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CIE4305 Coastal Dynamics - (2017-2018) (/mapleta/628) / Gradebook

Style: Numeric

## 2015-04-07 Exam (used as trial) 2018 (HTML) version

**Score:** 21/69.0

**Duration:** 3 hrs 22 min
**Started:** 4/4/18 11:34:15 AM GMT
**Finished:** 4/4/18 2:56:26 PM GMT

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**Assignments**
**Completed:** 0 **Active:** 0
**To Be Reviewed:** 1 **Passed:** 0

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Question

### Q1 2/2.0

*How does the magnitude of the set-up in the natural surf zone compare for locations B, C and F for both emerged as well as submerged breakwaters?*

*Choose the appropriate symbols in the below table, with set-up magnitudes ranging from zero (0) to the highest set-up (++).*

**Location C**

| Your response | Correct response |
|---|---|
| ++ | **++** |

**Grade:** 1/1.0

**Location B**

| Your response | Correct response |
|---|---|
| + | **+** |

**Grade:** 1/1.0

**Location F**

| Your response | Correct response |
|---|---|
| 0 | **0** |

**Grade:** 1/1.0

Total grade: 1.0×1/3 + 1.0×1/3 + 1.0×1/3 = 33% + 33% + 33%
Comment:
Point F is located just outside, or just at, the edge of the natural surfzone, so therefore set-up at this location is lowest, thus F = 0. If we were to follow a wave ray, point C is located in a straight line from F without any obstacles in the way. Set-up at point C is highest, thus C = ++. Point B lies in the wake of the breakwater. Both for fully emerged and partly submerged breakwaters, wave transmission is (partly) blocked, thus the gradient in radiation stress is lower than for an undisturbed transect. Therefore there is a set-up, but lower in magnitude than at point C, thus B = +.

### Q2 2/2.0

*Qualitatively indicate the magnitude and direction of $F_{y3}$ for each of the zones as indicated in the above figure using the symbols provided (the arrows represent the direction).*

**Zone between points A and B**

| Your response | Correct response |
|---|---|
| ⇨ | ⇨ |

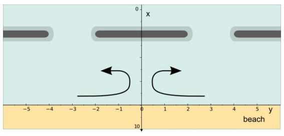
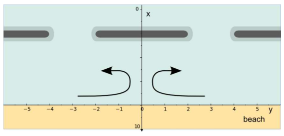
**Grade:** 1/1.0

**Zone between points B and C**

| Your response | Correct response |
|---|---|
| ⇦ | ⇦ |

**Grade:** 1/1.0

*Which of the below current patterns is driven as a consequence?*

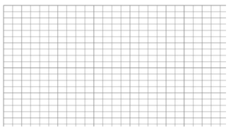
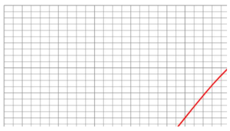
| Your response | Correct response |
|---|---|
|  |  |

**Grade:** 1/1.0

Total grade: 1.0×1/3 + 1.0×1/3 + 1.0×1/3 = 33% + 33% + 33%
Comment:
Breakwaters are equally spaced, so we can assume that the set-up magnitudes as deduced in Q1 also hold for points A and D. For emerged breakwaters, set-up at point E (wake of the breakwater) is zero. So we have highest set-up at points A and C, and zero set-up at points D, E and F. The set-up in B is lower than in A. Therefore, the flow between point A to B will be directed from A to B (rightward) and the flow between point B and C will be directed from C to B (leftward). The corresponding current pattern is figure 2 from the pdf.

### Q3 0/2.0

*Qualitatively sketch the expected shoreline response for the above described situation of emerged breakwaters and normally incident waves.*

| Your response | Correct response |
|---|---|
|  |  |

**Grade:** 0/1.0

Total grade: 0.0×1/1 = 0%
Comment:
We need to take 3 steps to obtain the correct answer:

a. What are the relevant hydrodynamics? We have solved this in Q1 and Q2. We are only looking at sediment transport due to the set-up dirven circulation current.

b. From hydrodynamics we can go to sediment transport. It is given that at the boundaries A and C (X = -3, X = 3) the morphodynamic change is zero. Moving from there towards the lee of the breakwater the set-up driven current increases in strength, picking up sediment and eroding the bed. This continues until the set-up driven current slows down and is forced outward at B, where the sediment can consequently settle.

c. So first erosion on either side and accretion in the centre. Make sure that sediment mass is conserved (erosion and accretion volume are equal).

