



Hydrodynamic regimes in the North Sea: using model results to examine changes and variability in mixed, stratified and ROFI regions in the period 1958-2008

Sonja van Leeuwen (1), Paul Tett (2), David Mills (1), Johan van der Molen (1), and Piet Ruardij (3)

(1) Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Lowestoft, United Kingdom (sonja.vanleeuwen@cefas.co.uk), (2) Scottish Association for Marine Science (SAMS), Oban, UK, (3) Royal Netherlands Institute for Sea Research (NIOZ), Texel, the Netherlands

Model results from a 50-year hindcast of the North Sea are analysed with respect to different hydrodynamic regions. Mixed, stratified and ROFI regions are characterised by different physical conditions and thus different biological activity and productivity. As meteorological conditions change these regions are likely to respond. For instance, increased air temperatures can cause more stable thermal stratification to occur, while increased fresh water run-off can increase haline stratification in the coastal zones. Regions that were previously mixed may become seasonally stratified when conditions change sufficiently. Changes like these and internal variability of the system should be taken into account when definitions for marine regions are proposed, for example within the Marine Strategy Framework Directive.

In this study a simulation of the period 1958-2008 (with the hydrodynamical model GETM) is analysed with respect to the spatial and temporal distribution of stratification characteristics. Regions of stratified (seasonal, permanent) and mixed conditions are compared with the standard image of Pingree and Griffiths (1978), and changes and variability over the past 5 decades are analysed, including changes in the meteorological conditions. Decadally averaged results for thermal stratification show a recent decrease in the days of continuous stratification in the German Bight area, notably in the Elbe channel, following an increase in stratified days in this region in the seventies. This indicates a large variability in the location of the tidal mixing front, complicating definitions of static marine regions. The central northern North Sea experienced the longest periods of continuous stratification in the decades 1960-1969 and 2000-2008, while decades in between show a marked decrease in the stratified period in this region.