Modelling the impact of climate change on the Wadden Sea ecosystem
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Five institutes work together on an integrated description of effects of climate change on the ecosystem in the Dutch Wadden Sea.
Major changes in the system are expected to result from temperature changes, and from a sea level rise. Therefore, in the experimental parts of the project the effects of these two steering factors on system responses are investigated.
The reproductive processes of bivalves, and especially of the Baltic tellin *(Macoma baltica)*, are studied by the NIOZ (Beukema/Drent/Philippart). It was expected that the animals respire a relatively large part of their tissue in warm winters, and thus, have a low reproduction in the next year. These studies are done in the laboratory and in experimental tidal basins at the IBN. In these tidal basins (mesocosms) IBN and NIOZ perform research on the system responses to the length of the emersion period (this would be affected by sea level rise) (1997), and to the water temperature. In 1998, in half of the basins, the temperature of the water is 4 oC higher than in neighbour basins.
Another possible effect of sea level rise is an altered energy dissipation by waves and flows. The University of Utrecht (Augustinus/Stelder) does research on the stability of tidal flats and the pioneer zone of salt marshes, closely related to activities by IBN.
A major organism in the Wadden Sea area that may strongly be affected by changing climate conditions concerns the many birds that use the area as a foraging area in mainly the autumn, winter and spring period (IBN sub project bird migration and modelling, Ens). The carrying capacity of the tidal flats for birds is studied through the development of a partly ethological model that describes how birds use (or: can use) the available food, depending on the density of the prey animals, of the predators themselves, and of the profit of a prey animal for the predator. This model DEPLETE simulates the course of the prey and predator densities through a winter period and predicts whether the available food is sufficient for a certain starting bird population or not. If not, then a part of the bird population has to leave to other foraging areas (or have to die).
As another approach, Delft Hydraulics and RIKZ (Vonk/vdTol/Baptist) together work on the development of an expert system, containing descriptive rules on how organisms react upon changing temperatures and changing emersion periods. This is a first part of the integrated modelling core project. A second part concerns the further development of the integrated dynamic ecosystem model EcoWasp (IBN-DLO: Brinkman). EcoWasp is basically a flow model, based on mass budgets of all substances, from nutrients, algae, consumers to detrital matter. Benthic and pelagic processes depend, among others, on temperature, emersion times and on light conditions. And this last may be affected by sea level rise as well. In both modelling projects, the several sub-projects have to be integrated.

One conclusion so far is that for many benthic ecological processes the length of the emersion period is of significant importance; a 4 °C temperature rise is not.
A second conclusion was that where the EcoWasp model was capable to reproduce primary productivities and benthic biomasses in the 'real' Wadden Sea system; it failed to do so when simulating the mesocosms situations. The experiments found much higher biomasses than the model could reproduce. This has implications for the descriptions of the internal production in the model systems.