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0.1 Climate and ocean ecosystems: mechanisms of their changes and interrelations

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Variations and changes of the Earth biosphere are generally related to climate variations, which can be forced by extraterrestrial (mainly of solar origin) and intraterrestrial factors, such as electromagnetic, magnetic and gravitation fields. Oceans are the most homogeneous areas of the Earth, so effects of global factors can be revealed there more clearly than on land. Joint analysis of solar activity and air pressure fluctuations in the highly energetic Kuroshio-Oyashio region in the North-Western Pacific was performed. Cross-spectra have shown prominent effects of solar activity at periods from 22 years till 27 days.

A scheme of climate-ecosystems interrelations in the ocean in presence of external forcing is constructed, that takes into account the following processes: 1) atmosphere characteristics perturbations caused by solar activity fluctuations; 2) changes of heat content of oceanic waters (mainly in tropic regions) due to solar radiation and atmospheric characteristics fluctuations; 3) ocean-atmosphere interactions displaying themselves in a very wide range of space-time scales; 4) large-scale ocean currents, transporting heat content anomalies from tropics to middle and high latitudes and thus affecting atmosphere circulation over the globe; 5) direct influence of electromagnetic and magnetic field fluctuations on biota and spreading their effects up trophic chains and inside populations; 6) feed-back of biota anomalies on the ocean and atmosphere physical properties.

Influence of forcing factors on ecosystem changes can be realized by different ways: 1) globally in all parts of trophic chains; 2) locally with time delays corresponding to

times of climatic anomalies transport a) by currents from tropics to the local areas, b) up trophic chains and inside populations.

Large stochastic variations are inherent for climate as well as for biota systems, leading to rather quick transitions between different mean conditions in both systems, generally named as *regime shifts*. But regime shifts are not evolutionary changes, they are bifurcations at some threshold values in these highly nonlinear systems. Supposing that we know objective criteria for regime shifts in the both systems, there is no necessity for their threshold values to coincide in space and time. It means that regime shifts in ecosystems can correlate with climate shifts or can arise independent of climate due to internal processes. The most prominent changes in biota will arise in key regions and in key periods of time in case of resonance between external forcing and internal cycles.