Assessing prospects for sustainability in the High Plains aquifer in southwest Kansas

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Annual Water Level Measurement Program

- ≈1400 wells measured in High Plains aquifer in 2016
As of May 2016 – there are 32,764 active water-right wells in Kansas, 26,290 of these wells are in areas that overlie the High Plains aquifer. As of 2013, over 89% of irrigation wells in Kansas had totalizing flowmeters.
Sustainability Assessment

Water Volume Change = Inflow - Outflow

\[ Q_{\text{stable}} = \text{Net Inflow} \]

GMD3 area = 8,342 mi^2

- 211 wells measured every year from 1996-2016
- 14,665 pumping wells
211 wells

Average annual water-level change (ft)

Annual water use ($10^6$ ac-ft)

GMD3
1996-2015: $R^2 = 0.34$


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Average annual water-level change (ft)

Annual water use ($10^6$ ac-ft)

GMD3
1996-2015: $R^2 = 0.34$
2005-2015: $R^2 = 0.77$

211 wells

\[ Q_{\text{stable}} = 1.22 \times 10^6 \text{ ac-ft} \]
\[ Q_{\text{av}} = 1.92 \times 10^6 \text{ ac-ft} \]

\[ \frac{1.22}{1.92} = 0.64 \]

\[ \Delta WL_{av} = -2.2 \text{ ft/yr} \]
\[ Q_{-1 \text{ ft/yr}} = 1.54 \times 10^6 \text{ ac-ft} \]

\[ \frac{1.54}{1.92} = 0.80 \]

2005-2015: \( R^2 = 0.77 \)
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Aquifer Water Balance

Water Volume Change = Net Inflow – Pumping

\[ \Delta WL \approx b - aQ \]

\[ Q_{\text{stable}} = \frac{b}{a} \]

\[ Q_{\text{goal}} = \frac{b}{a} - \frac{\Delta WL_{\text{goal}}}{a} \]