a. (14.5)

$$\begin{aligned}\rho\frac{d\boldsymbol{v}}{dt} &= -\nabla p - \rho \mathrm{g}\boldsymbol{k}\\ \nabla\cdot\boldsymbol{v} &= 0\end{aligned}$$

に対し,

$O(\epsilon^0)$:

$$\begin{aligned}0 &= -\nabla\bar{p} - \rho \mathrm{g}\boldsymbol{k} = -\frac{\partial\bar{p}}{\partial z} - \rho \mathrm{g}\\ \nabla\cdot\bar{\boldsymbol{v}} &= 0\end{aligned}$$

$O(\epsilon^1)$:

$$\begin{aligned}\rho\frac{D\boldsymbol{v}'}{Dt} &= -\nabla p' \qquad \left(\frac{D}{Dt}\equiv\frac{\partial}{\partial t}+\bar{u}\frac{\partial}{\partial x}\right)\\ \nabla\cdot\boldsymbol{v}' &= 0\end{aligned}$$

$O(\epsilon^0)$ と $O(\epsilon^1)$ を元の方程式から減じて,

$$\rho\left[\frac{\partial\bar{\boldsymbol{v}}}{\partial t} + (\boldsymbol{v}'\cdot\nabla)(\bar{\boldsymbol{v}}+\boldsymbol{v}')\right] = 0$$

$$\frac{\partial\bar{\boldsymbol{v}}}{\partial t} = -(\boldsymbol{v}'\cdot\nabla)(\bar{\boldsymbol{v}}+\boldsymbol{v}')$$

zonal mean をとり u 成分だけを考えると,

$$\begin{aligned}\overline{\frac{\partial\bar{u}}{\partial t}} = \frac{\partial\bar{u}}{\partial t} &= -\overline{\boldsymbol{v}'\cdot\nabla(\bar{u}+u')}\\ &= -\overline{\boldsymbol{v}'\cdot\nabla u'}\\ &= -\left(\overline{u'\frac{\partial u'}{\partial x}}+\overline{v'\frac{\partial u'}{\partial y}}+\overline{w'\frac{\partial u'}{\partial z}}\right)\\ &= -\left[\frac{\partial\overline{(u'u')}}{\partial x}+\frac{\partial\overline{(v'u')}}{\partial y}+\frac{\partial\overline{(w'u')}}{\partial z}-\overline{u'\nabla\cdot\boldsymbol{v}'}\right]\\ &= -\frac{\partial\overline{(v'u')}}{\partial y}-\frac{\partial\overline{(w'u')}}{\partial z} \qquad \left(\frac{\partial}{\partial x}(\text{zonal mean})=0\right)\end{aligned}$$

b. (14.13) ***Parseval's theorem***

$$\int_{-\infty}^{\infty}|f(x)|^2\,dx = \int_{-\infty}^{\infty}\left|\int_{-\infty}^{\infty}F(k)e^{ikx}\,dk\right|^2\,dx$$

$$
\begin{aligned}
&= \int_{-\infty}^{\infty} \left[\int_{-\infty}^{\infty} F(k)e^{ikx}\,dk\right]\left[\int_{-\infty}^{\infty} F^*(k')e^{-ik'x}\,dk'\right] dx \\
&= \int_{-\infty}^{\infty} F(k)\,dk \int_{-\infty}^{\infty} F^*(k')\,dk' \int_{-\infty}^{\infty} e^{-i(k'-k)x}\,dx \\
&= \int_{-\infty}^{\infty} F(k)\,dk \int_{-\infty}^{\infty} F^*(k')\,dk' \cdot \delta(k'-k) \\
&= \int_{-\infty}^{\infty} F(k)\,dk \cdot F^*(k) \\
&= \int_{-\infty}^{\infty} |F(k)|^2\,dk
\end{aligned}
$$

即ち,

$$||f(x)|| = ||f(k)||$$

函数列 $\{1,\, \sin kx,\, \cos kx\}$ が完備であることからも明らか.

