Scientific writing Lecture 2

How to read literatures
Pre-writing steps

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Review of Lecture 1

- Q1: What makes a good writer:
- Answer:
  - Having something to say
  - Logical thinking
  - A few simple, learnable rules of style (the tool you will learn in this class!)

Review of Lecture 1

- Q2: Can I write in Chinese in the first draft and then translate into English?
- Answer: **YES!**
  - You can (confirmed by many scientific writing books and professors).
  - But you need to follow English rules (learn in this class) and spend a decent amount of time in the revision.

Review of Lecture 1

- Q3: Is it really OK to use “I” or “We”?
- Answer: **YES!**
  - The active voice is livelier and easier to read
  - It is a myth that avoiding first-person pronouns lends objectivity to the paper.
  - By agreeing to be an author on the paper, you are taking responsibility for its content. Thus, you should also claim responsibility for the assertions in the text by using “we” or “I.”
  - Journals want active voice!
  - Great authors use “we” and “I”!

Review of Lecture 1

- Q4: Principles of effective writing:
  1. Cut the clutter (unnecessary words and phrases) 避免使用冗长的词组
  2. Use the active voice (subject + verb + object)运用主动语态
  3. Write with verbs: use strong verbs, avoid turning verbs into nouns, and don’t bury the main verb! 正确运用动词

Review of Lecture 1

- Q5: When is it OK to use the passive voice?
- Answer:
  - The method section.
  - Avoid using “we” and “I” in every sentence

Overview of the writing process

1. **Prewriting**
   - Collect, synthesize, and organize information
   - Brainstorm take-home messages
   - Work out ideas away from the computer
   - Develop a road map/outline

A lot of people skip this stage, which is not a proper way. You will end up convolute over these stages.

2. **Writing the first draft**
   - Putting your facts and ideas together in organized prose
3. **Revision**
   - Read your work out loud
   - Get rid of clutter
   - Do a verb check
   - Get feedback from others

Don't write and revise at the same time! One sentence doesn't need to be perfect before moves to the next sentence.

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What does your writing process now?

Proportionally, how much time do you think you (will) spend on each step?

1. Prewriting
2. Writing the first draft
3. Revision

What I think it should be (roughly!)

1. Prewriting (70%) ← **Literatures**
2. Writing the first draft (10%)
3. Revision (20%)

Example

River plumes as a source of large-amplitude internal waves in the coastal ocean

- By J. D. Nash and J. N Moum
- 4 pages and 4 figures

- Main idea(s)?
- How long did you read the paper?
- What did you focus on?

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How to read literatures

- Suppose you only have 30 min to read a new paper, how will you spend your time in each section?
  - 5 min abstract
  - 12 min figures/tables (3 min each)
  - 10 min discussion
  - 3 min conclusion

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Abstract: Satellite images have long revealed the surface expression of large amplitude internal waves that propagate along density interfaces beneath the sea surface. Internal waves are typically the most energetic high-frequency events in the coastal ocean, displacing water parcels by up to 100 m and generating strong currents and turbulence that mix nutrients into near-surface waters for biological utilization. While internal waves are known to be generated by tidal currents over ocean-bottom topography, they have also been observed frequently in the absence of any apparent tide-topography interactions. Here we present repeated measurements of velocity, density and acoustic backscatter across the Columbia River plume front. These show how internal waves can be generated from a river plume that flows as a gravity current into the coastal ocean. We find that the convergence of horizontal velocities at the plume front causes frontal growth and subsequent displacement downward of near-surface waters. Individual freely propagating waves are released from the river plume front when the front's propagation speed decreases below the wave speed in the water ahead of it. This mechanism generates internal waves of similar amplitude and steepness as internal waves from tide-topography interactions observed elsewhere, and is therefore important to the understanding of coastal ocean mixing.

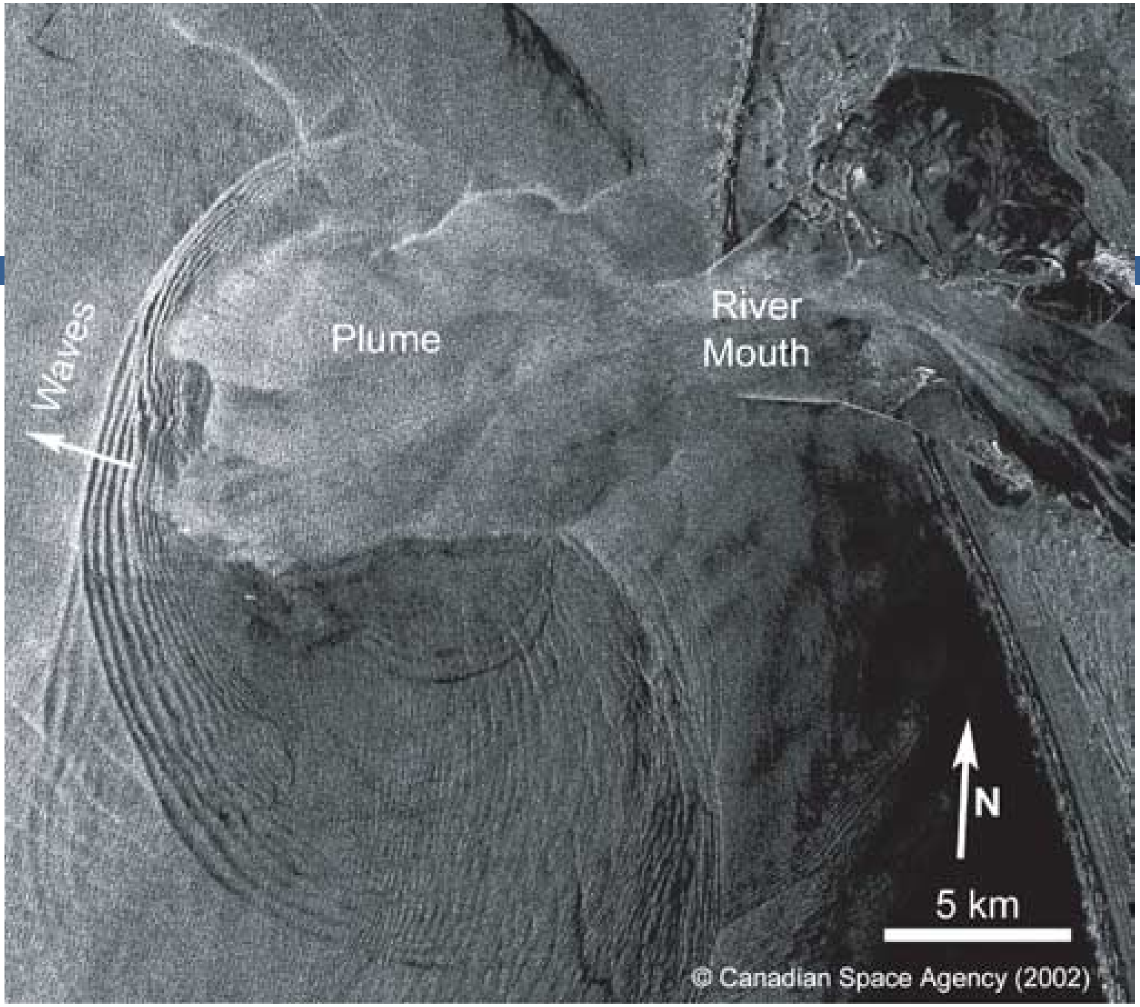

Figure 1 | Synthetic aperture radar (SAR) image of the Columbia River plume on 9 August 2002. Image indicates regions of enhanced surface roughness associated with plume-front and internal wave velocity convergences. Similar features appear in images during all summertime months (April–October; see http://oceanweb.ocean.washington.edu/rise/data.htm for more Columbia River plume images) and from other regions[1,2]. SAR image courtesy of P. Orton, T. Sanders and D. Jay; image was processed at the Alaska Satellite Facility, and is copyright Canadian Space Agency.