## Q4 1.5/3.0

*How would you expect the ratio of $L_g/L_b$ to influence the importance of the set-up ($\eta_2$) versus the net flow ($u_2$)?*

| Your response | Correct response |
|---|---|
| if $L_g/L_b$ increases then $\eta_2$ decreases<br>if $L_g/L_b$ increases then $u_2$ increases | **if $L_g/L_b$ increases then $\eta_2$ decreases**<br>**if $L_g/L_b$ increases then $u_2$ increases** |

**Grade:** 1/1.0

*Explain why this happens.*

When we reduce the $L_b$ , the gap between breakwaters becomes smaller, which means the effect of set-up reduces as well. Hence, the elevation reduces. Net flow increases because of the reduction of compensation of inflow and outflow.

**Grade:** 0/1.0

Total grade: 1.0×1/2 + 0.0×1/2 = 50% + 0%

Comment:

Interpretation of this question is simply: what happens if the gap length between two breakwaters is getting larger or if the length of the breakwater is getting smaller? This influences the hydrodynamics of the system.

The set-up or piling up at the inshore toe of the breakwater has its maximum for total lateral confinement and decreases as the gap length increases. Mass conservation requires that the water flowing onshore over the structure returns off-shore again through the gaps. In other words: if Lg/Lb is zero, we have a fully bounded situation and the wave forces over the breakwater are fully translated into a set-up. A net flow over the breakwater is not possible (since it cannot return). If we increase the gap length, the situation becomes less bounded, outflow is possible and part of the wave forces are now translated to a flow over the breakwater instead of to set-up. Note that an increasing u2 implies a decreasing eta2 and vice versa, since the wave force itself in transect T2 is unaffected and either results in eta2, in u2 or in a combination of the two depending on Lg/Lb. Hence, "**If Lg/Lb increases then u2 increases**" and "**If Lg/Lb increases then eta2 decreases**".

The more mathematical / elaborate answer is:

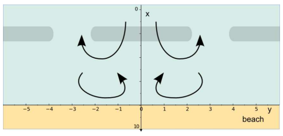
We take a control cross-section at the breakwater, so we know that u1*Lb = ugap*Lg (what comes in, must come out). Now, we have introduced the unknown variable ugap. In light of the answer options, we must relate this to our relevant parameters. In the previous formula we have Lb and Lg, so the ratio Lg/Lb is easily defined as Lg/Lb = u1/ugap. Now, to determine what would happen with the set-up eta2, we can try to find a relation between the outflow velocity and the set-up eta2. Using elementary fluid mechanics (hydraulic velocity head = h = u^2/2g) we can write the outflow velocity as: ugap = constant*sqrt(eta2), since the set-up in the gap is zero. Now equating this to the inflow, we get: Lg/Lb = u1/(constant*sqrt(eta_2)). An increase in u2 (and u1) implies a decrease in eta2 and vice versa (from a mass and momentum balance over the breakwater). So, for increasing Lg/Lb we must have a decreasing eta2 and an increasing u2.

## Q5 0/2.0

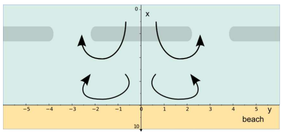
*What is the current pattern that could explain this?*

Incorrect

**Your Answer:**




**Correct Answer:**




**Comment:** The current pattern that could explain this is figure 3 (corresponding to fig. 12 from the pdf).

For a breakwater to be effective, there must be an accumulation of sand in the lee of the breakwater. If breakwater design is not done correctly, the wave related set-up can be such that there is a current pattern that does exactly the opposite. Figures 10 and 12 in the pdf show such patterns. However, a current pattern as in fig. 10 in the pdf is physically not possible: the set-up on top of the breakwater must be larger than on the sides.

## Q6 0/3.0

*In the criterion A>1, what should be the expression for A? Write A in terms of $\eta_2$, $\eta_B$ and $\eta_C$.*
*In doing so, write $\eta_2$ as eta2, $\eta_B$ as etab and $\eta_C$ as etac.*

A=

| Your response | Correct response |
|---|---|
| etac | **(eta2+etab)/etac** |

**Grade:** 0/1.0

Total grade: 0.0×1/1 = 0%

Comment:

This current pattern will occur if there is a pressure gradient directed from T2 to T3, e.g. the set-up on transect T2 must be larger than the set-up on transect T3. The set-up on the sides of the breakwater is always minimum, so eta_2 is larger than the set-up at F or D. This criterion is trivial and automatically satisfied. The second criterion must be that the set-up at point B (at the coast behind the breakwater) is larger than the set-up at point C, so eta_2 + eta_B must be larger than eta_C. Thus, writing this as A>1 provides the following expression for A: A = (eta2 + etab)/etac.

## Q7 0/2.0

If the ratio $L_g/L_b$ increases, what is likely to happen?

| Your response | Correct response |
|---|---|
| the tendency for erosion will become stronger | **the tendency for erosion will become weaker** |

**Grade:** 0/1.0

Total grade: 0.0×1/1 = 0%

Comment:

For an increasing ratio Lg/Lb the tendency for erosion will become weaker.