c. (14.14)

$$
\begin{aligned}
\iiint_{-\infty}^{\infty} \frac{\partial p'}{\partial x} e^{-i(kx+ly-\sigma t)}\,dxdydt &= \iint_{-\infty}^{\infty} \left\{[p'e^{-ikx}]_{-\infty}^{\infty} - \int_{-\infty}^{\infty} p'(-ik)e^{-ikx}\,dx\right\} dydt \\
&= \iint_{-\infty}^{\infty} \left\{0 + ik\int_{-\infty}^{\infty} p'e^{-ikx}\,dx\right\} dydt \\
&= ik\iiint_{-\infty}^{\infty} p'e^{-i(kx+ly-\sigma t)}\,dxdydt \\
&= ikP_{kl}^{\sigma}
\end{aligned}
$$

(p' は $(-\infty, \infty)$ で絶対可積な函数なので $p' \to 0\ as\ x \to \pm\infty$)

d. (14.22.1)

$$
\eta_k(k) = \begin{cases} A & k = k \pm dk \\ A^* & k = -k \pm dk \\ 0 & \text{elsewhere} \end{cases}
$$

に対して,

$$
\begin{aligned}
\eta'_k(x,t) &= \frac{1}{(2\pi)^2}\iint_{-\infty}^{\infty} \eta_k(k')\cdot e^{i(k'x-\sigma' t)}\,dk'd\sigma' \\
&= \frac{1}{4\pi^2}\Big[\eta_k(k+dk)\,e^{i[(k+dk)x-(\sigma+d\sigma)t]} + \eta_k(k-dk)\,e^{i[(k-dk)x-(\sigma-d\sigma)t]} \\
&\quad + \eta_k(-k+dk)\,e^{i[(-k+dk)x-(-\sigma+d\sigma)t]} + \eta_k(-k-dk)\,e^{i[(-k-dk)x-(-\sigma-d\sigma)t]}\Big] \\
&= \frac{A}{4\pi^2}\left[e^{i[(k+dk)x-(\sigma+d\sigma)t]} + e^{i[(k-dk)x-(\sigma-d\sigma)t]}\right] \\
&\quad + \frac{A^*}{4\pi^2}\left[e^{i[(-k+dk)x-(-\sigma+d\sigma)t]} + e^{i[(-k-dk)x-(-\sigma-d\sigma)t]}\right]
\end{aligned}
$$

$$
\begin{aligned}
&= \frac{A}{4\pi^2}e^{i(kx-\sigma t)}\left[e^{i(dk\cdot x-d\sigma\cdot t)}+e^{-i(dk\cdot x-d\sigma\cdot t)}\right] \\
&\quad + \frac{A^*}{4\pi^2}e^{-i(kx-\sigma t)}\left[e^{i(dk\cdot x-d\sigma\cdot t)}+e^{-i(dk\cdot x-d\sigma\cdot t)}\right] \\
&= \frac{1}{4\pi^2}\left[Ae^{i(kx-\sigma t)}+A^*e^{-i(kx-\sigma t)}\right]\left[e^{i(dk\cdot x-d\sigma\cdot t)}+e^{-i(dk\cdot x-d\sigma\cdot t)}\right] \\
&= \frac{1}{4\pi^2}\left[Ae^{i(kx-\sigma t)}+(Ae^{i(kx-\sigma t)})^*\right]\cdot 2\cos(dk\cdot x-d\sigma\cdot t) \\
&= \frac{1}{2\pi^2}\cdot 2\,\mathrm{Re}\left[Ae^{i(kx-\sigma t)}\right]\cos(dk\cdot x-d\sigma\cdot t) \\
&= \frac{1}{\pi^2}\,\mathrm{Re}\left[Ae^{i(kx-\sigma t)}\right]\cos(dk\cdot x-d\sigma\cdot t)
\end{aligned}
$$

$A\in\mathbb{R}$ なら, $\mathrm{A}\equiv\pi^2$ととって,

$$
= \cos(dk\cdot x-d\sigma\cdot t)\cos(kx-\sigma t)
$$

e.

$x\in\mathbb{R}, \mathrm{z}\in\mathbf{C}$ とする.

$$
\begin{aligned}
\int_{-\infty}^{\infty} e^{-(x+iu)^2}\,dx &= \lim_{L\to+\infty}\int_{-L}^{L} e^{-(x+iu)^2}\,dx \\
&= \lim_{L\to+\infty}\int_{-L+iu}^{L+iu} e^{-x'^2}\,dx'
\end{aligned}
$$

