Effects of offshore pumping on groundwater resources in coastal aquifers

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ABSTRACT

Recent work has shown that fresh and brackish groundwater may exist offshore along many world coastlines (e.g., Post et al., 2013). Pumping of these offshore resources has been proposed for more efficient oil drilling as well as drinking and agriculture. Although the pumping locations may be tens to hundreds of kilometers from shore, there may be adverse impacts to connected onshore water resources; these have not yet been assessed. We conducted numerical simulations of variable-density groundwater flow and salt transport in coastal aquifers with different geologic structure subject to offshore pumping to assess changes in onshore groundwater availability, land subsidence, and submarine groundwater discharge. Results show that offshore groundwater pumping can diminish onshore groundwater resources, reduce the offshore discharge of fresh groundwater, and cause widespread land subsidence. Heterogeneous aquifers are more vulnerable to a reduction in onshore groundwater storage and fresh submarine groundwater discharge than equivalent homogeneous aquifers. Heterogeneity also exacerbates the spatial range and magnitude of land subsidence with maximum effects that may occur onshore. This work suggests that coastal aquifers can be significantly impacted by offshore pumping activities and that geologic structure has a significant impact on vulnerability. These effects should be thoroughly considered in feasibility assessments for offshore drilling, particularly in highly populated regions.

REFERENCES

Post, V. E. A., J. Groen, H. Kooi, M. Person, S. Ge, and W. M. Edmunds (2013), Offshore fresh groundwater reserves as a global phenomenon., *Nature*, *504*(7478), 71–8, doi:10.1038/nature12858.

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