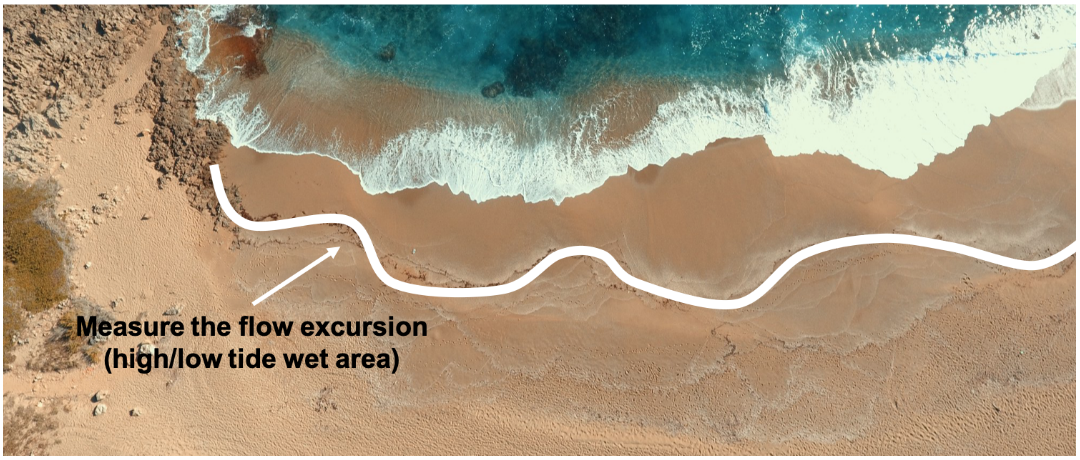
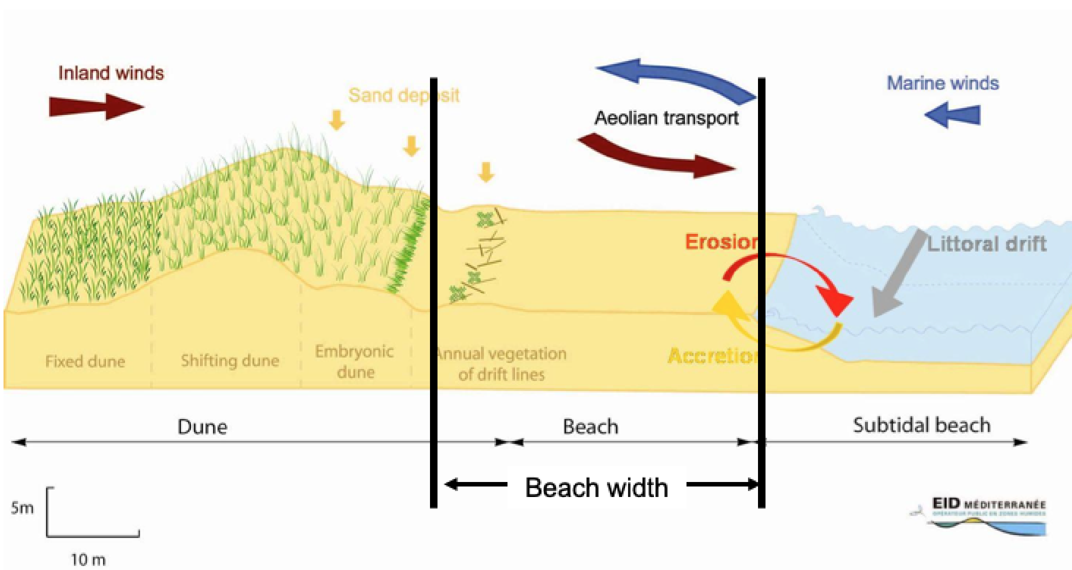
<u>**METRICS**</u>

1. **Shoreline position:**
    - Shoreline position will be measured from 15-min/mission drone-captured imagery to track the flow excursion.