正則函数 e^{-z^2} に対し,

$$
\oint e^{-z^2}\,dz = \left[\int_{-L+iu}^{L+iu}+\int_{L+iu}^{L}+\int_{L}^{-L}+\int_{-L}^{-L+iu}\right]e^{-z^2}\,dz = 0
$$

$$
\begin{aligned}
J_1 &= \int_{L+iu}^{L} e^{-z^2}\,dz \\
&= i\int_{u}^{0} e^{-(L+iy)^2}\,dy \\
&= ie^{-L^2}\int_{u}^{0} e^{y^2-2iLy}\,dy \\
|J_1| &\le e^{-L^2}\int_{u}^{0} e^{y^2}\,dy \to 0 \quad as \quad L\to+\infty \\
J_2 &= \int_{-L}^{-L+iu} e^{-z^2}\,dz \\
&= -\int_{L}^{L-iu} e^{-z^2}\,dz \\
&= \int_{L-iu}^{L} e^{-z^2}\,dz
\end{aligned}
$$

$$\begin{aligned}
&= i\int_{-u}^{0} e^{-(L+iy)^2}\,dy \\
&= ie^{-L^2}\int_{-u}^{0} e^{y^2-2iLy}\,dy \\
|J_2| &\le e^{-L^2}\int_{-u}^{0} e^{y^2}\,dy \to 0 \quad as \quad L\to+\infty
\end{aligned}$$

故,

$$\begin{aligned}
\lim_{L\to+\infty}\int_{-L+iu}^{L+iu} e^{-z^2}\,dz &= -\lim_{L\to+\infty}\left[\int_{L+iu}^{L}+\int_{L}^{-L}+\int_{-L}^{-L+iu}\right] e^{-z^2}\,dz \\
&= -\lim_{L\to+\infty}\left[0+\int_{L}^{-L}+0\right] e^{-z^2}\,dz \\
&= \lim_{L\to+\infty}\int_{-L}^{L} e^{-z^2}\,dz \\
&= \lim_{L\to+\infty}\int_{-L}^{L} e^{-x^2}\,dx \\
&= \int_{-\infty}^{\infty} e^{-x^2}\,dx \\
&= \sqrt{\pi}
\end{aligned}$$

f. below (14.23.1) (Problem 14.8)

$$\begin{aligned}
\eta_k(k) &= \frac{1}{\sqrt{2\pi}\,dk}\,e^{-\frac{(k-k_0)^2}{2dk^2}} \\
\eta_k'(x) &= \frac{1}{(2\pi)^2}\int_{-\infty}^{\infty}\frac{1}{\sqrt{2\pi}\,dk}\,e^{-\frac{(k'-k_0)^2}{2dk^2}}\cdot e^{ik'x}\,dk' \\
&= \frac{1}{(\sqrt{2\pi})^5\,dk}\int_{-\infty}^{\infty} e^{-\frac{1}{2dk^2}\left[(k'-k_0)^2-2dk^2ik'x\right]}\,dk' \\
&= \frac{1}{(\sqrt{2\pi})^5\,dk}\int_{-\infty}^{\infty} e^{-\frac{1}{2dk^2}\left[k'^2-2(idk^2x+k_0)k'+k_0^2\right]}\,dk' \\
&= \frac{1}{(\sqrt{2\pi})^5\,dk}\int_{-\infty}^{\infty} e^{-\frac{1}{2dk^2}\left[\{k'-(idk^2x+k_0)\}^2-(idk^2x+k_0)^2+k_0^2\right]}\,dk' \\
&= \frac{1}{(\sqrt{2\pi})^5\,dk}\,e^{-\frac{1}{2dk^2}\left[-(idk^2x+k_0)^2+k_0^2\right]}\int_{-\infty}^{\infty} e^{-\frac{1}{2dk^2}\{(k'+k_0)-idk^2x\}^2}\,dk' \\
&= \frac{1}{(\sqrt{2\pi})^5\,dk}\,e^{-\frac{1}{2dk^2}\left(dk^4x^2-2ik_0dk^2x\right)}\int_{-\infty}^{\infty} e^{-\frac{1}{2dk^2}(k'+k_0)^2}\,dk' \\
&= \frac{1}{(\sqrt{2\pi})^5\,dk}\,e^{\left(-\frac{dk^2}{2}x^2+ik_0x\right)}\cdot\sqrt{2dk^2\pi} \\
&= \frac{1}{(2\pi)^2}\,e^{-\frac{dk^2}{2}x^2}\cdot e^{ik_0x}
\end{aligned}$$

g. (14.24)

