Diff between CICE4 and CICE 6 code for stresses

1 Introduction

The equation for σ_1 (stressp) did not change. I set $k_t = 0$ for simplicity. For σ_2 (stressm) we had before

$$\frac{\partial \sigma_2}{\partial t} + \frac{e^2 \sigma_2}{2T} = \frac{P}{2T\Delta} D_T, \tag{1}$$

With the time discretization we have

$$\frac{(\sigma_2^{k+1} - \sigma_2^k)}{\Delta t_e} + \frac{e^2 \sigma_2^{k+1}}{2T} = \frac{P}{2T\Delta^{*k}} D_T^k, \tag{2}$$

$$\sigma_2^{k+1} \left(1 + \frac{e^2 \Delta t_e}{2T}\right) = \sigma_2^k + \frac{P}{\Delta^{*k}} \frac{\Delta t_e}{2T} D_T^k, \tag{3}$$

With what is defined in CICE4 we have

$$\sigma_2^{k+1} denom2^{-1} = \sigma_2^k + c1 D_T^k, \tag{4}$$

$$\sigma_2^{k+1} = \left(\sigma_2^k + c1 D_T^k\right) denom2, \tag{5}$$

For σ_{12} (stress12) we had before

$$\frac{\partial \sigma_{12}}{\partial t} + \frac{e^2 \sigma_{12}}{2T} = \frac{P}{4T\Delta} D_S, \tag{6}$$

It is very similar to the σ_2 eq (by a factor of 2) so we easily get

$$\sigma_{12}^{k+1} = \left(\sigma_{12}^k + c1 \frac{1}{2} D_T^k\right) denom2, \tag{7}$$

Now in CICE6 (I used revp4 as the latest code)...Following Bouillon we have for σ_2

$$\frac{\partial \sigma_2}{\partial t} + \frac{\sigma_2}{2T} = \frac{P}{2e^2 T\Delta} D_T, \tag{8}$$

With the time discretization we have

$$\frac{(\sigma_2^{k+1} - \sigma_2^k)}{\Delta t_e} + \frac{\sigma_2^{k+1}}{2T} = \frac{P}{2e^2 T\Delta^{*k}} D_T^k, \tag{9}$$

$$\sigma_2^{k+1}\left(1 + \frac{\Delta t_e}{2T}\right) = \sigma_2^k + \frac{P}{\Delta^{*k}}\frac{\Delta t_e}{2e^2 T} D_T^k, \tag{10}$$

With the new code (with revised evp as false) we have

$$\sigma_2^{k+1}\left(1 + arlx1i\right) = \sigma_2^k + \frac{P}{e^2\Delta^{*k}} D_T^k arlx1i, \tag{11}$$

With the definition of c0 (and revp=0) we have

$$\sigma_2^{k+1} = \left(\sigma_2^k + coD_T^k\right) denom1. \tag{12}$$

For σ_{12} we now have

$$\frac{\partial \sigma_{12}}{\partial t} + \frac{\sigma_{12}}{2T} = \frac{P}{4e^2 T\Delta} D_S, \tag{13}$$

Again as it is very similar to the σ_2 eq (by a factor of 2) we get

$$\sigma_{12}^{k+1} = \left(\sigma_{12}^k + co\frac{1}{2}D_S^k\right) denom1. \tag{14}$$