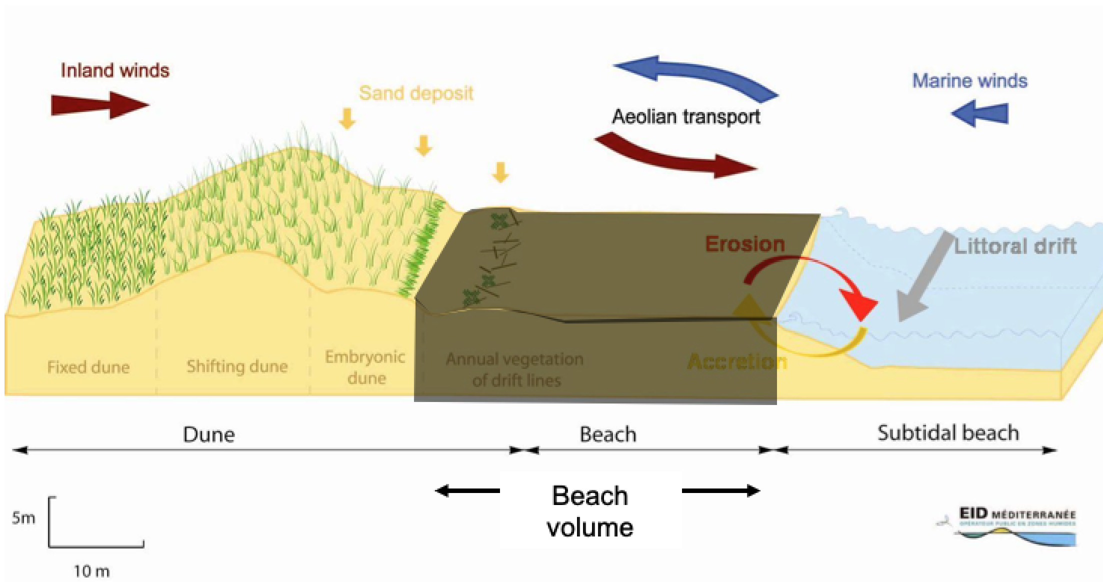


2. **Beach width:**
    - Beach width will be measured from the upper swash zone (low tide) to the dune toe.



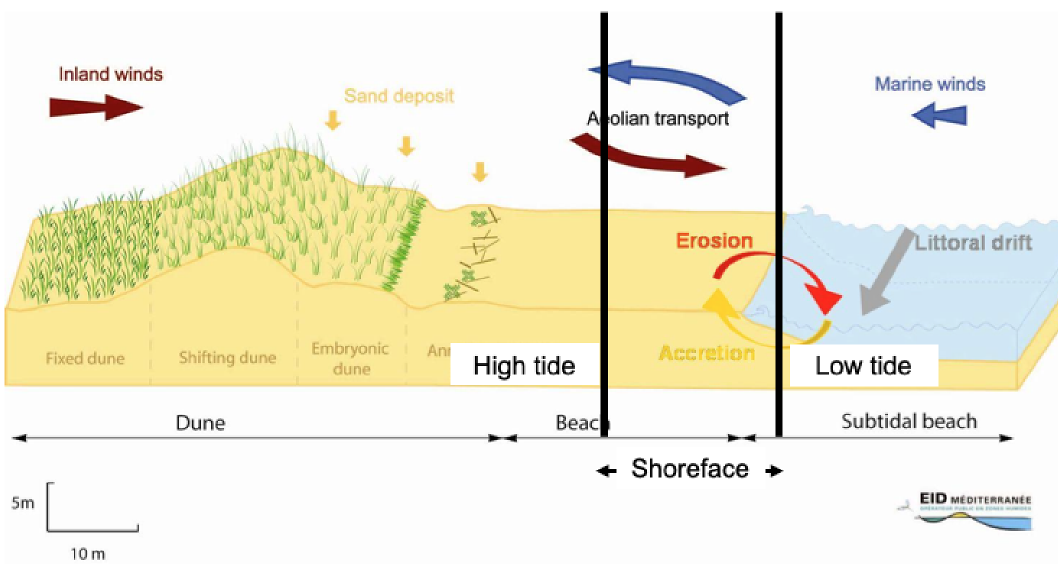
3. **Beach volume:**
4.