$$\begin{aligned}
\omega &= [\mathrm{g}|\boldsymbol{k}|\tanh(|\boldsymbol{k}|H)]^{\frac{1}{2}} \\
c_{\mathrm{g}} = \frac{\partial\omega}{\partial|\boldsymbol{k}|} &= \frac{1}{2}\left[\mathrm{g}|\boldsymbol{k}|\tanh(|\boldsymbol{k}|H)\right]^{-\frac{1}{2}} \cdot \mathrm{g}\left[\tanh(|\boldsymbol{k}|H) + |\boldsymbol{k}|H\frac{1}{\cosh^2(|\boldsymbol{k}|H)}\right] \\
&= \frac{1}{2}\sqrt{\mathrm{g}H}\left[|\boldsymbol{k}|H\tanh(|\boldsymbol{k}|H)\right]^{-\frac{1}{2}} \cdot \left[\tanh(|\boldsymbol{k}|H) + |\boldsymbol{k}|H\frac{1}{\cosh^2(|\boldsymbol{k}|H)}\right] \\
&= \frac{1}{2}\sqrt{\mathrm{g}H}\left[\frac{\tanh(|\boldsymbol{k}|H)}{|\boldsymbol{k}|H}\right]^{-\frac{1}{2}} \cdot \left[\frac{\tanh(|\boldsymbol{k}|H)}{|\boldsymbol{k}|H} + \frac{1}{\cosh^2(|\boldsymbol{k}|H)}\right] \\
&\to \frac{1}{2}\sqrt{\mathrm{g}H} \cdot 1 \cdot 2 \qquad as \quad |\boldsymbol{k}|H \to 0 \\
&= \sqrt{\mathrm{g}H} \\
&= c
\end{aligned}$$

h. (14.25.2)

$$\begin{aligned}
\eta'(x,y,0) &= \frac{1}{(\sqrt{2\pi}L)^2}e^{-\frac{x^2+y^2}{2L^2}} \\
\eta_{kl} &= \int\int_{-\infty}^{\infty}\frac{1}{(\sqrt{2\pi}L)^2}e^{-\frac{x^2+y^2}{2L^2}} \cdot e^{-i(kx+ly)}\,dxdy \\
&= \frac{1}{2\pi L^2}\int_{-\infty}^{\infty}e^{-\frac{1}{2L^2}(x^2+i2L^2kx)}\,dx \cdot \int_{-\infty}^{\infty}e^{-\frac{1}{2L^2}(y^2+i2L^2ly)}\,dy \\
&= \frac{1}{2\pi L^2}\int_{-\infty}^{\infty}e^{-\frac{1}{2L^2}\left[(x+iL^2k)^2+L^4k^2\right]}\,dx \cdot \int_{-\infty}^{\infty}e^{-\frac{1}{2L^2}\left[(y+iL^2l)^2+L^4l^2\right]}\,dy \\
&= \frac{1}{2\pi L^2}e^{-\frac{L^2}{2}k^2}\int_{-\infty}^{\infty}e^{-\frac{1}{2L^2}(x+iL^2k)^2}\,dx \cdot e^{-\frac{L^2}{2}l^2}\int_{-\infty}^{\infty}e^{-\frac{1}{2L^2}(y+iL^2l)^2}\,dy \\
&= \frac{1}{2\pi L^2}e^{-\frac{L^2}{2}(k^2+l^2)}\int_{-\infty}^{\infty}e^{-\frac{1}{2L^2}x^2}\,dx \cdot e^{-\frac{L^2}{2}l^2}\int_{-\infty}^{\infty}e^{-\frac{1}{2L^2}y^2}\,dy \\
&= \frac{1}{2\pi L^2}e^{-\frac{L^2}{2}(k^2+l^2)} \cdot \sqrt{2L^2\pi} \cdot \sqrt{2L^2\pi} \\
&= e^{-\frac{L^2}{2}(k^2+l^2)} \\
|\eta_{kl}|^2 &= e^{-L^2(k^2+l^2)}
\end{aligned}$$

i. (14.26)

$$\begin{aligned}
\omega &= [\mathrm{g}|\boldsymbol{k}|\tanh(|\boldsymbol{k}|H)]^{\frac{1}{2}} \\
c_{\mathrm{g}} = \frac{\partial\omega}{\partial|\boldsymbol{k}|} &= \frac{1}{2}\left[\mathrm{g}|\boldsymbol{k}|\tanh(|\boldsymbol{k}|H)\right]^{-\frac{1}{2}} \cdot \mathrm{g}\left[\tanh(|\boldsymbol{k}|H) + |\boldsymbol{k}|H\frac{1}{\cosh^2(|\boldsymbol{k}|H)}\right]
\end{aligned}$$

