One of the main problems for the retrieval of the sea surface wind fields from SAR images is still nowadays a low precise and accurate estimation of the wind directions. As well-known in the C-band, wind speeds are usually computed by the inversion of a semi-empirical backscatter model (GMF, Geophysical Model Function), where inferred wind directions are exploited as inputs to the procedure. The higher the estimation errors of wind directions, the lower the quality of SAR-derived wind fields. This is true also for the new X-band GMFs, although those models still require refinement and validation. In this work, two different algorithms, originally developed for C-band SAR data, have been used in order to emphasize the wind-derived features on the SAR amplitude and to extract wind directions directly from X-band TerraSAR-X data: a revisited version of the Local Gradient (LG) method [1] and the technique based on the use of 2D continuous wavelet transform (CWT2) ([2], [3], [4]). In particular, the former has been improved by using a new approach for weighting the local gradient histograms, which has been proved to infer the main wind direction on sub-images more quickly and accurately than the original one. Three ScanSAR SSC images, acquired on the 25th and 28th of February and on the 3rd of March 2010 near the south-east coast of France (Nice) in the Mediterranean Sea, have been processed. Moreover, the procedures have been applied to a dataset of ENVISAT ASAR images acquiring the same area during the same period. The SAR wind directions obtained by the application of both algorithms have been cross-correlated and also compared with wind vectors (at a grid resolution of 4 km x 4 km) provided by the atmospheric model ETA ([5]). [1] W. Koch: Directional analysis of SAR images aiming at wind direction, IEEE Trans. on Geoscience and Remote Sensing, 42, pp. 702-710 (2004). [2] S. Zecchetto, F. De Biasio: Wavelet analysis applied to SAR images to detect atmospheric structures, Il Nuovo Cimento, 24, n. 1, pp. 81-88 (2001). [3] S. Zecchetto, F. De Biasio, P. Trivero: Computation of wind direction from SAR images without external a priori information, Geoscience and Remote Sensing Symposium, pp. 3277-3280 (2007). [4] S. Zecchetto, F. De Biasio: A Wavelet Based Technique for Sea Wind Extraction from SAR Images, IEEE Trans. of Geoscience and Remote Sensing, 46, 10, pp. 2983-2989 (2008). [5] Mesinger F., Chou S.C., Gomes J.L., Jovic D., Bastos P., Bustamante J.F., Lazic L., Lyra A.A., Morelli S., Ristic I., Veljovic K.: An upgraded version of the Eta model, Meteorol Atmos Phys, 116, 63–79, 2012, DOI 10.1007/s00703-012-0182-z.