## Q8 1/1.0

*Indicate the initial morphodynamic response to be expected in the indicated zones on either side of the bar consistent with onshore migration (for each reagion choose between sedimentation, erosion and no change).*

Zone A: No change

Zone B:

| Your response | Correct response |
|---|---|
| Sedimentation | **Sedimentation** |

**Grade:** 1/1.0

Zone C:

| Your response | Correct response |
|---|---|
| Erosion | **Erosion** |

**Grade:** 1/1.0

Zone D: No change

Total grade: 1.0×1/2 + 1.0×1/2 = 50% + 50%

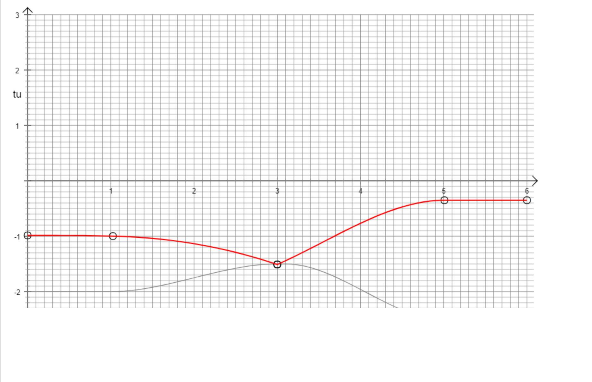
Comment:

Onshore migration, thus the bar is moving towards the coast. Therefore, initially there will be erosion in zone C, sedimentation in zone B, and nothing happens in zones A and D.

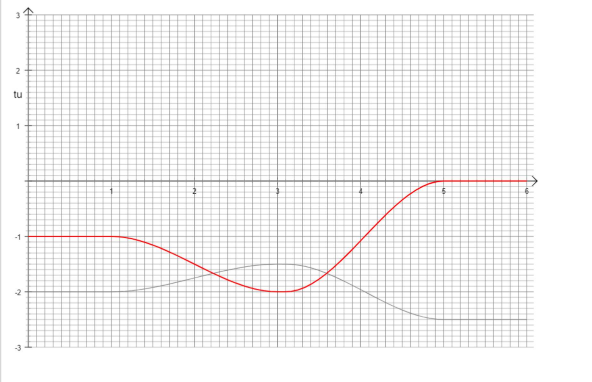
## Q9 0/3.0

*Qualitatively draw the sediment transport distribution over the bar consistent with your answer to the previous question.*

**Your response**




**Correct response**




**Grade:** 0/1.0

Total grade: 0.0×1/1 = 0%
Comment:
Transports are considered positive in positive x-direction. Positive x-direction is directed offshore, so positive transports are offshore directed. We are considering onshore transport, so at x = 0 the transport will have a value of S = -1 TU. In zone A there is no change in morphology, so the transport from X = 0 untill X = 1 is given by a straight line with a value of S = -1 TU. In zone B there is sedimentation, so the amount of sediment going into zone B is larger than the amount of sediment going out of zone B (negative gradient). On top of the bar initially there are no changes, and here we see a local minimum. In zone C there is erosion, so the amount of sediment going into zone C is less than the amount of sediment going out of zone C (positive gradient). In zone D nothing happens, and the transport is a straight line with a value of S = 0 (or at least larger than S = -1, as onshore transport due to skewness is larger in the nearshore).

## Q10 0/2.0

*For the conditions representative for the above described onshore bar migration, where are the waves breaking?*

X
**Incorrect**

**Your Answer:** at the bar

**Correct Answer:** onshore of the bar

**Comment:** Waves are breaking onshore of the bar. A net onshore transport is a result of wave skewness being more important than undertow. Waves are getting more skewed before breaking. Before breaking undertow is not relevant yet.

## Q11 1/2.0

Which hydrodynamic process(es) has (have) an important contribution to this transport?

| Your response | Correct response |
|---|---|
| wave skewness | **Longuet-Higgins streaming**<br>**wave skewness** |

**Grade:** 0.5/1.0

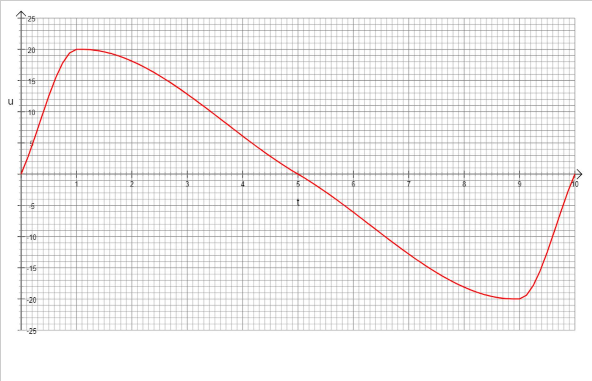
Total grade: 0.5×1/1 = 50%
Comment:
Wave skewness and LH-streaming are the most important mechanisms.Undertow gives an offshore transport. Long waves only give an onshore transport once the waves are breaking.

