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INFLUENCE OF THE ARAL SEA NEGATIVE WATER BALANCE ON ITS SEASONAL CIRCULATION AND VENTILATION PATTERNS: USE OF A 3D HYDRODYNAMIC MODEL.

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Within the context of the EU INCO-COPERNICUS program "Desertification in the Aral Sea Region: A study of the Natural and Anthropogenic Impacts" (Contract IAC2-CT-2000-10023), a large-scale 3D hydrodynamic model was adapted to address specifically the macroscale processes affecting the Aral Sea water circulation and ventilation. The particular goal of this research is to simulate the effect of lasting negative water balance on the 3D seasonal circulation, temperature, salinity and water-mixing fields of the Aral Sea. The original Aral Sea seasonal hydrodynamism is simulated with the average seasonal forcings corresponding to the period from 1956 to 1960. This first investigation concerns a period of relative stability of the water balance, before the beginning of the drying process. The consequences of the drying process on the hydrodynamic of the Sea will be studied by comparing this first results with the simulation representing the average situation for the years 1981 to 1985, a very low river flow period. For both simulation periods, the forcing considered are the seasonal fluctuations of wind fields, precipitation, evaporation, river discharge and salinity, cloud cover, air temperature and humidity. The meteorological forcings were adapted to the common optimum one-month temporal resolution of the available data sets. Monthly mean kinetic energy flux and surface tensions were calculated from daily ECMWF wind data. Monthly in situ precipitation, surface air temperature and humidity fields were interpolated from data obtained from the Russian Hydrological and Meteorological Institute. Monthly water discharge and average salinity of the river water were considered for both Amu Darya and Syr Darya river over each simulation

periods. The water mass conservation routines allowed the simulation of a changing coastline by taking into account local drying and flooding events of particular grid points. Preliminary barotropic runs were realised (for the 1951-1960 situation, before drying up began) in order to get a first experience of the behaviour of the hydrodynamic model. These first runs provide results about the evolution of the following state variables: elevation of the sea surface, 3D fields of vertical and horizontal flows, 2D fields of average horizontal flows and finally the 3D fields of turbulent kinetic energy. The mean seasonal salinity and temperature fields (in-situ data gathered by the Russian Hydrological and Meteorological Institute) are available for the two simulated periods and will allow a first validation of the hydrodynamic model. Various satellites products were identified, collected and processed in the frame of this research project and will be used for the validation of the model outputs. Seasonal level changes measurements derived from water table change will serve for water balance validation and sea surface temperature for hydrodynamics validation.