General Conclusions and Perspectives

The analysis of more than 4 years of velocity data at the surface in two locations, 23ºW and 10ºW, showed three principal types of quasi periodic oscillations in the intraseasonal band. The first oscillation was observed in the zonal velocity component near the surface as well as at intermediate depths, had a period of about 7 days, and occurred indistinctly along the year. In 2002, the 7 day period oscillations were particularly interesting since they had a strong signature in temperature records as well. The temperature 7-day period oscillation was strongest at the thermocline depth, suggesting the existence of a vertical component in the 7-day period signal.

The second oscillation had a period between 11 and 15 days, occurred in boreal spring and was forced by winds presenting the same periodicity. In 2000, the signature of this wave is detected as deep as 1000 m. Depending on the year, the 11 to 15 day period oscillation showed a SST signature as well. In 2004, the SST signature was particularly strong and we were able to estimate a zonal scale of about 30 degrees of longitude and to see a clear antisymmetric SST structure about the equator. This particular oscillation in 2004 presented no propagation and was consistent with a standing, second baroclinic mode, mixed Rossby-gravity wave.

The third type of intraseasonal quasi-periodic oscillation had a period of about 20 to 30 days. They occurred principally in boreal summer and fall but under exceptional conditions they were also observed in winter. These waves, better known as TIWs, presented a strong SST signature. The simultaneous analysis of SST and velocity data in the year 2002 showed that unlike the Pacific Ocean, the TIW in the Atlantic share the same period in temperature and current velocity time series. The TIW-SST signature was not the same at all locations: east of 10ºW the SST anomalies showed no propagation and larger zonal scales than west of 10ºW. Moreover, the propagation patterns at the equator, in the center of the basin, changed with time. These variations in the TIW-SST anomalies suggest the possibility of different types of TIWs.

The three quasi-periodic oscillations mentioned above presented variations from year to year. A full comparison between similar oscillations at different years is planned. Several questions arise. Is the 7-day period oscillation in the zonal component always related to fluctuations in subsurface temperature? What are the differences between 13-day period oscillations at the surface and at the subsurface? Are they all forced by the winds? Are they related? How deep do they reach? When do the 13-day period oscillations have an SST signature as well? Do we observe the same kind of TIW-SST anomalies detected in 2002 in other years? How do results about TIW from 2002 compare with datasets at 23ºW and 10ºW for the years 2004-2005? Indeed, the signals in the last data set (2003 to 2005) have only been partially explored.

The analysis of velocity measurements at intermediate depths (600 m-1700 m) showed a wide range of variability, and different spectral contents for the two horizontal velocity components, with zonal motions being dominated by larger periods than the meridional motions. The meridional component presented quasi-periodic oscillations with 14-day periods in spring and with 20-30 day periods in fall. The simultaneity with oscillations presenting the same periods in the surface suggests that these deep quasi periodic oscillations are the deep expression of forced surface waves. Other oscillations in the meridional component presented periods of approximately 60 days and had no apparent seasonal pattern. The 60-day period oscillations are consistent with mixed Rossby-gravity waves forced by the Deep Western Boundary Current as found by D'Orgeville et al. (2006). The meridional velocity component also showed long period fluctuations (~ 10 months) but only at 23ºW. These flows had vertical scales of about 600 m and upward phase propagation. Their presence, restricted to 23ºW, suggest that they could be the result of scattered Kelvin waves in the presence of the Mid Atlantic Ridge.

The zonal velocity component presented a seasonal cycle of large vertical scale (between 2190 m and 3066 m) and maximum amplitudes of 10 cm/s. On top of the seasonal cycle, EDJ were detected. Estimations of the time scales for EDJ gave three different values; 7 months, 18 months and 5 years. The two last ones were detected simultaneously, with the 18 months EDJ signal showing downward phase propagation. The diversity of time scales as well as vertical structures (standing mode vs. vertically propagating waves) implies a rather complex vertical and temporal behavior for the EDJs system. Again, several questions arise. Are all intermediate depths subject to the same EDJ time scales? The data suggests that EDJ around 1000 m have shorter time scales than EDJ at around 1500 m, but results are not conclusive. Does the Mid Atlantic Ridge affect the EDJ? What are the implications of meridional flows at 23°W in the interhemispheric water exchanges? Since data at intermediate depths are scarce, these questions will have to be addressed either by new data sets of long duration or by models capable of reproducing realistic EDJs.