## Q12 0/2.0

*Sketch the orbital velocity u as a function of time of such an asymmetric wave (with zero skewness).*

**Your response**


**Correct response**




**Grade:** 0/1.0

Total grade: 0.0×1/1 = 0%
Comment:
Draw an asymmetric wave in space (x, eta). Consider yourself to be an observed at a fixed position x that sees the wave passing. Starting from the steep forward pitched face, what is the signal that you obtain?

## Q13 0/3.0

Hypothesize about a feasible physical explanation for this.

because the duration of flood is longer than the duration of ebb, which gives the sediment more time to settle in the tidal propogating process.

**Grade:** 0/1.0

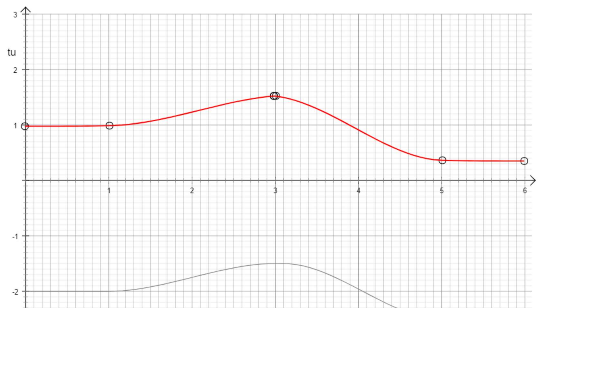
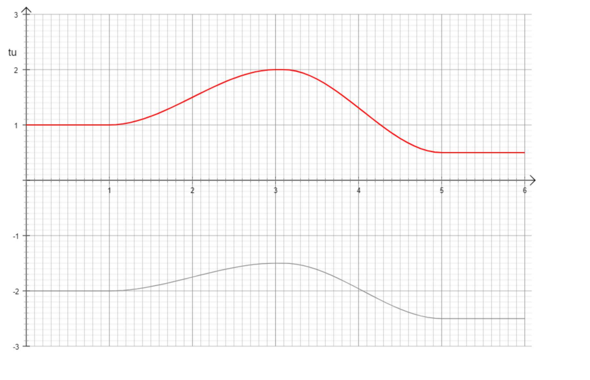
Total grade: 0.0×1/1 = 0%
Comment:
1. Zero free stream skewness with significant asymmetry leads to a skewed bottom shear stress
2. The asymmetry in the accelerations: larger accelerations from offshore to onshore cause more sand suspension during the onshore wave stroke and hence more sediment transport.
3. Small time between maximum offshore velocity and flow reversal means some sand stirred during offshore stroke may persist into the onshore stroke => onshore sediment transport

Question

## Q14 2/2.0

*Qualitatively draw the corresponding sediment transport distribution over the bar*

- For guidance the bathymetry is represented as a gray line.
- Transport is considered positive in the positive x-direction (to the right in the image of the cross-shore profile).
- Assume that at x=0, the transport magnitude is 1 offshore transport unit (tu). The direction and thus the correct sign has to be determined by you.

| Your response | Correct response |
|---|---|
|  |  |

**Grade:** 1/1.0

Total grade: 1.0×1/1 = 100%

Comment:

Offshore transport, thus at x = 0 the transport S = 1 TU. The figure you are supposed to draw is the mirrored version of the figure from Q9.

## Q15 0/2.0

*Which of the below statement(s) is(are) true?*

| Choice | Selected | ✔/✘ | Points |
|---|---|---|---|
| The shorter waves from the western sector are swell waves and the longer waves are wind waves. | No | | |
| The swell waves are larger in January than in July | No | ✘ | |
| The waves from the E to NE are swell waves | Yes | ✘ | -1 |

**Comment:** The longer waves from the western sector are swell waves. The shorter waves are wind waves.
Consider the location of Tanger. It is sheltered by land from swell waves propagating from N-NE. The only waves coming from this direction have to be locally generated.
Tanger is a at mid-latitude, where the swell is especially seasonal with much larger wave heights in the Northern winter than in the summer. The world-wide significant wave height distribution is shown in Figure 4-8 of the book (Section 4.3. Large scale variations in wave environments)

## Q16 0/1.0

*Name the hydrodynamic process that ensures that even waves from the east are capable of generating an east-to-west alongshore transport at Marbel Residency.*

| Your response | Correct response |
|---|---|
| diffraction | • **refraction**<br>• **reffraction**<br>• **refration** |

