WIND SPEED MAPS CALCULATED FROM SATELLITE IMAGERY

Rivo Uiboupin, Marine Systems Institute at Tallinn University of Technology
Anastasiia Domina, Marine Systems Institute at Tallinn University of Technology
Laura Raag, Marine Systems Institute at Tallinn University of Technology

In addition to wind speed measurements conducted at point locations the wind field characteristics can be retrieved from satellite imagery. A space bourn sensor SAR (Synthetic Aperture Radar) can be used to measure sea surface roughness that is induced by wind. Therefore, SAR images can be used to retrieve high resolution wind field at 10m level by implementing widely used CMOD5 algorithm (C-band geophysical model function).
The SAR imagery originating from ENVISAT/ASAR sensor which is used in GORWIND project has pixel spacing of 75 m and the temporal coverage over Gulf of Riga area is approximately 1-2 image per two days. The main advantage of SAR retrieved wind field is that it provides high spatial resolution indirect measurements over the entire Gulf of Riga area. This enables to detect small scale wind field features that can not be resolved by any other means besides remote sensing. The downside of the satellite wind retrievals is that low temporal coverage which does not allow continuous detection of temporal variations in wind field. However, despite possible shortcomings, marine winds are generally mapped relatively well from satellite images. Example images of wind speed retrievals from SAR are shown in figure 1.
The mean monthly wind speed maps were calculated from satellite imagery using 800 images that were acquired during years 2007- 2010 to characterize monthly wind field variation (Figure 2). Also mean annual wind speed maps for four different years (from 2007 to 2010) and for the entire time period were calculated to characterize inter-annual and spatial variations of wind field (Figure 3 and Figure 4).

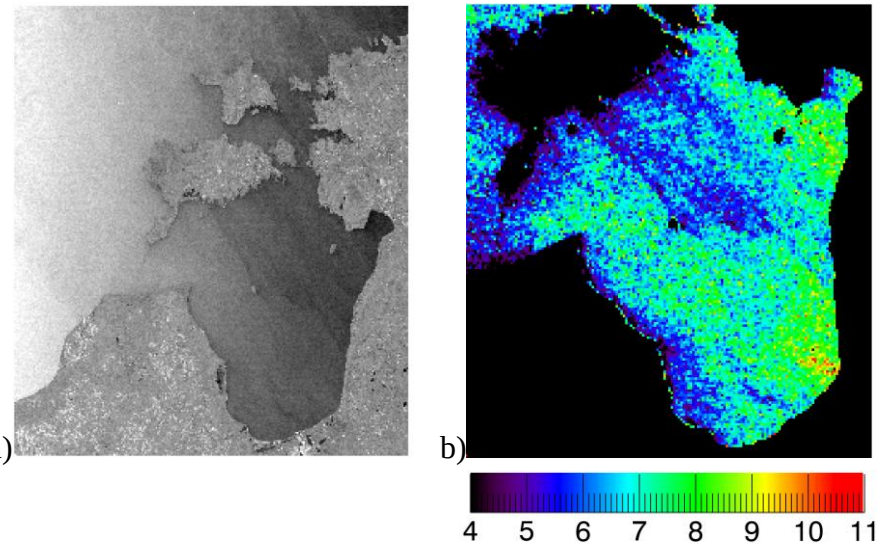
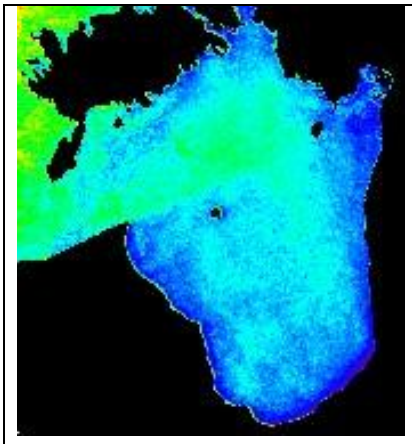
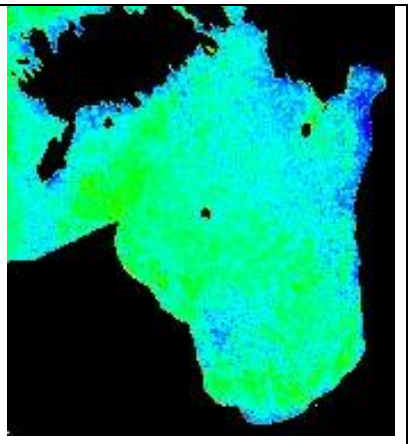
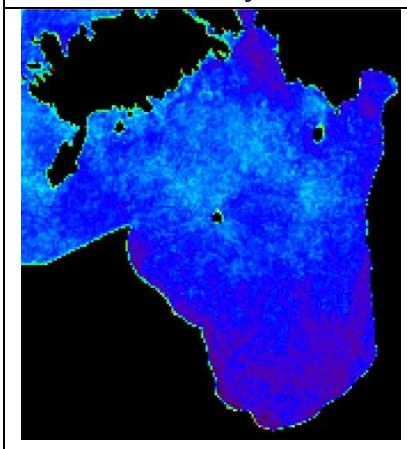
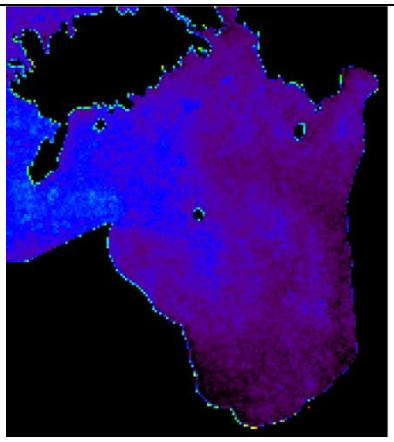
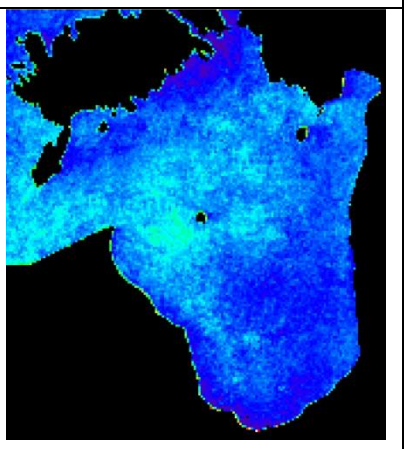
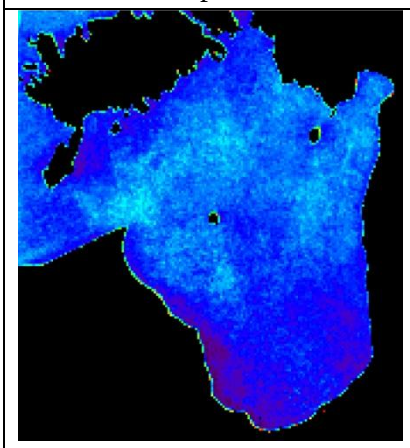
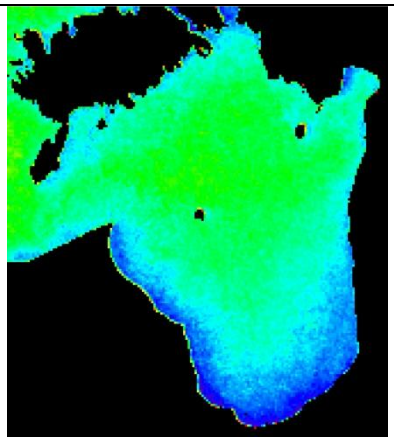
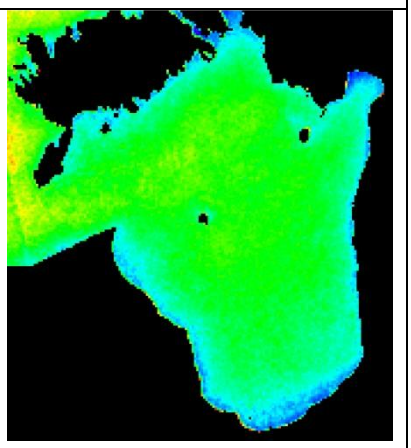