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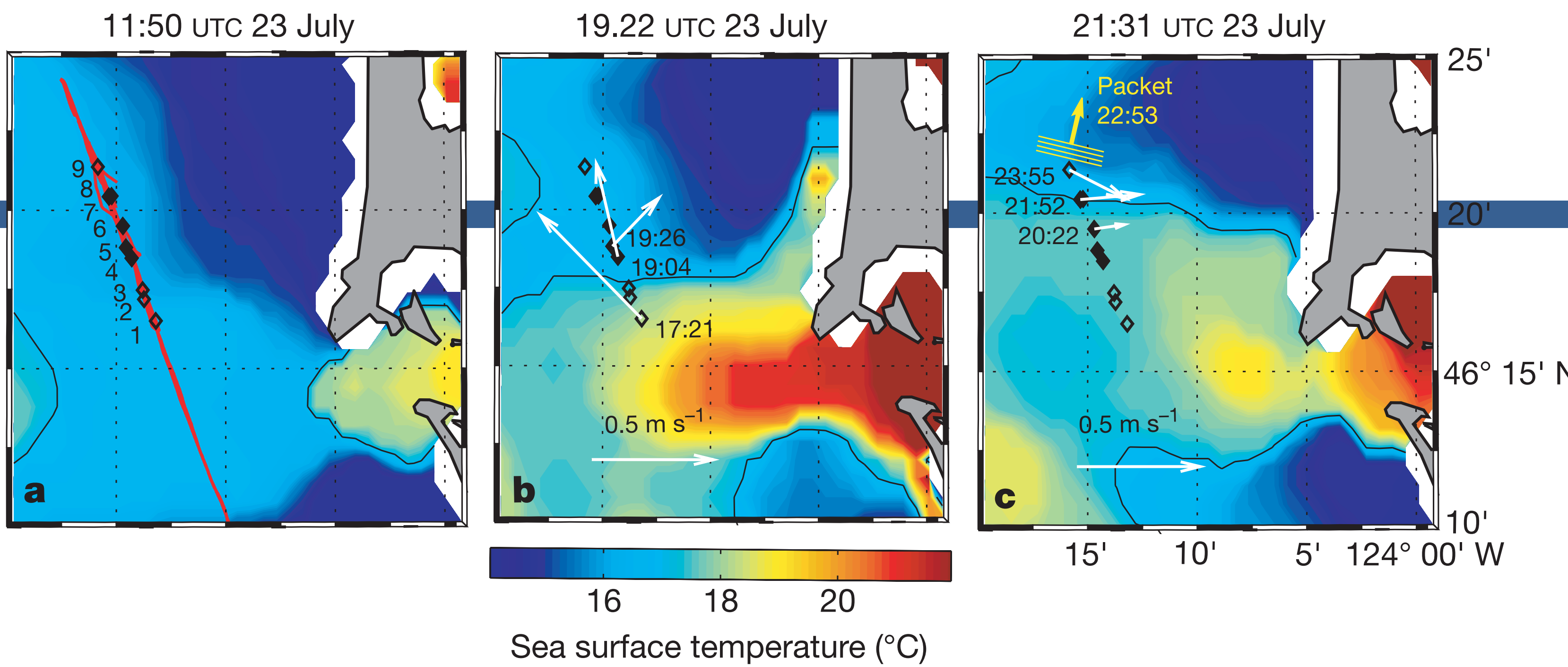


Figure 2 | Progression of the Columbia River plume from satellite-derived SST images. Times (23 July 2004 UTC) are 11:50 (**a**), 19:22 (**b**) and 21:31 (**c**). Red line in left panel is ship track. Diamonds show locations where plume front was crossed; filled diamonds correspond to the four crossings presented in Fig. 3. Near-surface fluid velocities behind the plume front u_p at selected crossings are indicated in **b** and **c** (45-s average over $0\ \mathrm{m} < z < 5\ \mathrm{m}$); vectors are grouped to correspond to time of SST images. The 17 °C isotherm is contoured and represents the approximate front location. Location of the wave packet at 22:53 as imaged by shipboard X-band radar is shown in **c**.