$$
\begin{aligned}
&= \frac{1}{2}\sqrt{\mathrm{g}}\,[|\boldsymbol{k}|\tanh(|\boldsymbol{k}|H)]^{-\frac{1}{2}} \cdot \left[\tanh(|\boldsymbol{k}|H) + |\boldsymbol{k}|H\frac{1}{\cosh^2(|\boldsymbol{k}|H)}\right] \\
&\rightarrow \frac{1}{2}\sqrt{\mathrm{g}} \cdot (|\boldsymbol{k}| \cdot 1)^{-\frac{1}{2}} \cdot (1+0) \qquad as \quad |\boldsymbol{k}|H \rightarrow \infty \\
&= \frac{1}{2}\sqrt{\frac{\mathrm{g}}{|\boldsymbol{k}|}} \\
&= \frac{c}{2}
\end{aligned}
$$

j. (14.33.2)

$$
\begin{aligned}
-\mathrm{g}H\frac{\partial \hat{p}'}{\partial z} + \mathrm{g}\hat{p}' &= -R\bar{T}\frac{\partial}{\partial z}\left(\frac{p'}{\bar{p}}\right) + \mathrm{g}\hat{p}' \\
&= -R\bar{T}\left(\frac{1}{\bar{p}}\frac{\partial p'}{\partial z} - p' \cdot \frac{1}{\bar{p}^2}\frac{\partial \bar{p}}{\partial z}\right) + \mathrm{g}\hat{p}' \\
&= -R\bar{T}\left(\frac{1}{\bar{p}}\frac{\partial p'}{\partial z} - \frac{\hat{p}'}{\bar{p}}\frac{\partial \bar{p}}{\partial z}\right) + \mathrm{g}\hat{p}' \\
&= -\frac{1}{\bar{\rho}}\frac{\partial p'}{\partial z} + \hat{p}' \cdot \frac{1}{\bar{\rho}}\frac{\partial \bar{p}}{\partial z} + \mathrm{g}\hat{p}' \\
&= -\frac{1}{\bar{\rho}}\frac{\partial p'}{\partial z} + \hat{p}' \cdot (-\mathrm{g}) + \mathrm{g}\hat{p}' \\
&= -\frac{1}{\bar{\rho}}\frac{\partial p'}{\partial z}
\end{aligned}
$$

k. (14.33.3)

$$
\begin{aligned}
\frac{1}{\rho}\frac{d\rho}{dt} &\sim \frac{1}{\bar{\rho}}(1-\hat{\rho}')\left(\frac{D\bar{\rho}}{Dt} + \frac{D\rho'}{Dt} + u'\frac{\partial \bar{\rho}}{\partial x} + w'\frac{\partial \bar{\rho}}{\partial z}\right) \\
&\sim \frac{1}{\bar{\rho}}\left(\frac{D\bar{\rho}}{Dt} + \frac{D\rho'}{Dt} + w'\frac{\partial \bar{\rho}}{\partial z}\right) - \frac{\hat{\rho}'}{\bar{\rho}}\frac{D\bar{\rho}}{Dt} \qquad (\bar{\rho} = \bar{\rho}(z)) \\
&= \frac{1}{\bar{\rho}}\frac{D\bar{\rho}}{Dt} + \left(\frac{1}{\bar{\rho}}\frac{D\rho'}{Dt} - \rho' \cdot \frac{1}{\bar{\rho}^2}\frac{D\bar{\rho}}{Dt}\right) + \frac{1}{\bar{\rho}} \cdot w'\frac{\partial \bar{\rho}}{\partial z} \\
&= \frac{1}{\bar{\rho}}\frac{D\bar{\rho}}{Dt} + \frac{D\hat{\rho}'}{Dt} - \frac{w'}{H} \\
w'\frac{\partial \bar{\rho}}{\partial z} &= w'\frac{\partial}{\partial z}\left(\frac{\bar{p}}{R\bar{T}}\right) \\
&= \frac{w'}{R\bar{T}}\frac{\partial \bar{p}}{\partial z} \\
&= \frac{w'}{R\bar{T}} \cdot (-\bar{\rho}\mathrm{g})
\end{aligned}
$$

$$= -\bar{\rho}\frac{w'}{H}$$

l. (14.37) → (14.40)

