medium Po River discharges combined with sustained strong episodes of bora winds triggered the development of the plume extending to the northeast across the basin as the southern limb of a cyclonic gyre in the Northern Adriatic.

Key-words: River plume, drifters, satellite data, Adriatic Sea

Introduction

During strong bora events, the Po River plume generally extends toward the Istrian Peninsula instead of going south in the West Adriatic Current (1). In winter, this feature is visible both in temperature and in chlorophyll due, respectively, to the lower temperature and higher nutrients concentration of the river water compared to the surrounding sea (2). The particular structure and evolution of the Po River plume was studied using satellite and *in situ* data in February 2003 as part of the DOLCEVITA project.

Materials and methods

AVHRR data were acquired and processed at OGS using the TeraScan system to create SST maps of the Northern Adriatic. SeaWiFS data were downloaded from the DAAC, processed and extracted with the SeaDAS software to provide maps of surface chlorophyll concentration. Most of the drifters involved in the study were of the modified CODE-type and followed the currents in the first meter of water, while the optical drifters, SVP/OCM, had a drogue centered at 15 m depth (3). The drifter optical data consist of upwelling radiance and downwelling irradiance in seven visible wavelengths. The positions of the drifters were obtained through the Argos and/or the GPS systems. Surface velocities were calculated from low-pass filtered drifter position data and exclude tidal/inertial components.

Results

During February 2003, the drifter trajectories combined with the satellite data evidenced a well developed Po River plume with a cyclonic gyre in the northern part of the Adriatic. Both temperature (see example in Figure 1) and chlorophyll (see example in Figure 2) images show the formation of the plume starting on 16-17 February, its evolution on 18-23 February and its dissipation near the end of the month (24-26 February). The surface temperature of the plume is 3 °C lower than the rest of the basin and the fresh water is much richer in chlorophyll. The northeastward currents in the core of the plume computed from the drifter trajectories have speeds as large as 20 cm/s. The occurrence of the plume was concomitant with an extended episode of strongly sheared bora winds spanning 9-19 February with maximum strength around 16-17 February. During the entire month the Po river discharge remained below the climatological monthly mean. The optical drifters revealed drastic difference in the optical properties between the

warm/poor waters south of the Istrian Peninsula and the cold/rich Po plume, as can be seen in spectra of remote sensing reflectance (Figure 3).

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References

1. Cushman-Roisin, B., M. Gacic, P.-M. Poulain and A. Artegiani, 2001. Physical Oceanography of the Adriatic Sea. Kluwer Academic Publishers, 304 pp.
2. Mauri E. and P.M. Poulain (2001) Northern Adriatic Sea surface circulation and temperature/pigment fields in September and October 1997, J. Mar. Syst., 29, 51-67.
3. Poulain P.-M., L. Ursella, E. Mauri and D. Deponte (2003) DOLCEVITA-1 Cruise 31-January – 24 February 2003, Report of drifter-related activities. Rel. 08/2003/OGA/03, 32 pp.

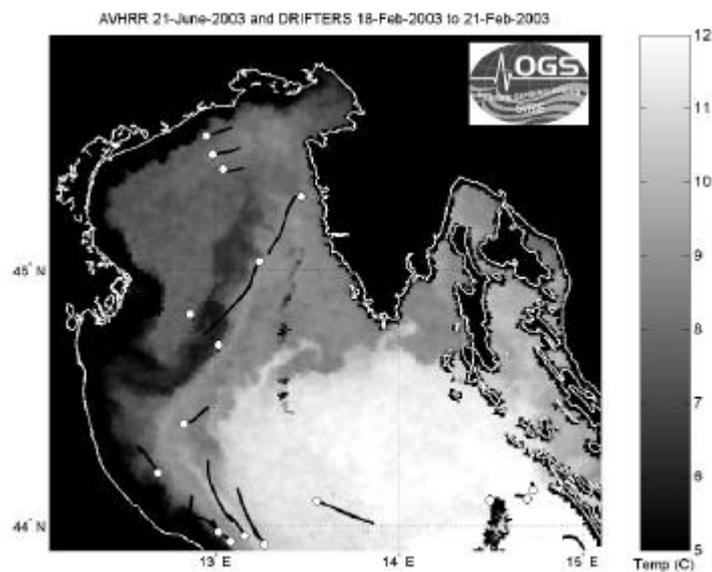


Figure 1. AVHRR-SST image of the Northern Adriatic on 21 February 2003 at 02:07 GMT, with drifters tracks superimposed for a period of 4 days (18-21 February). White circles represent the drifter locations at midnight on 21 February.

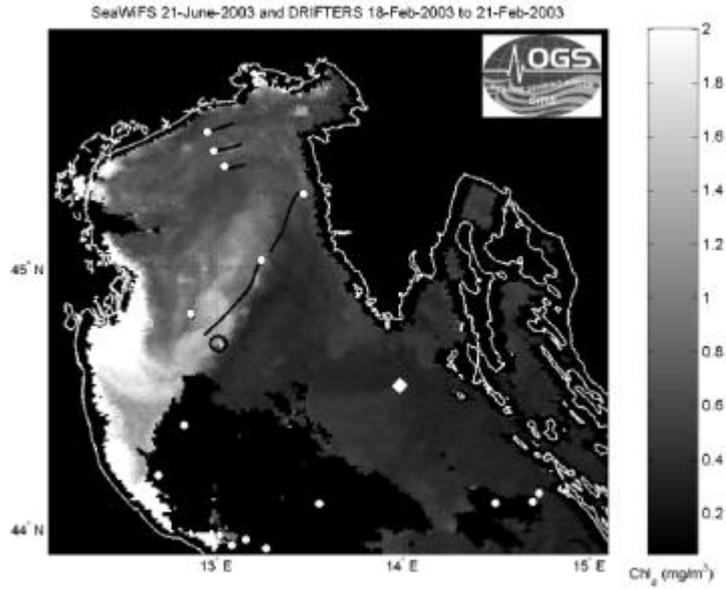


Figure 2. Same as Figure 1 but for surface chlorophyll-a derived from SeaWiFS data. The open circle and white diamond symbols denote the positions of the optical measurements of Figure 3.

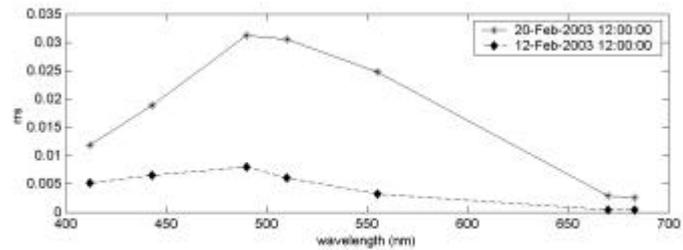


Figure 3. Examples of remote sensing reflectance ($\mu\text{W}/\text{cm}^2/\text{nm}/\text{sr}$) recorded by the optical drifters south of the Istrian Peninsula (diamond symbol) and in the Po Plume core (star symbols). The locations of the measurements are posted in Figure 2.