**Grade:** 0/1.0

Total grade: 0.0×1/1 = 0%

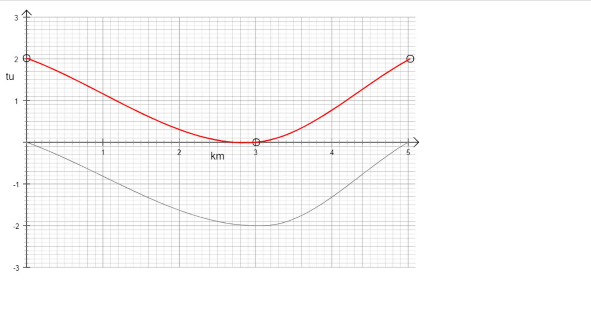
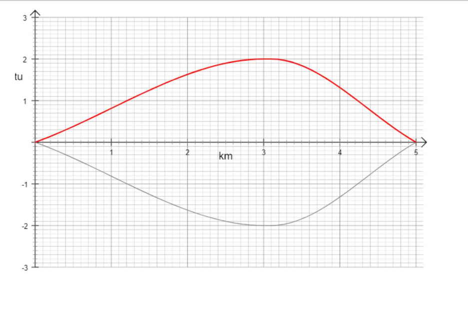
Comment:

Waves coming from the east refract and tend to become more parallel to the coastline. This results in an oblique incidence and non-zero sediment transport.

Chapter 5. Coastal hydrodynamics, Sections 5.2.1-5.2.5. Chapter 8. Longshore transport and coastline changes. Section 8..2.3.

## Q17 0/3.0

*Draw the transport caused by the westerly waves.*

| Your response | Correct response |
|---|---|
|  |  |

**Grade:** 0/1.0

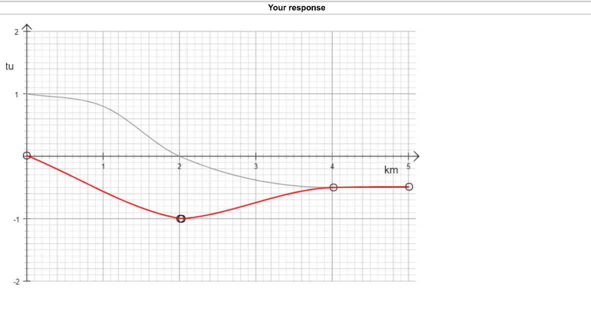
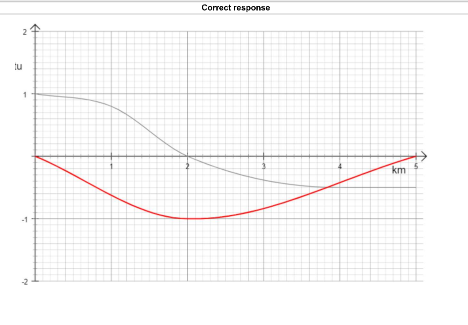
Total grade: 0.0×1/1 = 0%

Comment:

Before 1950s, the coastline position was stable along the whole bay. This means that there were no gradients in the net sediment transport. Thus, the transport by easterly waves was compensated by the transport produced by westerly waves at every location of the coastline. Considering this, the transport curve of the westerly waves is equal to the one given but with opposite sign (positive according to the reference system).

## Q18 0/2.0

*Draw the alongshore transport along the bay corresponding to fig.18 .*

| Your response | Correct response |
|---|---|
|  |  |

**Grade:** 0/1.0

Total grade: 0.0×1/1 = 0%

Comment:

There is a condition of zero sediment transport at the harbour (x=0 km). Between x=0 km and x=2 km there is accretion, and thus a decrease in the sediment transport rate (negative slope). Since the coastline does not change at x=2 the slope of the transport at this location is zero. Between x=2 and x=5 km there is coastline retreat, i.e. an increase in transport capacity or erosion (positive slope).

The transport has to decrease from x=2 to x=0, where it is equal to zero. This mean that the net transport goes in the negative x-direction (from right to left). It increases in magnitude from x=5 until a maximum at x=2, and then decreases until x=0.

Note: make sure that the points where the coastline change is maximum correspond with the maximum magnitude of the slope.

Question

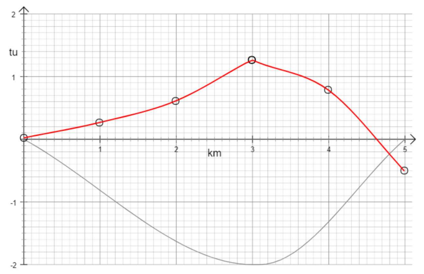
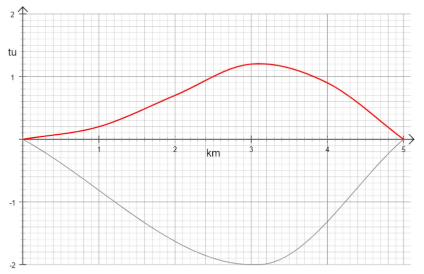
**Q19** 3/3.0

*Now draw the transport caused by the westerly waves after the construction of the harbour.*

Do this by calculating the values of the curve at points: x=0, x=1, x=2, x=3, x=4 and x=5 and use these 6 points to make the polygon. Please note that:

You should use your answer to the previous question.