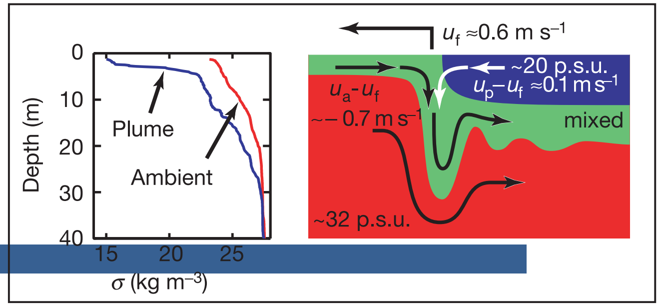
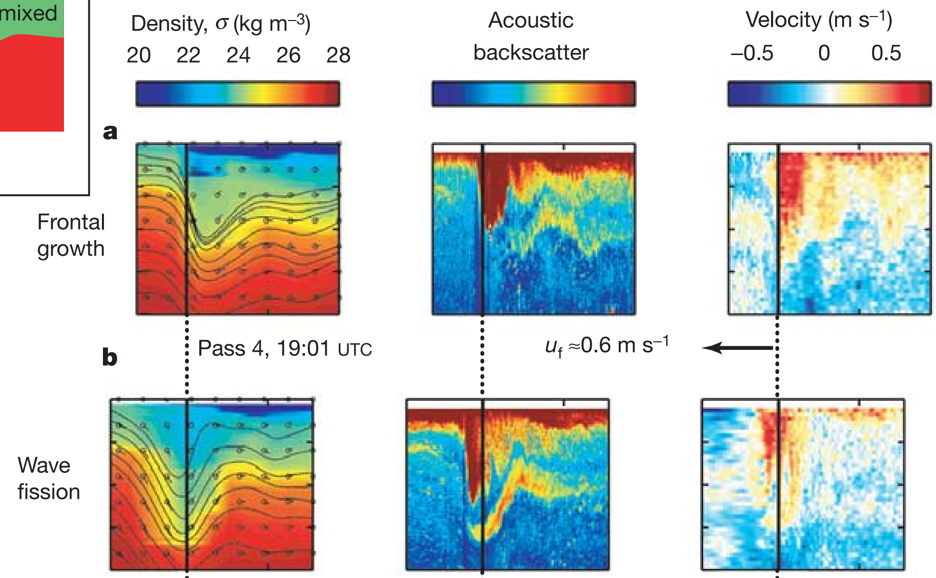
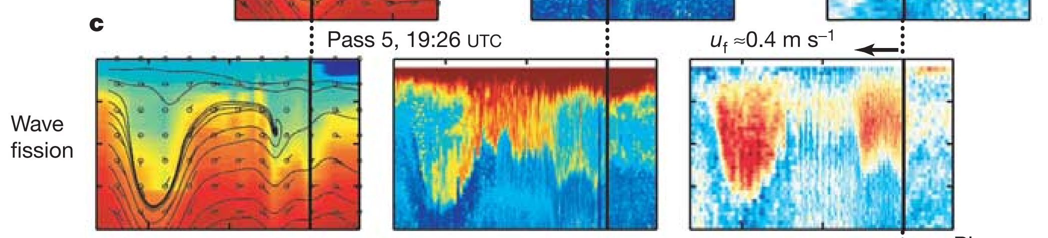
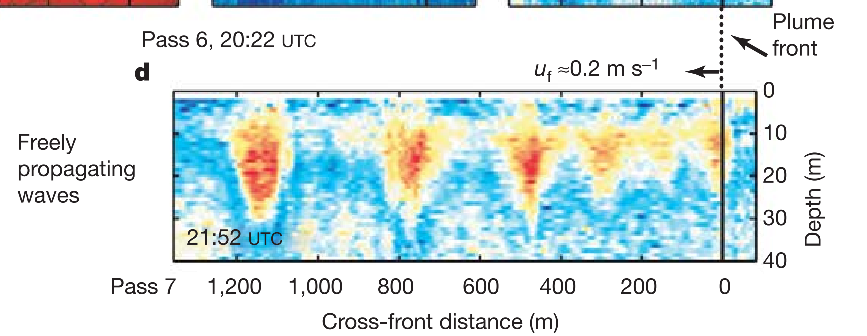


Figure 3 | Three stages of a wave-generation event. **a**, Frontal growth at the plume's leading edge; **b**, **c**, wave fission from the plume front; and **d**, free propagation of a train of large-amplitude internal waves. Shown are density (left), acoustic backscatter (middle) and cross-front component of horizontal velocity (right) in a reference frame aligned with the front (see Methods). Positive distances and velocities are approximately northward; velocities are relative to a stationary reference frame. Panels are shifted to align the plume front (as determined from sea surface salinity); vertical black lines represent the plume front (zero cross-front distance). Only cross-front velocity is shown for the freely propagating waves in **d**. Particle streamlines and velocity vectors (u,w) in a reference frame moving with the front (translating at speed u_f as indicated) are contoured over the density plots. A schematic cartoon illustrating frontal growth in a reference frame moving with the plume front (at speed u_f) is shown in upper left inset. Velocities of the near-surface fluid behind the plume front (u_p) and ambient water ahead of it (u_a) are indicated. Also shown for pass 4 (panel **a**) are vertical profiles of density ahead of (red, ambient) and behind (blue, plume) the front.







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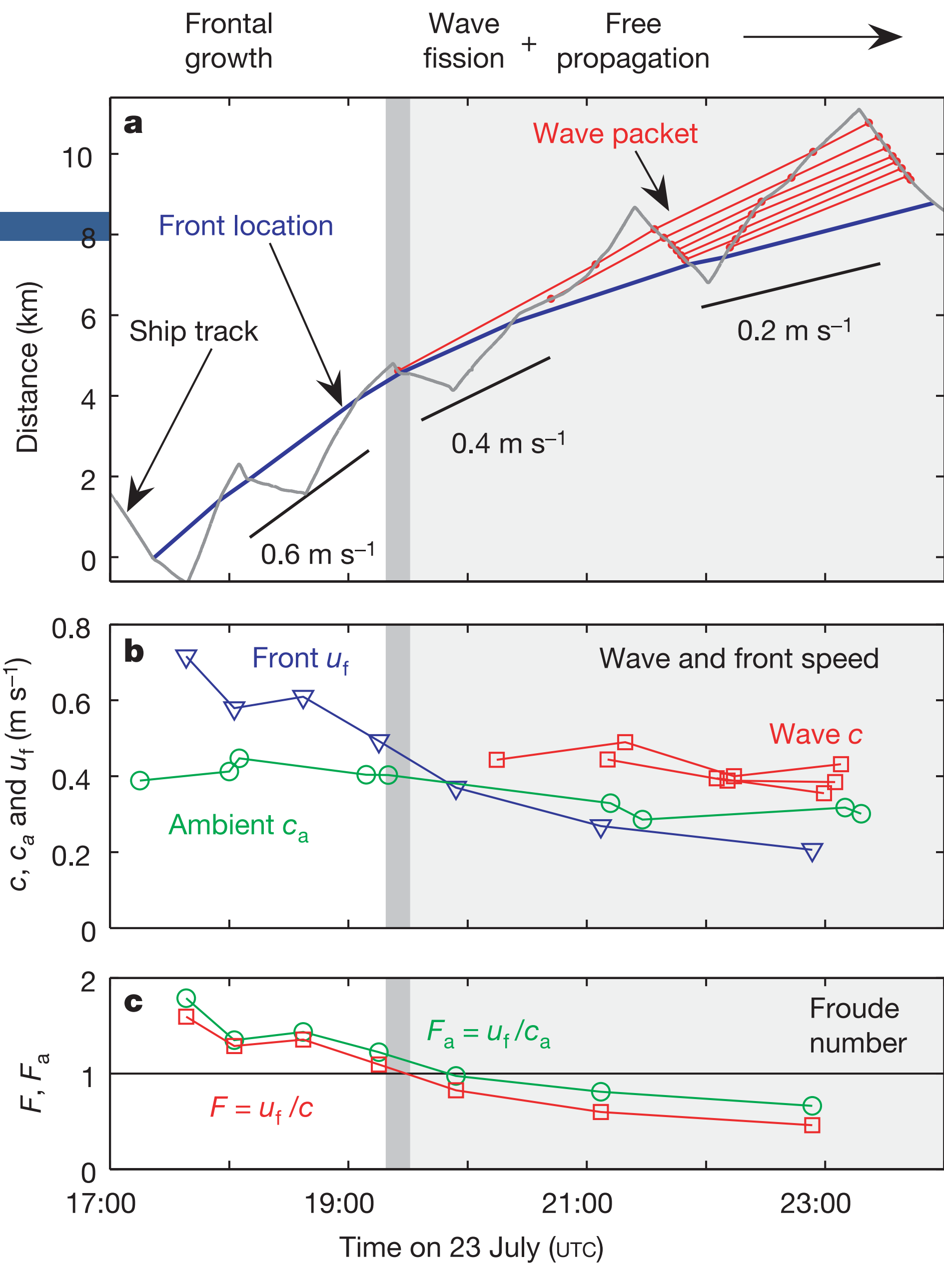

Figure 4 | Time-evolution of plume front and wave packet. **a**, Location of ship (grey), plume front (blue) and wavepacket (red) as a function of time. Ordinate is distance from the first frontal crossing along a curved trajectory perpendicular to either plume front or leading wave. **b**, The speed of the plume front (u_f, blue) as computed from the rate of change of front location. The first-mode linear wavespeed ahead of the plume (c_a, green) reflects the slowly-changing background density and velocity structure in the ambient ocean; observed wavespeeds computed from first-differences of wave location (c, red) are higher. Corresponding Froude numbers are shown in **c**; F was computed using $c = 0.45\ \mathrm{m\,s^{-1}}$. The vertical grey bar represents the first wave fission event (Fig. 3b) and $F = 1$; light shading represents the domain over which fission and free propagation are permitted ($F < 1$).