- Beach/dune volume will be calculated based on the elevations estimated using the drone-captured imagery. Images will cover approximately 50 to 100 meters alongshore.
- Can be calculated using Pix4d or by analytical approaches (integrating under a curve) using beach individual beach profiles.



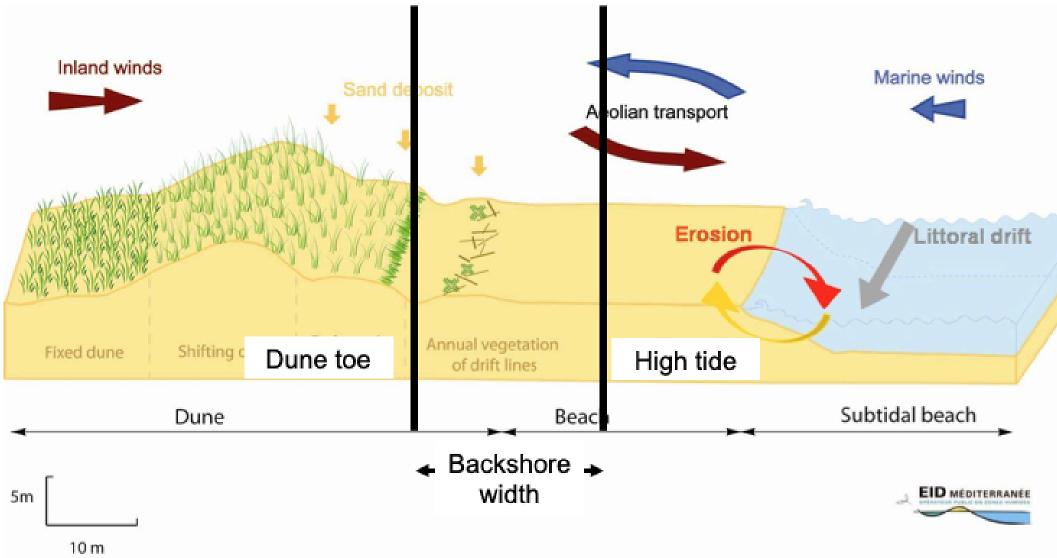
5. **Shoreface:**

- Shoreface extension (area that gets wet during low and high tide, swash excursion and wave runup) will be measured using drone-captured imagery and depth will be measured walking with the rod over selected transects.



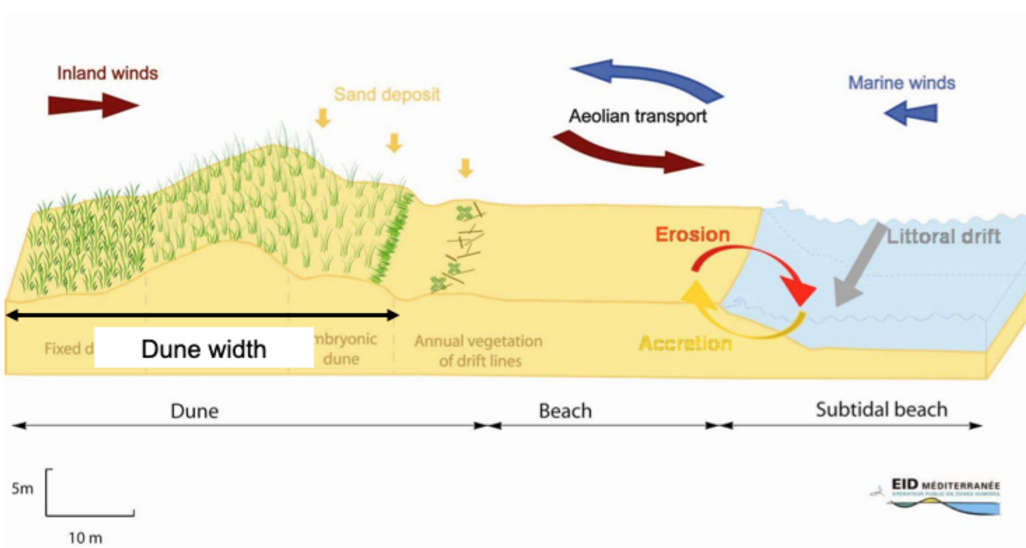
6. Backshore width:

- Beach backshore will be measured from the upper swash zone (high tide) to the dune toe.