- For reference, the green line in the picture shows the transport by easterly waves as given previously for the situation before the 1950s.
- The y-axis represents the same transport units as in the previous questions.
- Transport is assumed positive in the positive x-direction (to the right in the figure)

| Your response | Correct response |
|---|---|
|  |  |



Grade: 1/1.0

Total grade: 1.0×1/1 = 100%

Comment:

The addition of the easterly transport (negative) given in this question, and the westerly transport (positive) that you have to determine should be equal to the solution of Q18. Or phrased in a different way, the difference between the easterly transport (negative) and the net transport (Q18) is equal to the westerly transport (positive). Calculate the values of westerly transport that satisfy that condition at x=0,1,2,3,4 and 5 and draw the corresponding curve.

**Q20** 0/3.0

*Explain in words how the construction of the harbour can cause the changes in net and gross sediment transport as observed in the last two questions.*

because of the construction of the harbour, it cuts down the wave from west, and results in erosion in the lee side, so that it has a negative sediment transport rate. On the other hand, easterly induced wave transports sediment alongshore, which has a positive sediment transport rate. In terms of net sediment transport, because the easterly induced wave is compensated by westerly wave, but because of limited effect of lee side erosion caused by westerly wave, it still has a positive sediment transport rate and causes accretion because of negative gradient. far away from the harbour, the effect can be negligible.

*This question is not graded by the computer. It is reviewed by your instructor, who assigns a grade.*

**Comment:**

The transport by the easterly waves was not affected by the construction of the harbour. However, the transport by westerly waves was reduced, and the maximum value shifted to the east due to the sheltering effect of the harbour. As a consequence the easterly and westerly gross sediment transport did not compensate each other anymore and the residual transport was directed towards the west.

**Q21** 0/1.0

*What is the name of the feature that has developed in front of the Tarik hostel (see 1990 shoreline)?*

| Your response | Correct response |
|---|---|
| refraction | **Tombolo** |

Grade: 0/1.0

Total grade: 0.0×1/1 = 0%

Comment:

The feature is a tombolo. You can find further information in Chapter 8. Longshore transport and coastline changes. Section 8.4.3. Shadow effects due to obstacles away from the shoreline.

**Q22** 0.5/1.0

**a)** *What is the phase relationship between the semi-diurnal tidal wave at the Marsdiep inlet (I) and at the island of Schiermonnikoog (SK)? The arrival of the tidal wave:*

| Your response | Correct response |
|---|---|
| is first at the Marsdiep inlet | **is first at the Marsdiep inlet** |

Grade: 1/1.0

**b)** *This can be explained from:*

| Your response | Correct response |
|---|---|
| the propagation speed of the tidal wave from the Southern Hemisphere through the Atlantic to Europe | **the Coriolis deflection of the tidal wave in the North Sea basin** |

Grade: 0/1.0

Total grade: 1.0×1/2 + 0.0×1/2 = 50% + 0%

Comment:

In which direction does the tide propagate in the North Sea? Which factors control tidal range? Which ones control tidal phase?

(See 3.8.2 Amphidromic systems, 5.7.2 Tidal Propagation Along the Shore)

The tidal wave arrives first at the Marsdiep inlet, because the tide travels from west to east, and is far enough from Schiermonnikoog that the high water does not reach both points simultaneously. This phase relationship can be explained by the Coriolis deflection of the tidal wave in the North Sea. This deflection causes the tidal wave to propagate counterclockwise around the North Sea.

**Q23** 2/2.0

Consider the situation of a tidal wave propagating along a basin from the sea to the landward end, where it is reflected. At a certain location, the resulting tidal wave has a purely propagating character when the ratio between the amplitudes of the reflected and incoming wave is

| Your response | Correct response |
|---|---|
| 0 | **0** |

Grade: 1/1.0

and a purely standing character if the ratio is

| Your response | Correct response |
|---|---|
| 1 | **1** |

Grade: 1/1.0

.

Total grade: 1.0×1/2 + 1.0×1/2 = 50% + 50%

Comment:

This question is about the ratio between incoming and reflected waves for purely propagating and purely standing waves. For purely standing waves, the incoming and reflected wave have the same amplitude. Such a purely standing character can be (theoretically) present in the entire basin without frictional attenuation or at the basin end if friction does play a role. The ratio of reflected:incoming = 1. A purely propagating character at a certain location implies that the amplitude of the reflected wave has been entirely damped by friction and the ratio of reflected:incoming = 0.