Abstract: Satellite images have long revealed the surface expression of large amplitude internal waves that propagate along density interfaces beneath the sea surface. Internal waves are typically the most energetic high-frequency events in the coastal ocean, displacing water parcels by up to 100 m and generating strong currents and turbulence that mix nutrients into near-surface waters for biological utilization. While internal waves are known to be generated by tidal currents over ocean-bottom topography, they have also been observed frequently in the absence of any apparent tide-topography interactions. Here we present repeated measurements of velocity, density and acoustic backscatter across the Columbia River plume front. These show how internal waves can be generated from a river plume that flows as a gravity current into the coastal ocean. We find that the convergence of horizontal velocities at the plume front causes frontal growth and subsequent displacement downward of near-surface waters. Individual freely propagating waves are released from the river plume front when the front's propagation speed decreases below the wave speed in the water ahead of it. This mechanism generates internal waves of similar amplitude and steepness as internal waves from tide-topography interactions observed elsewhere, and is therefore important to the understanding of coastal ocean mixing.

Tips from Lecture 1

Use active voice

In summary, internal waves generated from the Columbia River plume are of similar amplitude and steepness to those generated over topography elsewhere in the coastal ocean[10]. Although less energetic than some waves which propagate through deep water (for example, through the South China Sea[28]), these plume-generated internal waves are large compared to the local water depth, and have important implications for biology and turbulent mixing.

Passive voice in method section

METHODS

Density, biological fluorescence and turbulence profiles were obtained from within 2 m of the surface to the bottom using the Chameleon turbulence profiler[29]; its horizontal resolution is limited by the unequal but nominally 100-m spacing between profiles. Our perspective of the structure of the waves and front is augmented with a rapidly sampled echosounder (Biosonics 120 kHz; acoustic scatterers include zooplankton and density microstructure) and acoustic Doppler current profiler (ADCP; RD Instruments 300 kHz), both mounted 1 m beneath the sea surface

Combination of active and passive voice

Satellite images capture single snapshots of waves radiating from the mouth of the Columbia River (Fig. 1; refs 1, 2). However, they provide no information on the waves' internal structure. Nor do they show the sequence of events leading to their generation, since these images are acquired infrequently (<1 per day). Our recent *in situ* observations across a front at the northern edge of the tidally pulsing Columbia River plume provide the necessary sequencing to clearly define the condition for the formation of large-amplitude internal waves from a gravity current. By analogy to topographic release of waves from a sill, this condition is described in terms of a Froude number.

Short sentences

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How to read literatures

- Suppose you only have 30 min to read a new paper, what will you focus on?
  - 5 min abstract
  - 12 min figures/tables (3 min each)
  - 10 min discussion
  - 3 min conclusion

How to read literatures

- Suppose you have 3-5 hours to read a paper, what will you focus on? What/how will you record?
  - Abstract
  - Introductions
  - Methods
  - Results
  - Discussions
  - Conclusions

Literature reading records

1. Ideas
   A. Main conclusions
   B. Any motivation to your own study?
   C. Potential comparisons
   D. Possible improvement?
   E. Important figures/tables
   F. Useful literature reviews
   …
2. Sentences/words

Strub+James, 2000 DSR2
CCS regions:
- Northern region (off Oregon and Washington north of about 43oN):
    Straight coast and two main sources of fresh-water input: CR (46oN) and Strait of Juan de Fuca (48oN)
    Wind: moderately upwelling-favorable in summer and strongly downwelling-favorable in winter
- Middle region (35 – 43 oN):
    A number of capes and the strongest seasonal contast in winds: strong and persistent upwelling-favorable winds in summer and downwelling-favorable winds during winter storms.
    The influence of storms decreases south of approximately 35-37 oN, where monthly mean winds remain upwelling-favorable all year.
- South California Bight (32 – 35oN):
    Coast turns sharply eastward at 35oN
    Sheltered from strong wind forcing found in elsewhere in the system: weak winds.
- North Baja California (NBC: 22 – 32oN)
    Winds are stronger than SCB, upwelling-favorable all year round, weaker than the summer winds off northern region.
    Several capes: most prominent at Punta Eugenia (27-28oN)

Marchesiolo et al, 2003 JPO
In spring frontal insta- bilities appear along the newly formed coastal current and roll up into cyclonic vortices. Most filaments occur in summer, associated with strong squirts (~1 m/s) forming both cold and warm, mushroom-shaped patterns at multiple scales (Figs. 2 and 3), especially south of Cape Blanco. In autumn, meanders and eddies are the dominant patterns, both inshore and offshore of the CC. In winter, the offshore eddy field is strongest. There is significant vertical motion within the cold filament that impacts the PBL with evident patchiness in its depth (Fig. 3b) and the associated vertical mixing intensity.

Kurian 2011 JGR
It is also shown that the formation of long-lived eddies and eddy activity are greatest roughly between latitudes 32°–40°N, with a distinct minimum to the north of about 42°N. There are few key eddy generation sites along the coast; these sites include Punta Eugenia (~28°N), Point Conception (~34°N), and Cape Blanco (~43°N). Both studies report less seasonal variation in eddy birth, though the eddy strength is highest during summer. Eddies propagate westward, with cyclones (and anticyclones) showing a general tendency for poleward (and equatorward) deflection, as shown globally by Chelton et al. [2007, 2011] and for the CCS region by Morrow et al. [2004]. Eddy radii of approximately 60–80 km and propagation speeds around 2 km/day have been reported.

The prewriting step

Get organized first!

- Don’t try to write and gather information simultaneously
- Gather and organize information BEFORE writing the first draft

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Organizing your thoughts…

Do you have an organizational system?

If you don't, create one that suit you!

Spend more time organizing and less time writing. It is just plain less painful!

Develop a road-map

- Arrange key facts and citations from literature
- Develop a crude road-map/outline BEFORE writing the first draft
- Think in sections and paragraphs (NOT sentences)

Example of outline

- List (2-4) goals (your proposed answers)
- List (2-4) key papers that provide foundation of your work
- List (2-4) main ideas in the introduction

You need to think about these points even BEFORE or while DOING experiments!

