generating function for the reciprocal alternating central binomial coefficients

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It is also not very well known this relation:

$$\frac{4\left(\sqrt{x+4}-\sqrt{x}\,\operatorname{arcsinh}(\frac{\sqrt{x}}{2})\right)}{\sqrt{(x+4)^3}} = 1-\frac{x}{2}+\frac{x^2}{6}-\frac{x^3}{20}+\frac{x^4}{70}-\frac{x^5}{252}+\frac{x^6}{924}-...$$

where one clearly appreciate that the function on LHS generates the sequence $(-1)^n\binom{2n}{n}^{-1}$.

To obtain the relation above one should use some kind of software because for the function is "terrible" to calculate derivatives of any order. It is a little challenge to give a recursive formula that gives the inverses of these alternating central binomial numbers, when evaluated at $x=0$ at those derivatives.