Near-inertial waves *extract energy* from barotropic **quasi-geostrophic flow**

Cesar B. Rocha and Gregory L. Wagner and William R. Young

crocha**@ucsd**.edu   glwagner**@mit**.edu   wryoung**@ucsd**.edu

Main points

Simplified solutions of the Xie & Vanneste (2015) equations

With barotropic quasi-geostrophic flow, $\psi = \psi(x, y, t)$, uniform background buoyancy frequency, N_0, and single-mode near-inertial vertical structure, e^{imz}, the [**?**] coupled model (Appendix A) reduces to

$$q_t + J(\psi, q) = D_q, \qquad (1)$$

with the wave-averaged quasi-geostrophic potential vorticity

$$q = \triangle\psi + \tfrac{1}{f_0}\left[\tfrac{1}{4}\triangle|\phi|^2 + \tfrac{i}{2}J(\phi^\star, \phi)\right]. \qquad (2)$$

Above, the streamfunction is defined so that the geostrophic velocity is $(u_e, v_e) = (-\psi_y, \psi_x)$, $\triangle \stackrel{\text{def}}{=} \partial_x^2 + \partial_y^2$ is the horizontal Laplacian, $J(f, g) = f_x g_y - f_y g_x$ is the lateral Jacobian, and ϕ is near-inertial back-rotated velocity,

$$u_w + iv_w = e^{i(mz - f_0 t)}\phi(x, y, t). \qquad (3)$$

Also in (**??**), the superscript star * denotes complex conjugation. The near-inertial back-rotated velocity, ϕ, is governed by

$$\phi_t + J(\psi, \phi) + \tfrac{i}{2}\phi\triangle\psi - \tfrac{i}{2}f_0\lambda^2\triangle\phi = D_\phi, \qquad (4)$$

where $\lambda = \frac{N_0}{f_0 m}$ is an intrinsic horizontal scale.

Power integrals: The physics of stimulated imbalance

The "alert" block environment looks like this. It also has justified text, but it has a border and a light background to make it stand out. You can create one like so:

```
\begin{alertblock}{Title}
.......
\end{alertblock}
```

Altering Column Spans

You can make columns that span multiple other columns relatively easily. Lengths are defined in the template that make columns look normal-ish if you want to use a four-column layout like this poster. If you want to use a different number of columns, you will have to modify those lengths accordingly at the top of the poster.tex file. In particular, near the top of the TeX file you will see lines that look like:

```
\setlength{\sepwid}{0.024\paperwidth}
\setlength{\onecolwid}{0.22\paperwidth}
\setlength{\twocolwid}{0.464\paperwidth}
\setlength{\threecolwid}{0.708\paperwidth}
```

Set "sepwid" to be some small length somewhere near 0.025 (this is the space between columns). Then if n is the number of columns you want, you should set

$$\text{onecolwid} = \frac{1}{n}(1 - (n + 1) \times \text{sepwid}),$$
$$\text{twocolwid} = 2 \times \text{onecolwid} + \text{sepwid},$$
$$\text{threecolwid} = 3 \times \text{onecolwid} + 2 \times \text{sepwid}.$$

Block Colours

For the standard blocks there are two colours; one for the title and one for the block body:

```
\setbeamercolor{block title}
{fg=red,bg=white}

\setbeamercolor{block body}
{fg=black,bg=white}
```

The *fg* colour sets the text colour and *bg* sets the background colour. For the normal blocks it makes no sense to use a background colour other than white. You *can* change it, but it will look weird!

Alert Block Colours

You can similarly modify the colours for alert blocks (but try not to overdo it):

```
\setbeamercolor{block title}
{fg=black,bg=norange}

\setbeamercolor{block body}
{fg=black,bg=white}
```