- List (2-4) main findings of your study

← Why you write the paper

- List possible comparisons/discussions

← Link findings to introductions

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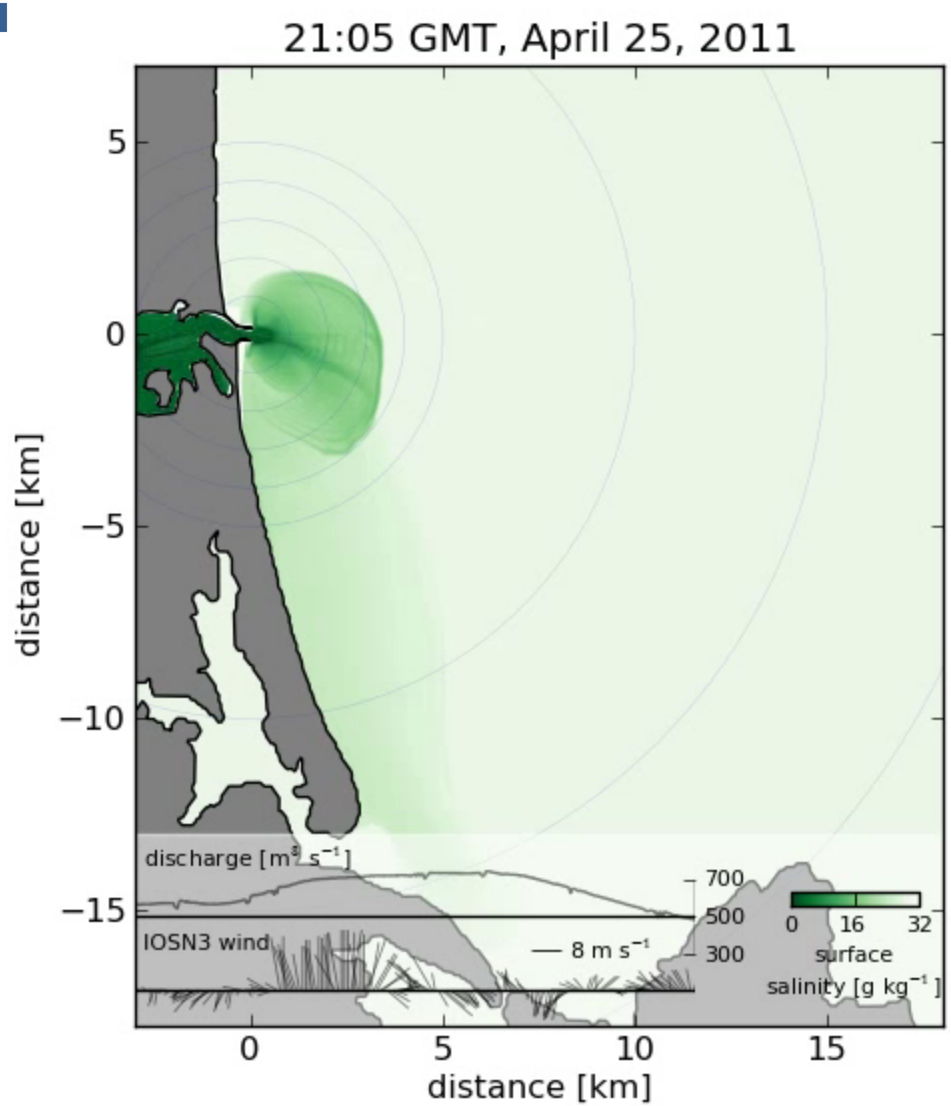
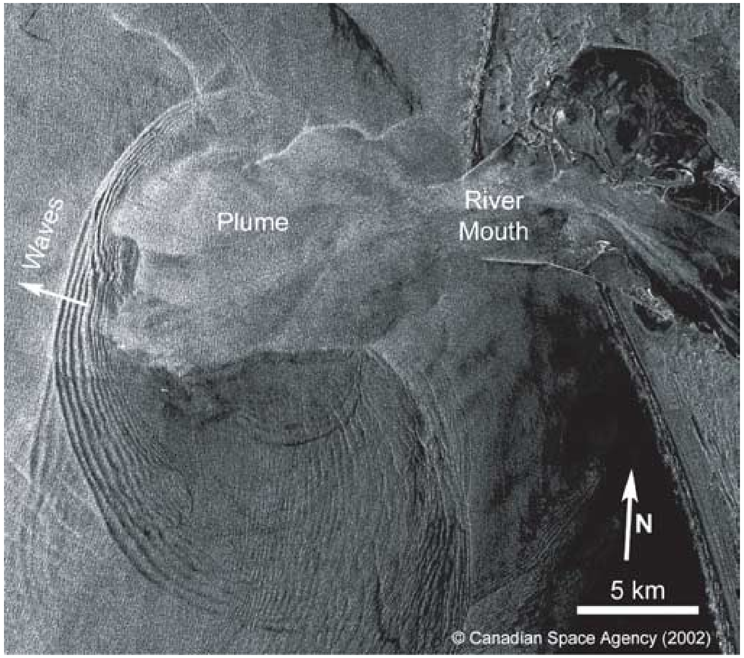
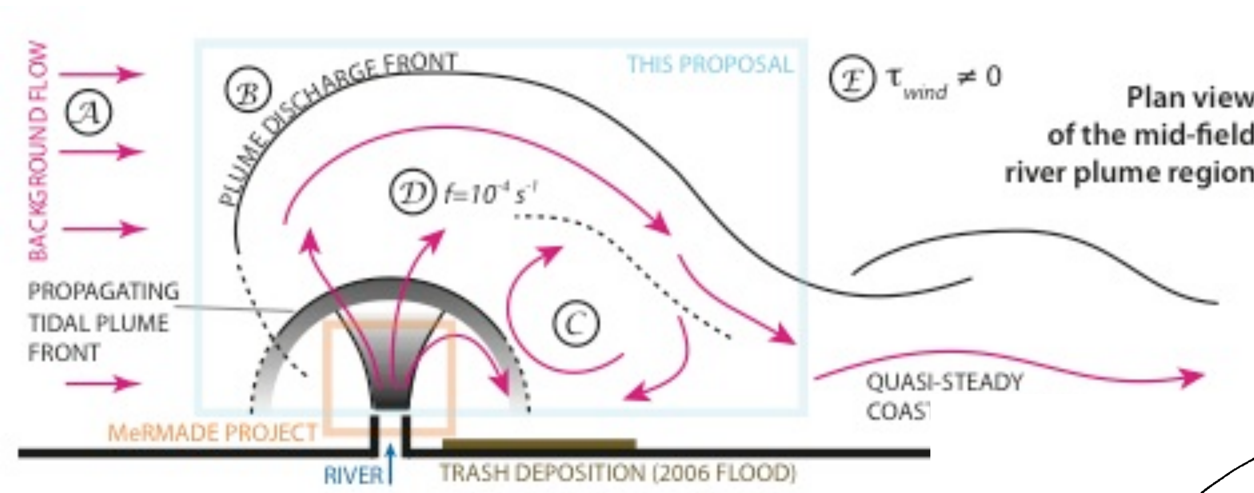
River plumes 河口冲淡羽



