Geophysical Research Abstracts
Vol. 17, EGU2015-5006, 2015
EGU General Assembly 2015

Analysis of the Escherichia coli dynamics in Civitavecchia bathing areas using the multi-platform coastal observing system C-CEMS (Civitavecchia-Coastal Environment Monitoring System)

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Coastal areas are strongly affected by episodes of fecal contamination due to polluted water inflows from inadequately treated sewages that can cause a loss of resilience of the coastal ecosystems and also an alteration of their functioning.
With the aim to provide an useful tool to assess the effects of such phenomena a big effort has been undertaken to the realization of a multi-platform monitoring observing system C-CEMS (Civitavecchia-Coastal Environment Monitoring System) in the coastal zone of Civitavecchia (Northern Latium, Italy), which collect a large amount of data by fixed stations, periodic in-situ samplings and remote observations and use them to feed the mathematical models in order to forecast the paths of the polluted substances in the marine environment.
This work is focused on the analysis of the dispersion of Escherichia coli in Civitavecchia bathing areas during the summer 2012. Four daily field surveys under different meteomarine conditions were performed to detect the E. coli concentration at the discharge points and the control stations located in the bathing areas. The collected samples were analysed through the Culture-Based technique (CB) and the Fluorescent Antibody (FA) method in order to estimate both the viable culturable cells and the total E.coli population. The comparison between bacterial concentrations obtained by the two methods shows that the quantitative discrepancy between the culture and microscopical counts increases as the distance to the discharge point grows, underlining the occurrence of a high percentage of non viable cells, which are detected by FA only, at the control stations.
Microbiological datasets integrated with C-CEMS measures were used to feed and validate the hydrodynamical (Delft3d-Flow and Swan) and bacterial dispersion (Delft3d-Waq) models.
In order to analyze the contribute of physical (transport induced by marine currents) and biological processes (cells decay connected to solar radiation, temperature and salinity conditions) on the bacterial dispersion, the flushing time was calculated in those areas where the fecal contamination discharge occurred.
The results show that during the August simulation the flushing time calculated at the discharge stations is lower than June and July ones because of higher marine currents (1.59 hours). Moreover, even if the environmental conditions characterizing June and July simulations (high solar radiation) favour the bacterial decay, the flushing time calculated in these days has maximum values (3.48 and 3.08 hours, respectively), indicating that the E.Coli dispersion along the coast of Civitavecchia depends more on the hydrodynamic conditions compared to the decay biological processes.