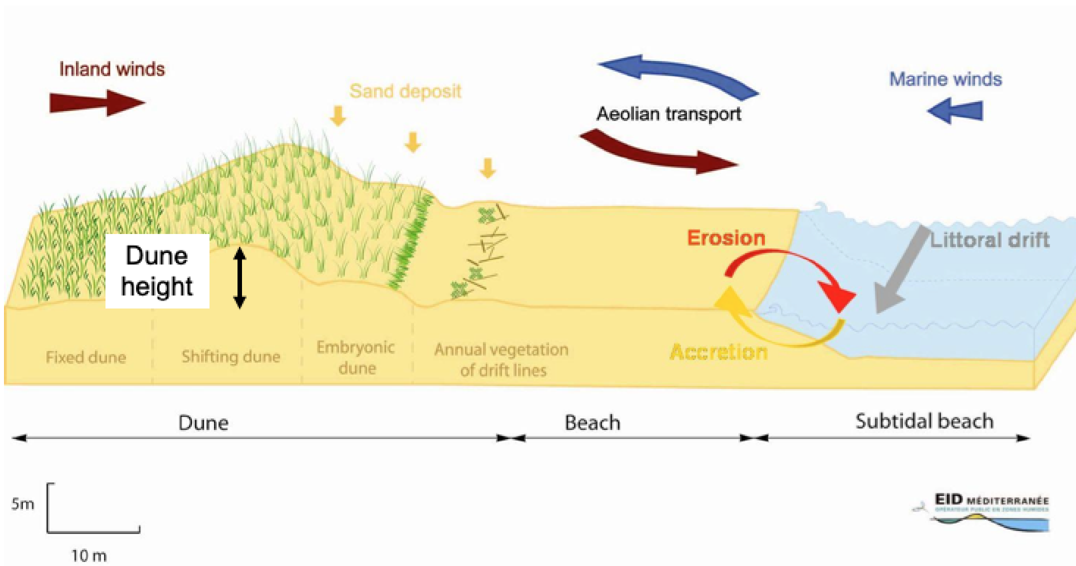


7. Dune width:

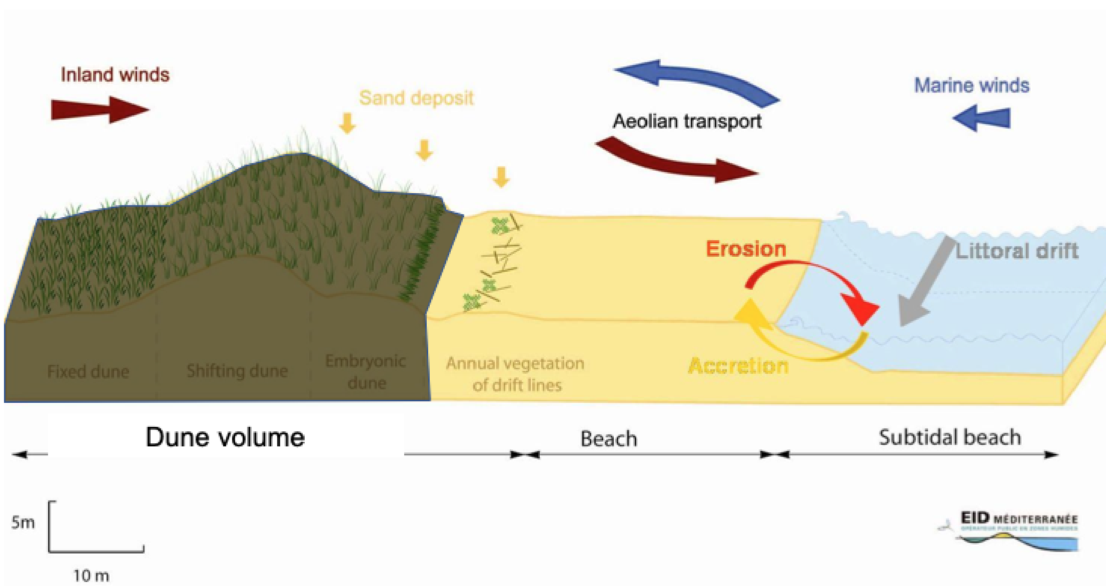
- Dune width will be measured from the foredune to the back dune.



