Polynomial Expansion Coefficients : Seawater Equation of State

Jackett: eos.f	SCRUM	SCRUM MP
A0=+19092.56	A0=+19092.56	A00=+19092.56
A1=+209.8925	A1=+209.8925	A01=+209.8925
A2=-3.041638	A2=-3.041638	A02=-3.041638
A3=-1.852732e-3	A3=-1.852732e-3	A03=-1.852732e-3
A4=-1.361629e-5	A4=-1.361629e-5	A04=-1.361629e-5
B0=+104.4077	B0=+104.4077	A10=+104.4077
B1=-6.500517	B1=-6.500517	A11=-6.500517
B2=+0.1553190	B2=+0.1553190	A12=+0.1553190
B3=-2.326469e-4	B3=-2.326469e-4	A13=+2.326469e-4
D0=-5.587545	D0=-5.587545	AS0=-5.587545
D1=+0.7390729	D1=+0.7390729	AS1=+0.7390729
D2=-1.909078e-2	D2=-1.909078e-2	AS2=-1.909078e-2
E0=+4.721788 — 10	E0=+4.721788e-1	B00=+4.721788e-1
E1=+0.1028859 — 10	E1=+1.028859e-2	B01=+1.028859e-2
E2=-2.512549e-3 — 10	E2=-2.512549e-4	B02=-2.512549e-4
E3=-5.939910e-6 — 10	E3=-5.939910e-7	B03=-5.939910e-7
F0=-0.1571896 — 10	F0=-1.571896e-2	B10=-1.571896e-2
F1=-2.598241e-3 — 10	F1=-2.598241e-4	B11=-2.598241e-4
F2=+7.267926e-5 — 10	F2=+7.267926e-6	B12=+7.267926e-6
G0=+2.042967e-2 — 10	G0=+2.042967e-3	BS1=+2.042967e-3
G1=+1.045941e-3 — 100	G1=+1.045941e-5	E00=+1.045941e-5
G2=-5.782165e-8 — 100	G2=-5.782165e-10	E01=-5.782165e-10
G3=+1.296821e-5 — 1000	G3=+1.296821e-7	E02=+1.296821e-7
H0=-2.595994e-5 — 1000	H0=-2.595994e-7	E10=-2.595994e-7
H1=-1.248266e-7 — 1000	H1=-1.248266e-9	E11=-1.248266e-9
H2=-3.508914e-7 — 1000	H2=-3.508914e-9	E12=-3.508914e-9
Q0=+999.842594	Q0=+999.842594	QR =+999.842594
Q1=+6.793952e-2	Q1=+6.793952e-2	Q01=+6.793952e-2
Q2=-9.095290e-3	Q2=-9.095290e-3	Q02=-9.095290e-3
Q3=+1.001685e-4	Q3=+1.001685e-4	Q03=+1.001685e-4
Q4=-1.120083e-6	Q4=-1.120083e-6	Q04=-1.120083e-6
Q5=+6.536332e-9	Q5=+6.536332e-9	Q05=+6.536332e-9
U0=+0.824493	U0=+0.824493	Q10=+0.824493
U1=-4.0899e-3	U1=-4.08990e-3	Q11=-4.08990e-3
U2=+7.6438e-5	U2=+7.64380e-5	Q12=+7.64380e-5
U3=-8.2467e-7	U3=-8.24670e-7	Q13=-8.24670e-7
U4=+5.3875e-9	U4=+5.38750e-9	Q14=+5.38750e-9
V0=-5.72466e-3	V0=-5.72466e-3	QS0=-5.72466e-3
V1=+1.0227e-4	V1=+1.02270e-4	QS1=+1.02270e-4
V2=-1.6546e-6	V2=-1.65460e-6	QS2=-1.65460e-6
W0=+4.8314e-4	W0=+4.8314e-4	Q20=+4.8314e-4

SRUM assumes that there is not pressure variation along geopotentials, so pressure and depth are interchangeable. Therefore, the coefficients associated with pressure are divided by 10 or 100 to convert from bar to meters.

p (bars) = 0.1 z (meters)

In parallel SCRUM the sign of some of the coefficients are changed so all the expansion contribution for each term is always added.

Check Values:

$\Theta = 3°C$, $S = 35.5$ PSU, $z = -3000$ m

$\rho = 1041.833262$ $\frac{Kg}{m^3}$

$\rho_0 = 1028.284512$ $\frac{Kg}{m^3}$

$K = 23068.547051$

$\alpha = 1.654934 \times 10^{-4}$ $1/°C$

$\beta = 7.438424 \times 10^{-4}$ $1/PSU$

Jackett & McDougall implementation:

$$p1 = Q_0 + Q_1 T + Q_3 T^2 + Q_4 T^3 + Q_5 T^4 + Q_6 T^5$$
$$p2 = U_0 + U_1 T + U_2 T^2 + U_3 T^3 + U_4 T^4$$
$$p3 = V_0 + V_1 T + V_2 T^2$$

$$\boxed{Rho\phi = p_1 + S(p_2 + p_3 S^{1/2} + W_0 S)}$$

density at standard one atmosphere pressure

$$\frac{\partial (Rho\phi)}{\partial S} = p_2 + 1.5 p_3 S^{1/2} + 2 W_0 S$$

$$p4 = Q_1 + 2Q_3 T + 3Q_4 T^2 + 4Q_5 T^3 + 5Q_6 T^4$$
$$p5 = U_1 + 2U_2 T + 3U_3 T^2 + 4U_4 T^3$$
$$p6 = V_1 + 2V_2 T$$

$$\frac{\partial (Rho\phi)}{\partial T} = p_4 + S(p_5 + p_6 S^{1/2})$$

e:

$$\boxed{\begin{aligned} P &= -abs(z) \\ P &= -0.1\, abs(z) \end{aligned}}$$

due to pressure and depth conversion