波動解を仮定:

$$\begin{pmatrix} u' \\ w' \\ \hat{p}' \end{pmatrix} = \begin{pmatrix} U_k^\sigma \\ W_k^\sigma \\ P_k^\sigma \end{pmatrix} e^{i(kx-\sigma t)}$$

(14.37.1) に代入:

$$-i\omega U_k^\sigma + \frac{\partial \bar{u}}{\partial z} W_k^\sigma = -\mathrm{g}H \cdot ikP_k^\sigma \qquad (\text{l}.1)$$

(14.37.3) に代入:

$$ikU_k^\sigma + \frac{\partial W_k^\sigma}{\partial z} = 0 \qquad (\text{l}.2)$$

(14.37.4) に代入:

$$\left[(-i\omega)^2 + N^2\right] W_k^\sigma + \mathrm{g}H \cdot (-i\omega)\frac{\partial P_k^\sigma}{\partial z} = 0 \qquad (\text{l}.3)$$

(l.1) $\times k +$ (l.2) $\times \omega$:

$$\begin{aligned}
k\frac{\partial \bar{u}}{\partial z}W_k^\sigma + \omega\frac{\partial W_k^\sigma}{\partial z} &= -\mathrm{g}H \cdot ik^2 P_k^\sigma \\
\mathrm{g}HP_k^\sigma &= -\frac{1}{ik^2}\left[\omega\frac{\partial W_k^\sigma}{\partial z} + k\frac{\partial \bar{u}}{\partial z}W_k^\sigma\right] \\
\mathrm{g}HP_k^\sigma &= \frac{i}{k}\left[(c_x - \bar{u})\frac{\partial W_k^\sigma}{\partial z} + \frac{\partial \bar{u}}{\partial z}W_k^\sigma\right] \\
\mathrm{g}H\frac{\partial P_k^\sigma}{\partial z} &= \frac{i}{k}\left[-\frac{\partial \bar{u}}{\partial z}\frac{\partial W_k^\sigma}{\partial z} + (c_x - \bar{u})\frac{\partial^2 W_k^\sigma}{\partial z^2} + \frac{\partial^2 \bar{u}}{\partial z^2}W_k^\sigma + \frac{\partial \bar{u}}{\partial z}\frac{\partial W_k^\sigma}{\partial z}\right] \\
&= \frac{i}{k}\left[(c_x - \bar{u})\frac{\partial^2 W_k^\sigma}{\partial z^2} + \frac{\partial^2 \bar{u}}{\partial z^2}W_k^\sigma\right] \quad (14.39)
\end{aligned}$$

(l.3) and (14.39):

$$\begin{aligned}
(N^2 - \omega^2)W_k^\sigma - i\omega\frac{i}{k}\left[(c_x - \bar{u})\frac{\partial^2 W_k^\sigma}{\partial z^2} + \frac{\partial^2 \bar{u}}{\partial z^2}W_k^\sigma\right] &= 0 \\
(N^2 - \omega^2)W_k^\sigma + (c_x - \bar{u})\left[(c_x - \bar{u})\frac{\partial^2 W_k^\sigma}{\partial z^2} + \frac{\partial^2 \bar{u}}{\partial z^2}W_k^\sigma\right] &= 0 \\
\frac{\partial^2 W_k^\sigma}{\partial z^2} + \left[\frac{N^2 - \omega^2}{(c_x - \bar{u})^2} + \frac{\frac{\partial^2 \bar{u}}{\partial z^2}}{(c_x - \bar{u})}\right]W_k^\sigma &= 0 \quad (14.40.1')
\end{aligned}$$

$$m^2(z) = \frac{N^2}{(c_x - \bar{u})^2} - k^2 + \frac{\dfrac{\partial^2 \bar{u}}{\partial z^2}}{(c_x - \bar{u})} \quad (14.40.2)$$

と置いて (14.40) を得る.

修正履歴:

2001/11/07: a.: $u'\nabla \cdot \boldsymbol{v}' \to \overline{u'\nabla \cdot \boldsymbol{v}'}$
b.: $e^{ik'x} \to e^{-ik'x}$, $(k - k') \to (k' - k)$
l.: 追加.
その他雑多な変更.