8. **Dune height:**
    - Dune height will be measured from the fore dune to the mid dune or from the back dune to the mid dune (will depend on vegetation cover).



9. **Dune volume:**
    - Dune volume will be calculated based on the measured dune width and height. Volume will take in consideration the whole alongshore extent of the dune, approximately 50 to 100 meters alongshore.



10. Grain size:

- Surface sediment samples will be collected at fore dune, mid dune, back dune, berm/upper beach (high tide), and swash zone (low tide). Sediment samples will be collected by surface scooping up to wading depth.

Granulometric analysis
Procedure

1. Dry the sand sample using a laboratory oven.

2. Place the dry sand sample in a pre-weighed beaker, weigh, and record the total weight of the sand sample.

3. A representative weighed sample is poured into the top sieve which has the largest screen openings. Each lower sieve in the column has smaller openings than the one above. At the base is a round pan, called the receiver.

4. Then, shake the sieves/system, usually for some fixed amount of time (a couple of minutes).

5. After the shaking is complete the material on each sieve is weighed. The mass of the sample of each sieve is then divided by the total mass to give a percentage retained on each sieve. The size of the average particle on each sieve is then analysed to get a cut-off point or specific size range, which is then captured on a screen.

6. The results are presented in a graph of percent passing versus the sieve size. On the graph the sieve size scale is logarithmic.

7. To find the percent of aggregate passing through each sieve, first find the percent retained in each sieve. To do so, the following equation is used,

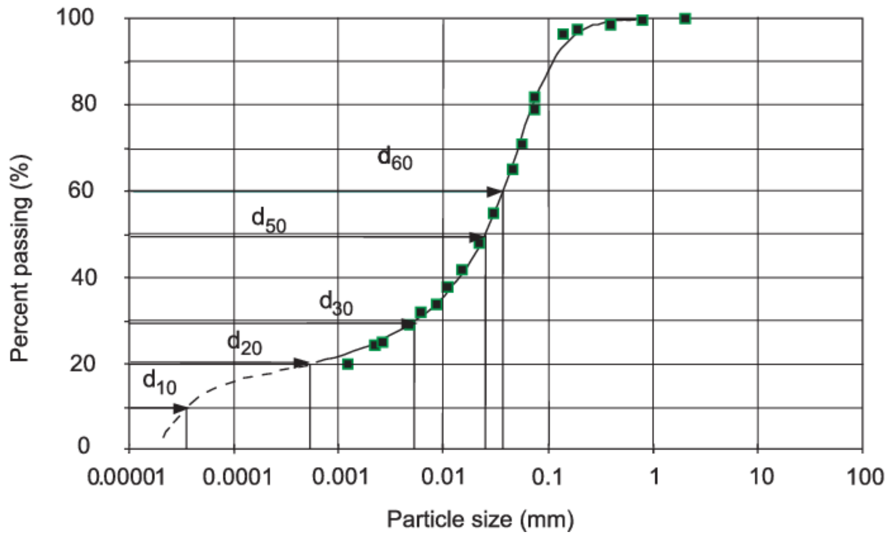
$$\%\text{Retained} = \frac{W_{Sieve}}{W_{Total}} \times 100\%$$

