

what is eddy kinetic energy?

full current:  $u = \bar{u} + u'$

averaging in time:  $\langle u \rangle = \langle \bar{u} \rangle + \langle u' \rangle$   
 $= \langle \bar{u} \rangle$

0

$$\begin{aligned} eke &= \frac{u^2 + v^2}{2} - \frac{\bar{u}^2 + \bar{v}^2}{2} \\ &= \frac{(\bar{u} + u')^2 - \bar{u}^2 + (\bar{v} + v')^2 - \bar{v}^2}{2} \\ &= \frac{u'^2 + 2\bar{u}u' + v'^2 + 2\bar{v}v'}{2} \end{aligned}$$

$$\langle eke \rangle = \frac{\langle u'^2 \rangle + \langle v'^2 \rangle}{2}$$

In practice, it is difficult to exactly separate these two components

From NEMO model output (averaged), we know 5-day averaged velocity, but no information about the full current, so we can not compute 5-day eke. But we can treat model output as the full current, and then compute the its average over a long period (>model output frequency), e.g., a month, then we will have both full current,  $u$ , and mean current,  $\bar{u}$ , on a larger time scale, e.g., monthly

$$eke = \frac{u^2 + v^2}{2} - \frac{\bar{u}^2 + \bar{v}^2}{2}$$

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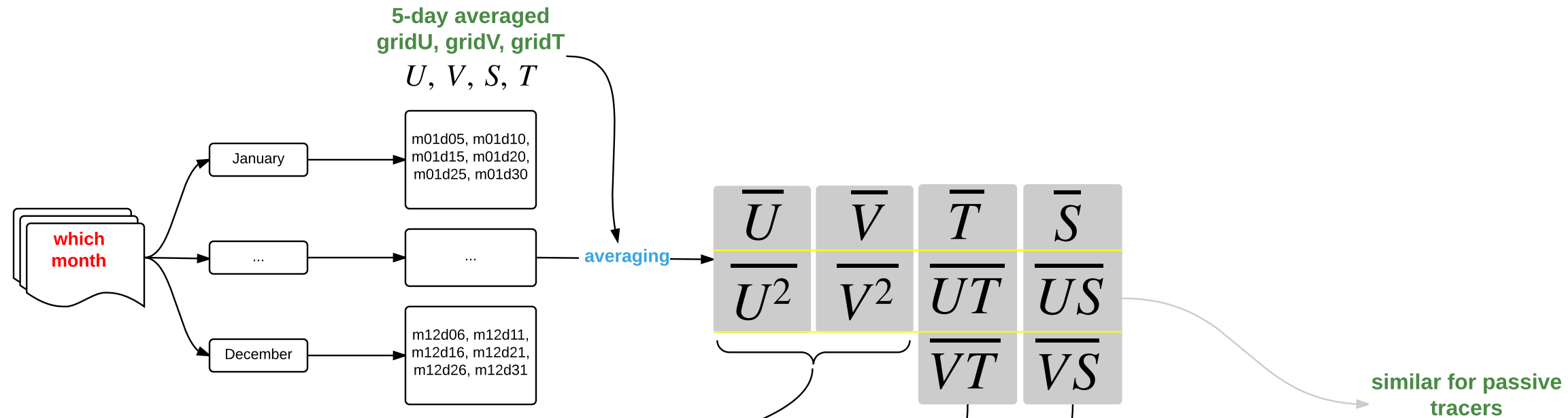
$$u^2 = \frac{\sum_{t=1}^N u^2(t)}{N}$$

$$\bar{u} = \frac{\sum_{t=1}^N u(t)}{N}$$

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$$eke = \frac{[u^2 - \bar{u}^2]_{i,j} + [u^2 - \bar{u}^2]_{i-1,j}}{2} + \frac{[v^2 - \bar{v}^2]_{i,j} + [v^2 - \bar{v}^2]_{i,j-1}}{2}$$

eke on t-point



$$mke = \frac{\bar{U}^2 + \bar{V}^2}{2}$$

$$eke = \frac{\overline{U^2} - \bar{U}^2 + \overline{V^2} - \bar{V}^2}{2}$$

$$SaltFlux_{eddy} = \int_0^L \int_0^{H(l)} (\overline{US}(t, z, l) - \bar{U}(t, z, l)\bar{S}(t, z, l)) dz dl$$

$$= \frac{\int_0^L \int_0^{H(l)} U \cdot S(t, z, l) dz dl}{\int_0^L \int_0^{H(l)} U \cdot S(t, z, l) dz dl} - \int_0^L \int_0^{H(l)} \bar{U}(t, z, l) \cdot \bar{S}(t, z, l) dz dl$$

$$HeatFlux_{eddy} = \rho_0 C_p \int_0^L \int_0^{H(l)} (\overline{UT}(t, z, l) - \bar{U}(t, z, l)\bar{T}(t, z, l)) dz dl$$

Here L is the length of a section, H(l) is the water depth along the section