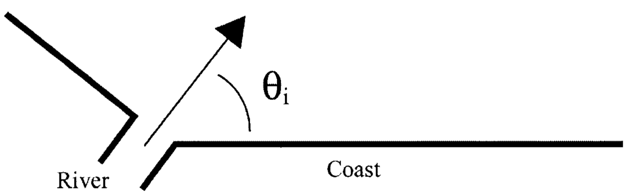


Angled inflow river plume dynamics



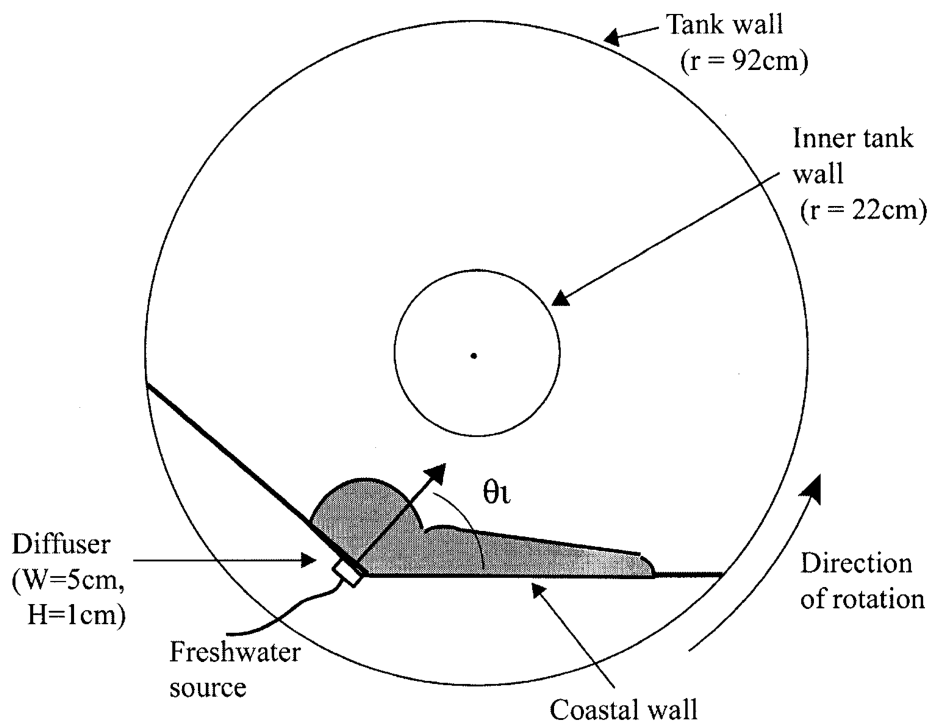
理想状态下的河流冲淡羽

In a preliminary study, Horner *et al* (2000), show that the river inflow angle (defined as the angle between the inflowing river water and the coast to the right of the mouth, Figure 6.1) may determine whether or not a bulge forms.



实际的河流冲淡羽（河口偏角）

旋转平台模拟



1. How much does the inflow angle modify the alongshore transport of freshwater?
    - ANSWER: The coastal current transport varies from 0 - $0.4Q$ as the inflow angle varies from 0^o - 90^o.
    - This trend has already been shown by me (conference paper) and Avicola and Huq (2003), but neither of these accurately quantify the transport.
2. What is the critical inflow angle, θ_c?
    - ANSWER: The coastal current transports all of the river flow when the river angle is below a critical value, θ_c. This angle is approximately 40^o - 50^o.
    - Below this angle the bulge is also observed to be steady, which is required by a simple volume balance.
    - I also show that θ_c is a function of Fr_i and Ro_i.
3. Can the variation in coastal current flux with inflow angle be predicted by an alongshore momentum balance?
    - ANSWER: The alongshore momentum in the coastal current balances the component of alongshore momentum from the source. i.e.

    $$UQ\cos\theta_{src} = \oint_c^d u^2 h dy. \tag{1}$$

    This is a simple result that one should expect, but it turns out to be complicated to interpret since there are a number of other terms in the momentum balance that must be zero, or sum to zero, for the above balance to hold.

4. Previous work

There are four key papers that provide the foundation for this work.

1. Garvine (1987)
   - Garvine (1987) developed a non-linear layer model that included treatment of fronts as discontinuities to study the behavior of estuary plumes and fronts. He found that plumes with smaller inflow angles tended to generate coastal currents that were supercritical.
   - This model is different than ours, since he forces the plume to be steady by imposing an alongshore ambient current.
   - It presents a possible explanation for the critical angle observed in our experiments. Strong fronts are observed between the bulge and the coastal current for low inflow angles. The existence of this front may modify the dynamics such that the coastal current transport is increased.
   - This last point has not been fleshed out completely and may be important in the ultimate interpretation of our data.
2. Pichevin and Nof (1997) and Nof and Pichevin (2001)
   - Pichevin and Nof (1997) examined steady oceanic inflows analytically using a two-layer, inviscid model. They considered the alongshore momentum balance in the vicinity of the mouth and showed that inflows perpendicular to the coast cannot be steady due to the unbalanced flux of momentum into the coastal current.
   - In a subsequent paper, Nof and Pichevin (2001) (hereafter referred to as NP) showed that the offshore migration of a growing bulge at the inflow provides a Coriolis force to balance the coastal current momentum flux. In this case, the momentum balance was satisfied only when the

4. Avicola and Huq (2003)

- Avicola and Huq (2003) considered the effect of both the channel exit radius of curvature and the inflow angle on the plume behaviour. They define a separation ratio $\Gamma = \frac{df}{u}$. Here, d is the maximum distance from the wall to the inflowing jet and is defined in terms of the the inflow angle and the radius of curvature of the channel exit. In their experiments, they found that a gyre formed when $\Gamma > 0.5$ and a steady current formed when $\Gamma < 0.5$. The critical inflow angle was found to be between 60^o and 75^o.
- It is unclear why Avicola and Huq (2003) obtain a critical inflow angle that is significantly greater than any of the other experiments. The most likley conclusion is that it is related to the radius of curvature, which is confounded with the inflow angle in their experiments.
- It would be good to incorporate their separation ration into our description of the plume, but I have not done that yet.

In summary, evidence exists that the coastal current transport increases as the inflow angle decreases and that full transport is obtained for low inflow angles. In addition to confirming this result with more detailed experiments, this paper will provide four important contributions. It will

1. provide an accurate measurement of the coastal current flux.
2. show how the critical angle depends on bulk parameters of the inflow (Ro & Fr).
3. describe how the inflow angle affects the momentum balance.
4. describe the occurence of a critical angle and, thus, how the flow is modified from an unsteady to a steady flow.