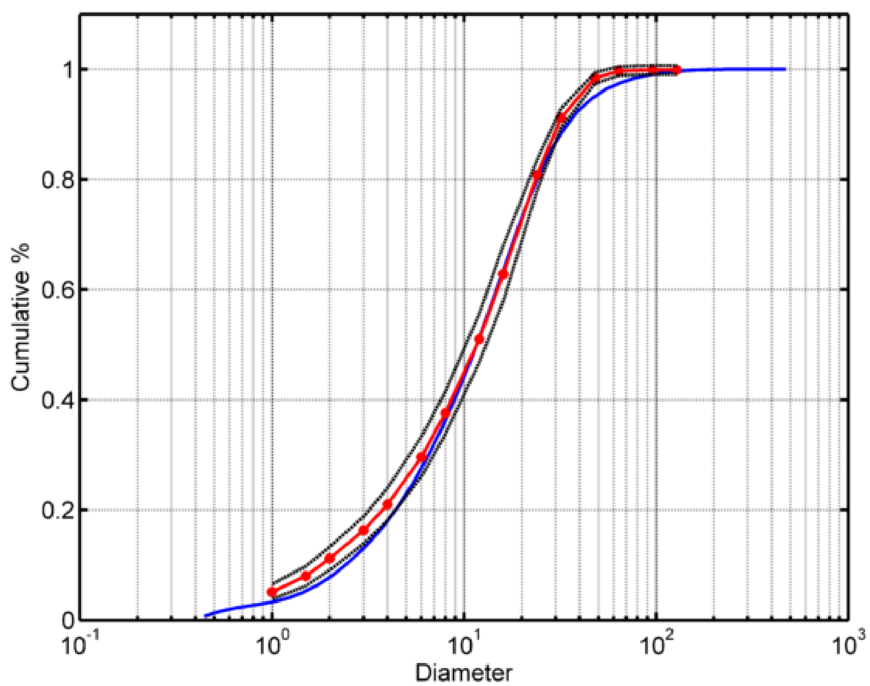
where W_{Sieve} is the mass of aggregate in the sieve and W_{Total} is the total mass of the aggregate.

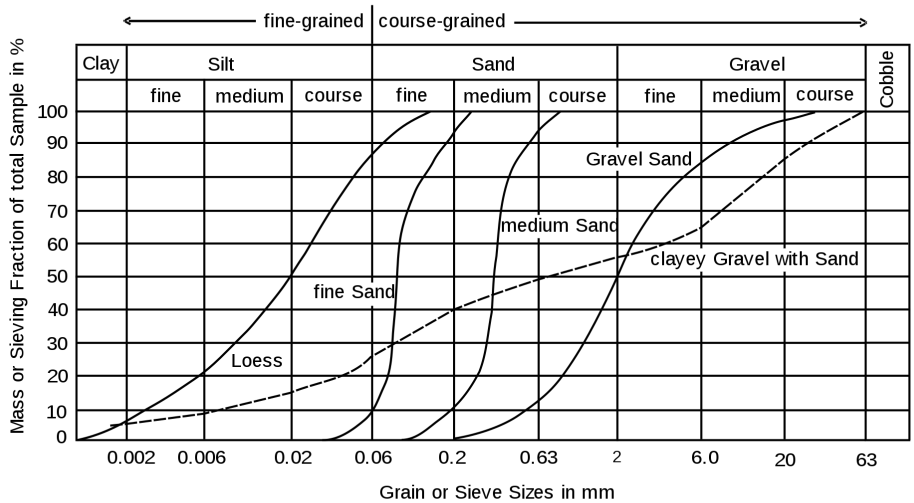
8. Next, find the cumulative percent of aggregate retained in each sieve. To do so, add up the total amount of aggregate that is retained in each sieve and the amount in the previous sieves. The cumulative percent passing of the aggregate is found by subtracting the percent retained from 100%.

$$\%\text{Cumulative Passing} = 100\% - \%\text{Cumulative Retained.}$$

9. The values are then plotted on a graph with cumulative percent passing on the *y-axis* and logarithmic sieve size on the *x-axis*.







fine-grained
course-grained
Clay
Silt
Sand
Gravel
Cobble
fine
medium
course
fine
medium
course
fine
medium
course
100
90
80
70
60
50
40
30
20
10
0
Mass or Sieving Fraction of total Sample in %
Gravel Sand
medium Sand
clayey Gravel with Sand
fine Sand
Loess
0.002
0.006
0.02
0.06
0.2
0.63
2
6.0
20
63
Grain or Sieve Sizes in mm