Figure 1.Calibrated SAR image on 2008.03.15 (19.57 utc) (left) and corresponding resized SAR image processed with CMOD5N algorithm showing the wind speed (m/s) information in the Gulf of Riga region (right).

		
January		March
		
April	May	June
		
July	August	September

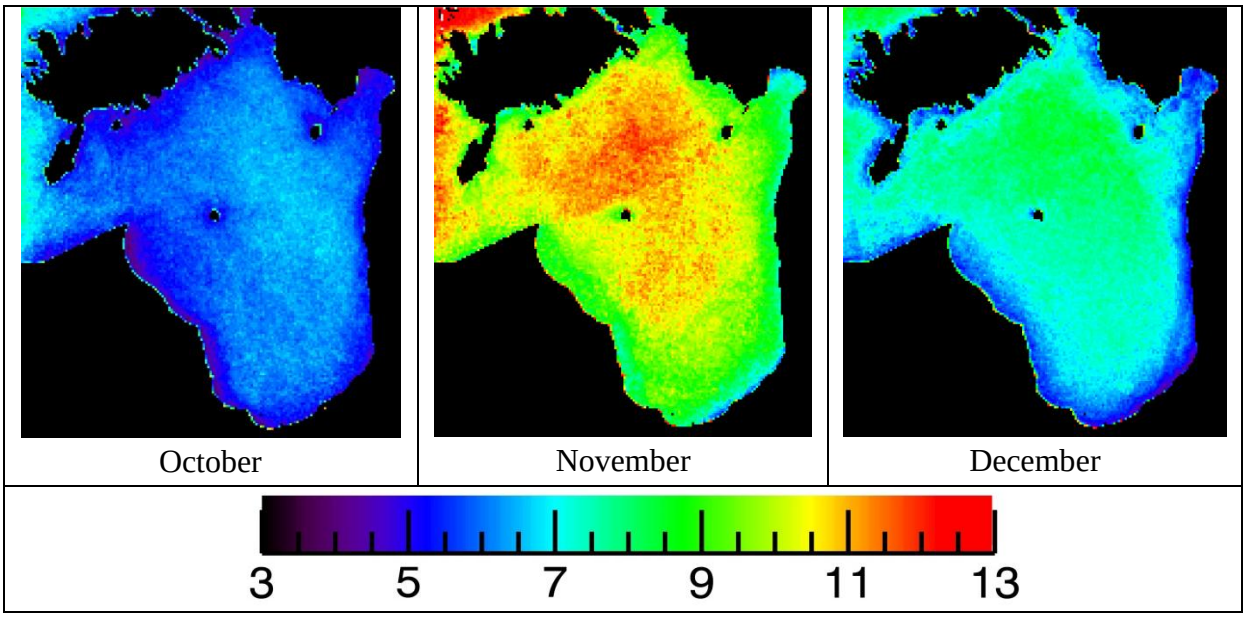
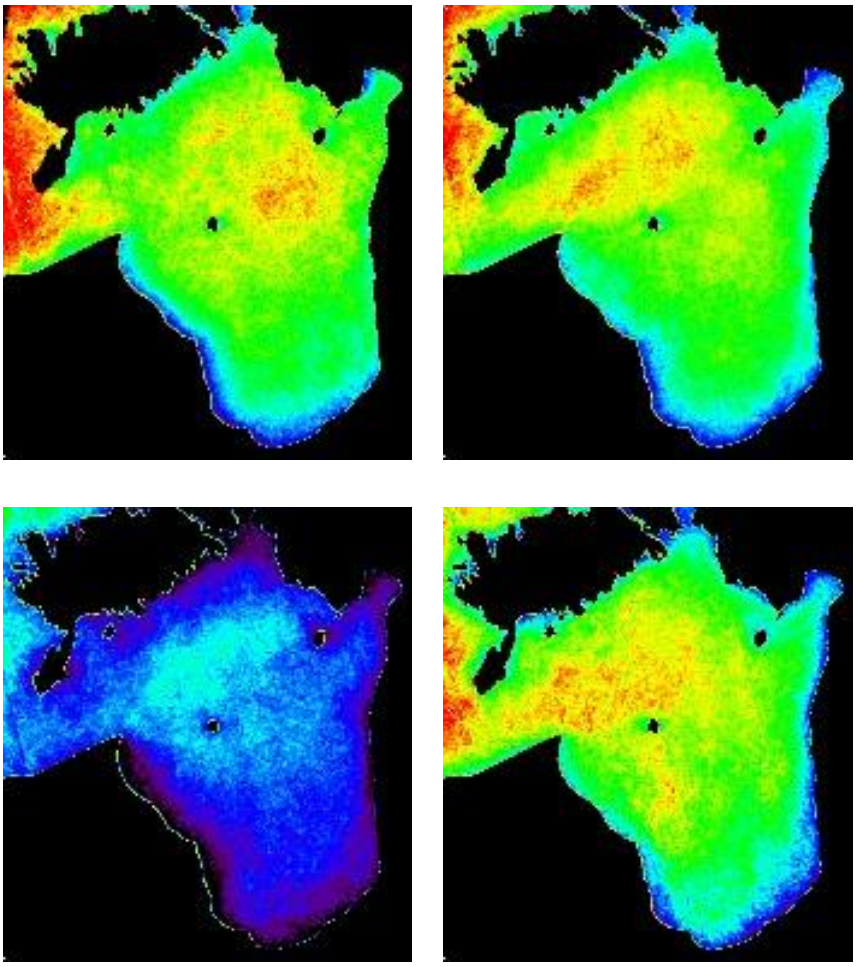


Figure 2. Mean monthly wind speed (m/s) maps retrieved from satellite imagery over Gulf of Riga.



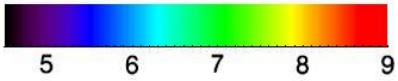


Figure 3. Mean annual wind speed (m/s) maps from satellite imagery for four different years: top left- 2007, top right - 2008, bottom left - 2009 and bottom right - 2010.

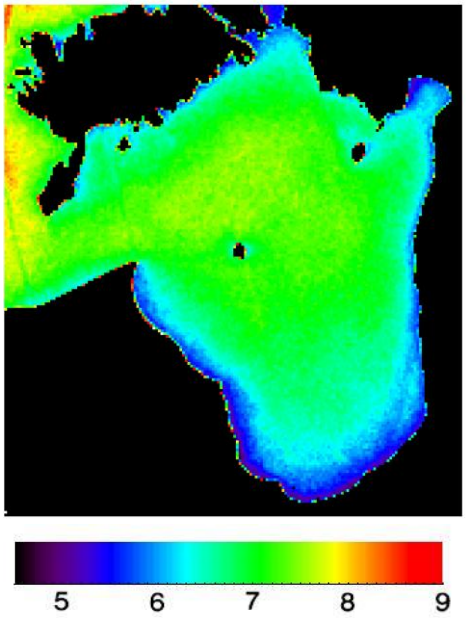


Figure 4. Mean annual wind speed (m/s) map calculated from satellite imagery for years 2007-2010