3. Experimental methods and description of data

All of the results presented here were obtained on the 2m diameter rotating table (Figure 1). The table and experimental techniques are described in Horner-Devine et al (2006) and Horner-Devine (2006) and the details are not repeated here. The paper describes three different sets of experiments, which focus on the bulge dynamics, coastal current fluxes and dependence on Fr and Ro, respectively.

1. Experiment 1: Bulge

   - Description of data: Simultaneous PIV/PLIF in a horizontal sheet intersecting the bulge is used to measure the velocity and density fields in the bulge region. These are used to determine the structure of the bulge and the growth rate.
   - For this set of experiments, all parameters (T, g', Q) are fixed except for the inflow angle, which is varied between 0^o and 90^o. The parameters for

2. Experiment 2: Coastal current

   - Description of data: Simultaneous PIV/PLIF in an angled sheet in the coastal current is used to make direct measurements of the freshwater transport and momentum flux in the coastal current. This is compared with the freshwater discharge and alongshore momentum fluxes from the river inflow.
   - As in experiment 1, all parameters (T, g', Q) are fixed except for the inflow angle, which is varied between 0^o and 90^o.

3. Experiment 3: Dependence of the critical angle on Fr and Ro

   - This set includes approximately 45 simple dye experiments in which T, g', Q and θ_{src} are varied and the dependence of the critical angle on Ro and Fr is deduced.
   - For these experiments, no velocity or density data were measured. Instead, video of the plume is interogated to determine if the plume is steady or unsteady.

Expt.	**Run**	T	Q	θ_i	g'	W	H	Ro	Fr
–	–	s	$\mathrm{cm^3\,s^{-1}}$	degrees	$\mathrm{cm\,s^{-2}}$	cm	cm	–	–
169	1	25	9.8	90	7	5	1	0.78	0.74
170	2	25	9.8	20	7	5	1	0.78	0.74
171	3	25	9.8	40	7	5	1	0.78	0.74
172	4	25	9.8	60	7	5	1	0.78	0.74
173	5	25	9.8	80	7	5	1	0.78	0.74
174	6	25	9.8	70	7	5	1	0.78	0.74
175	7	25	9.8	50	7	5	1	0.78	0.74

Table 1. Experimental parameters for the angled inflow bulge runs

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5. Analysis

Results

a. Bulge dynamics

The main conclusion from the bulge dynamics section is that the bulge is unsteady if the inflow angle is above the critical inflow angle. This is shown qualitatively in Figure 2. In order to be more quantitative, we fit a line to a cross-shelf velocity profile and use that to locate the center for the bulge circulation. The location of the center is then plotted in time, and the rate of growth is computed. These data show that the bulge grows for $\theta_{src} > 40^o$.

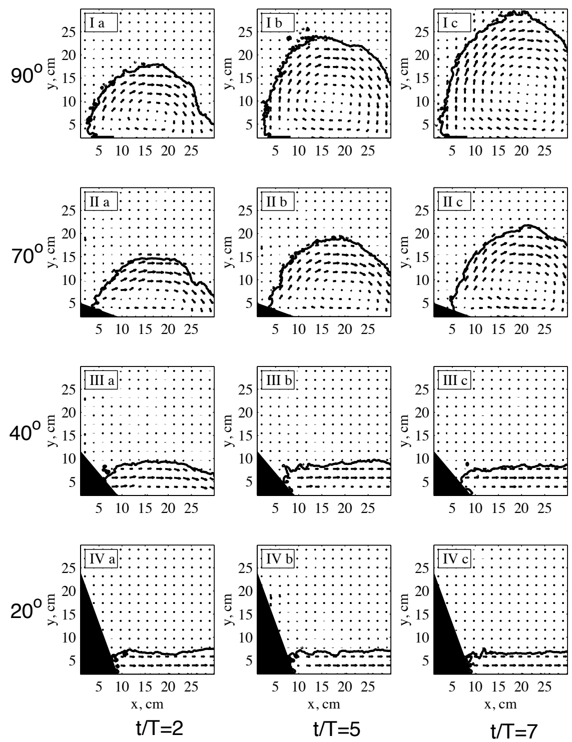

FIG. 2. Plume evolution for plumes with different inflow angles. The contour marks 20% of the inflow buoyancy. Columns a, b, and c correspond to $t/T = 2, 5$, and 7 s, respectively. Rows I - IV correspond to runs with $\theta_i = 90^o, 70^o, 40^o$ and 20^o, respectively. The black shaded triangle shows the location and angle of the hinged inflow wall.

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Discussion

d. Dependence on Ro & Fr

This section was part of the original motivation for the work. Garvine (1987) found that lower inflow angles resulted in supercritical coastal currents, and I supposed that this result would have consequences for the dynamics of the bulge. This hypothesis turned out to be true; the critical inflow angle is different depending on the inflow Fr. The connection to Garvine's result is not that direct, however. We find that a higher Fr_i results in a higher θ_c.

I'll try to dissect this a bit better. Garvine found that low inflow angles resulted in high coastal current Froude number. The bulge (or turning region) is subject to an inertial momentum balance and the coastal current is geostrophic. He finds that the two are separated by a strong front, which he refers to as a coastal front. When the inflow angle is large, there is more mixing in the turning region (due to the longer streamlines), the flow entering the coastal current is subcritical and the coastal front that divides the bulge from the coastal current is not as strong.

My hypothesis is that the coastal front is related to the steadiness of the bulge and the critical angle. Thus, if the inflow Fr is high, it will still be supercritical even for higher inflow angles and the front will be maintained. This causes the plume to remain steady. This hypothesis implies that the unsteadiness is somehow related to the upstream propagation of some disturbance from the coastal current. I still need to sort that out.

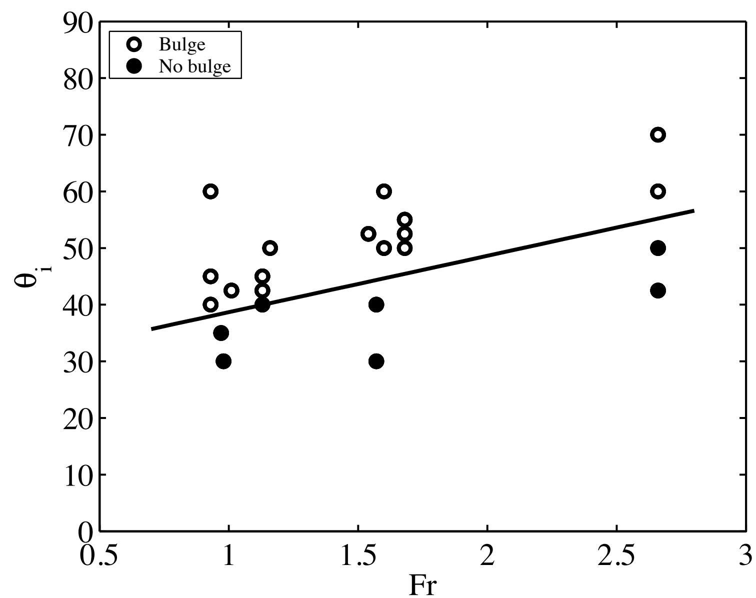

FIG. 6. Inflow angle and inflow Froude number regime plot.

