FRESHEM – Fresh-saline groundwater distribution in Zeeland (NL) derived from airborne EM

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In a setting of predominantly saline surface waters, the availability of fresh water for agricultural purposes is not obvious in Zeeland, The Netherlands. Canals and ditches are mainly brackish to saline due to saline seepage, which originates from old marine deposits and salt-water transgressions during historical times. The only available fresh groundwater is present in the form of freshwater lenses floating on top of the saline groundwater. This fresh groundwater is vital for agricultural, industrial, ecological, water conservation and drinking water functions. An essential first step for managing this fresh groundwater properly is to know the present spatial fresh-brackish-saline groundwater distribution. As traditional salinity monitoring is labour-intensive, airborne electromagnetics (AEM), which is fast and can cover large areas in short time, is an efficient alternative.

A consortium of BGR, Deltares and TNO started FRESHEM Zeeland (FREsh Salt groundwater distribution by Helicopter ElectroMagnetic survey in the Province of Zeeland) in October 2014. Within 3x2 weeks of the first project year, the entire area of about 2000 km^2 was surveyed using BGR's helicopter-borne geophysical system totalling to about 10,000 line-km. The HEM datasets of 17 subareas were carefully processed using advanced BGR in-house software and inverted to 2.5 Million resistivity-depth models. Ground truthing demonstrated that the large-scale HEM results fit very well with small-scale ground EM data (ECPT). Based on this spatial resistivity distribution, a 3D voxel model for Chloride concentration was derived for the entire province taking into account geological model data (GeoTOP) for the lithology correction and local in-situ groundwater measurements for the translation of water conductivity to Chloride concentration. The 3D voxel model enables stakeholders to implement spatial Chloride concentration in their groundwater models.