**Q24** 3/3.0

*Estimate the ratio of the basin length $L_b$ over the tidal wave length L.*

Correct

Tip: You can write the final result or the arithmetic expression in the text field (e.g. 1/5*3 is equivalent to 0.6 and both answers are accepted).

Attention: Use the point as a decimal separator.

**Your Answer:** 0.496

**Correct Answer:** 130000/(sqrt(9.81*3.5)*44700) ± 5.0%

**Comment:** We are given the length of the pre-closure basin as 130 km, but how do we know the tidal wavelength? What is the period of the dominant tidal constituent here? How fast would that tidal wave travel?
(See 3.8.1 the Dynamic Theory of the Tides)

$L_b$ = 130 000 m
g = 9.81 m/s
$h_{basin}$ = 3.5 m
$T_{tide}$ = 12.4167 hrs (M2) = 44700 s
$L_{tide}$ =$C_{tide}$*$T_{tide}$ = sqrt(gh)*$T_{tide}$ = sqrt(9.81*3.5)*44700 = 261 924 m

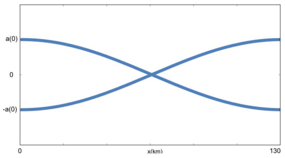
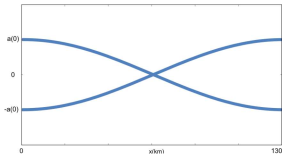
**$L_b/L_{tide}$ = 0.4963 ~= 0.5**

Answers accepted to within 5% of the correct value.

Question

## Q25 1/2.0

*a) If one had to choose from the below figures, which figure may best resemble the tidal envelope in this situation?*

| Your response | Correct response |
|---|---|
|  |  |

**Grade:** 1/1.0

*b) At which location(s) along the basin do maxima of horizontal exchange of water occur?*

| Your response | Correct response |
|---|---|
| x=0 km<br>x= 130 km | **x=65 km** |

**Grade:** 0/1.0

Total grade: 1.0×1/2 + 0.0×1/2 = 50% + 0%
Comment:
We discovered in the previous question that the tidal wave was approximately half the basin length (so we are not dealing with a short basin!). If we assume that frictional attenuation is limited, then this incoming wave would reflect off the far end. This gives us a standing character wave with one node in the middle and two antinodes at either end, like in the second option.

In a standing wave, we have maximum vertical motion at the antinodes and maximum horizontal motion at the nodes. The node for this case is located in the middle of the basin, at x=65 km.

(See 5.7.3 Tidal Propagation into Basins, Appendix E: Dutch Closures)

## Q26 0/2.0

*Name the process that is responsible for the differences between fig.23 and the one you picked in the previous question (Q25a).*

| Your response | Correct response |
|---|---|
| resonance | • **friction**<br>• **damping**<br>• **dampening**<br>• **bed friction**<br>• **shear stress**<br>• **energy dissipation**<br>• **dissipation**<br>• **bed shear stress**<br>• **bottom shear stress**<br>• **bottom friction** |

**Grade:** 0/1.0

Total grade: 0.0×1/1 = 0%
Comment:
Compare your answer to Q25 with Fig 23- what is the difference between them at the landward end? What process might control the decreasing tidal range along the basin?
(See 5.7.3 Tidal Propagation into Basins)

Friction is responsible for reducing the tidal range along the basin, but the following answers are all accepted:
friction
damping
dampening
bed friction
shear stress
energy dissipation
dissipation
bed shear stress
bottom shear stress
bottom friction

## Q27 0/2.0

Which of the below statement(s) about fig.23 is(are) true:

| Your response | Correct response |
|---|---|
| To compute the tidal prism only A2 is relevant | **To compute the tidal prism only A1 is relevant**<br>**A2 = A3** |

**Grade:** 0/1.0

Total grade: 0.0×1/1 = 0%
Comment:
Consider the given information: what are the implications of a point with zero horizontal exchange? Which volumes of water will be exchanged with the sea on each tidal cycle? Which will not? Where will that water go?
(See 5.7.3 Tidal Propagation into Basins, Appendix E: Dutch Closures)

The tidal prism relates to the volume of water exchanged through the inlet between the basin and the sea. Since horizontal exchange at x=45km is zero, A2 and A3 only exchange with each other (in this idealized schematization), and can be excluded from the prism. Hence, only A1 is necessary to compute the prism. If A2 and A3 exchange with each other, for continuity A2 must equal A3.