Another Example

Eddy-wind interaction in an idealized oceanic mesoscale eddy

1. Goals:

1.1 How does current -wind interaction influence the eddy?

- ANSWER: based on the wind stress equation $\tau = \rho_a C_D (u_a - u_0)|u_a - u_0|$, where u_a is the 10 m wind speed and u_0 is the current speed.
- Thus, the eddy modifies the wind stress by modifying the current speed U.
- The main impact is on attenuating the eddy amplitude (thus the EKE? Jin10, Seo16)

1.2 How does SST-wind interaction influence the eddy?

- ANSWER: based on the assumption that locally high wind stress over warm water and low wind stress over cold water. (Chelton07)
- So the wind stress is smaller over the cyclones and larger over anticyclones.
- The main impact on the SST impact is on the eddy propagation (D&F87, Seo16)
- One thing to notice here is Ekman (horizontal) transport is also higher over anticyclones. Thus, such horizontal transport will move larger amount of warmer water out with higher SST-wind coupling -> amplify the wind condition, i.e., away from the no wind condition. On the other hand, the horizontal transport is smaller over cyclones (cold water), thus it will move smaller amount of cold water out with higher SST-wind coupling -> leads to the wind effect smaller, i.e., more close to the no wind condition.
- -> I think this is the one of most interesting (new) findings in our paper.

1.3 How is the interaction applied to the real coastal ocean?

- This should be emphasized in the paper, in order to differentiate from other papers. None of them has directly related the impact of eddy with SST and SST gradient, which are the main parameters in the coastal ocean.
- Refer to the series of papers (C&W, W, Y&C), to discuss the single eddy impact to the whole EBCS region (CCS?).

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2. Motivation/Previous work

There are four key papers that provide the foundation of this work:

1. Chelton EA 2007:

Provide the fundamental theory of SST-eddy interaction

- Chelton et al. (2007) developed the schematics of the influence of SST on winds near a meandering SST front (Fig. 3) for the first time (?). They detailed description is locally high wind stress over warm water and low wind stress over cold water generate a curl that varies linearly with the crosswind component of the SST gradient and a divergence that varies linearly with the downwind component of the SST gradient.
  I think our analysis does not relate to the wind stress curl, we only study the wind stress magnitude, i.e., acceleration over warm and deceleration over cold water.
- Their analysis is based on several previous work on SST modification of stability and vertical mixing in the atmospheric boundary layer
- The wind stress curl is of particular interest oceanographically as it generates open ocean upwelling and downwelling through Ekman pumping (Gill 1982; Cushman-Roisin 1994) -> This results the SST coupling case has one side downwelling and the other side upwelling.

2. Dewar and Flierl (1987)

Theoretic study on current-/SST- forced rings (eddy) separately

- Some effects on rings (Gulf Stream rings), under eastward wind (?) -> Thus, their southward drifting of eddies will be westward drifting in our upwelling case and eastward drifting in our downwelling case???
- The forced ring has two components
  - The dependence of wind stress on sea surface velocity "top drag"
  - The dependence of wind stress under a temperature sensitive drag coefficient. -> SST coupling only??
- Cold air over warm water will be convectively turbulent, thus transfer momentum to the ocean with greater efficiency.

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4. Analysis

Anomaly is calculated as the average SST (or SST gradient) within 1 eddy radius minus the average at the same location in the corresponding background case. So the size of the eddy is an important parameter controlling the SST (and SST gradient) anomaly magnitude.

0. No wind condition

See black lines in all panels.

- Location: Both eddies propagate offshore (westward), while cyclones tend to move poleward and anticyclones move equartorward. This is a result of wave radiation (McWilliam and Flierl 1979, Chelton 2011). The meridional propagation speed is on the order of 0.5 km/day. This is consistent with the global eddy observation (Chelton) and CCS observation (Kurian). There is a clear deflection around 650km offshore, which happens around xx day. My guess is that the first half corresponds to the self-adjustment. The alongshore movement is the same in two cases.
- Amplitude: Decrease continuously in all cases, exponential decay? This is because eddy-induced pumping damps the SLA signal, however, this will enhance the temperature signal, as discussed below.
- SST anomaly: Continuously increase the magnitude and the increase rate slows down with time. This is because the eddy-induced pumping (upwelled in cyclone brings deeper cold water to eddy; downwelled in anticyclone brings ambient warm surface water into eddy). Thus, the eddy temperature signal is larger in later time than initial time.

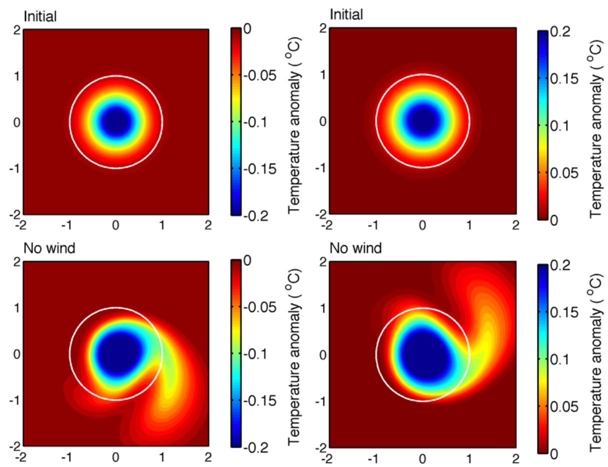

Figure. Surface temperature anomaly at initial and final conditions for cyclones (left) and anticyclones (right; colorbar has been flipped). Note the noticeably large size of temperature signal in the final condition.

- SST gradient anomaly: similar to the SST anomaly.

a. Effect of wind only

Compare the black and blue lines in all panels. This only captures the horizontal Ekman transport, thus move bulk water horizontally to the offshore/inshore depending on the wind direction (upwelling/downwelling favorable wind).

- Eddy location: Offshore movement is enhanced/depressed depends on the wind direction (upwelling/downwelling favorable wind).
- Eddy amplitude: no changes, or slightly decrease
- SST anomaly: magnitude decreases. Because the warm/cold anomaly water has been moved horizontally outside of the eddy. There is an exception for anticyclone under upwelling favorable wind: a slightly increase in magnitude between 50 - 130 day. I don't have good explanation on this.
- SST gradient anomaly: decreases. Similar reason of SST anomaly.

Compositional organization

- Like ideas should be grouped
- Like paragraphs should be grouped
- Don’t “Bait-and-Switch” your reader too many times.

e.g., when discussing a controversy, follow:

arguments (all) 赞同的观点

counter-arguments (all) 反对的观点

rebuttals (all) 反驳

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Week 2 Assignment

Find a research (can be SRTP) or an experiment (you’ve done in previous courses), write an outline in order to prepare a manuscript.

- List 3 goals (your proposed answers)
- List 3 key papers that provide foundation of your work with their main ideas
- List 3 main ideas in the introduction
- List 3 main findings of your study
- List possible comparisons/discussions

Send the outline (with key papers) by email: kjyyxz2017@163.com before Sunday Dec. 10th

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