## Q28 0/2.0

At which location in the basin is the propagating character of the tidal wave strongest, and at which location is the standing character strongest?
*The propagating character is strongest at $x/L_b$ =*

| Your response | Correct response |
|---|---|
| 1/4 | **0** |

**Grade:** 0/1.0

*The character is completely standing at $x/L_b$ =*

| Your response | Correct response |
|---|---|
| 0 | **1** |

**Grade:** 0/1.0

Total grade: 0.0×1/2 + 0.0×1/2 = 0% + 0%
Comment:
Consider that x/Lb = 0 is the seaward end and x/Lb is the landward end of the basin. What is the character of the wave when it first enters the basin? What about when it reaches the landward end?
(See 5.7.3 Tidal Propagation into Basins)

The tide enters the basin as a propagating wave, attenuates as it travels through the basin, reflects off the landward end, then continues to attenuate as it returns towards the sea. Hence, the propagating character is strongest at the seaward end (x/Lb=0), and the standing character is strongest where the wave reflects at the landward end (x/Lb=1).

## Q29 0/2.0

*Explain the location of zero discharge at x = 45 km. In doing so, make a comparison to the standing wave pattern that you chose in one of the previous questions.*

For purely standing wave, the zero discharge occurs when $L/L_b$ equals 1/4, which is 32.5 km in this case while it actually delays to 45 km in reality. This proves that this partly progressive wave and partly standing wave pattern.

*This question is not graded by the computer. It is reviewed by your instructor, who assigns a grade.*

**Comment:**
Where in an idealized standing wave do we see maximum velocity? Maximum amplitude? What might cause Fig 23 to deviate from that idealized standing wave?
(See 5.7.3 Tidal Propagation into Basins)

In a perfect standing wave for this basin and tidal wavelength, areas left and right of a node (from the node to the zero discharge point at an antinode) are equal, and the node sits in the middle of the basin. The maximum exchange of water occurs at the node and the volumes of water on either side of the node are equal. In the present non-ideal situation, the areas left and right of the point of maximum exchange of water must still be equal (this volume of water does not leave the basin), but because of the progressive damping, this leads to a point of zero discharge at x=45km.

## Q30 0/2.0

*Explain why the tidal prism increased.*

prism is composed of tidal range and basin area for short basin but in this case, short basin theory may not valid any more.

*This question is not graded by the computer. It is reviewed by your instructor, who assigns a grade.*

**Comment:**
How did the position of the dam influence the prism? What are the implications of a shorter basin for its friction or inertia-dominance?
(See 5.7.3 Tidal Propagation into Basins)

1. The closure dam was located close to the location of zero exchange of water. As a result, the tidal prism (the volume of water, excluding any fresh water, that has to flow in and out through the inlet during one tidal cycle) did not decrease.
2. In a shorter basin, the tidal wave experiences less frictional dampening because it has a shorter travel distance. This means that the amplitude of the reflected wave is larger than it would have been prior to the construction of the dam. This means that the tidal range increased, which thus also increased the tidal prism.

Question

Q31 2/2.0

*For the benefit of which elements in the basin is sediment imported?*

Correct

**Your Answer:** the tidal flats, since their areal size is too small compared to the channel area

**Correct Answer:** the tidal flats, since their areal size is too small compared to the channel area

**Comment:** Which elements of the basin are out of equilibrium after the closure? Why are they out of equilibrium?
(See 9.8 Changes in Dynamic Equilibrium)

The channels respond to changes in the tidal prism (as the main pathway for water flowing through the basin, their size relates to the volume of water that must be conveyed on every tidal cycle). Since the tidal prism increased by ~25%, the channel volume should not be "too big" for the volume of water moving around in the basin. If anything, we would expect the channels to grow until they reach the right size, which would result in an export of sediment as the channels are "excavated".

What, then, is the problem? From p.423-424, we know that there is a relationship between the area of the tidal flats, channels, and the total basin area. After the closure, the relative area of the flats was too small (most flats are located to closer to the rear of the basin, which was effectively lost during the closure), so the sediment being imported is used to build them up within the new, smaller basin.

Q32 0/3.0

*What is the expected long-term response of the adjacent coastlines and ebb-tidal delta to the closure?*

*a) Adjacent coastlines*:

| Your response | Correct response |
|---|---|
| no change | **erosion** |

**Grade:** 0/1.0

*b) Ebb-tidal delta:*

| Your response | Correct response |
|---|---|
| erosion | **sedimentation** |

**Grade:** 0/1.0

Total grade: 0.0×1/2 + 0.0×1/2 = 0% + 0%

Comment:

How will the tidal prism change after the closure? What are the consequences for the ebb-tidal delta? If the ebb-tidal delta grows, where will that sediment come from? If it has to shrink, where will the excess sediment be transferred to?
(See 9.8 Changes in Dynamic Equilibrium)

We know that the tidal prism increased by about 25%. From eq. 9.2, that means that the ebb-tidal delta should grow larger (sedimentation). Where will this sediment come from? As discussed in the previous question, we know there is already a demand for sediment into the basin, so the sediment is not coming from the basin. The only other source must then be the adjacent coastlines, which will erode.