The slope and incision length of affected local cross abrasion and accretion using ASTER GDEM image analysis

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Abstract. Remote sensing technology is to support the identification and assessment of resources and disasters in coastal areas and oceans, because it has the advantage of covering large areas and the highest of the spatial and temporal resolution. Aster GDEM image is used to determine the slope and the length of cross the incision on exposed area abrasion and accretion. Western coastal of Banten Province has experienced abrasion with the furthest distance of 125.05 m to 274.73 m. and experienced accretion with the furthest distance of 31.65 m to 111.58 m. ASTER GDEM results of image analysis in areas of abrasion has a slope about 1.4° to 3.3° and cross the incision length is approximately 350.52 meters to 506.57 meters. At the accretion region has a slope about 2.0° to 3.1° and cross the incision length about 306.62 m to 562.05 m.

Keywords: ASTER GDEM, coastal, abrasion, accretion, slope

1. Introduction
Indonesia in general has three coastlines with one very different natural physical conditions, especially geologic settings. For example in Banten Province, the geological setting behind the seaside coastal area (Java Sea), coastal areas between islands (Sunda Strait), and open coastal areas (Indian Ocean), have different characteristics and can be utilized to support development and simultaneously Control it [1].

Remote sensing technology is very supportive in the identification and assessment of resources in coastal areas and oceans, because it has advantages that include large areas and high temporal resolution, many choices of remote sensing satellite types that have a pretty good accuracy in identifying objects on the surface of the earth [2], [3], [4], [5], [6], [7].

In relation to the unique and highly interesting coastal deposition environments to be observed above and the advantages of remote sensing technology, it is necessary to research the relevance of abrasion and accretion processes with slope slope slopes on the coast of Banten Province.

The aim of this research is to know the slope in coastal area affected by abrasion and accretion by using Advanced Space borne Thermal Emission and Reflection Image Radiometer Global Digital Elevation Model (ASTER GDEM) with the calculation of the length of the cross-sectional line so that it gets big slope, in the west coast of Banten Province. Research Sites in coastal areas of the sea, from Anyer to Tanjung Lesung, Pandeglang District, Banten Province with coordinates 6°17'30"LS-6°32'30"LS and 105°40'30"BT-105°50 '00"BT.Map of study sites affected by abrasion, accretion and calculation of slope/slope on the coast of Banten can be seen in Figure 1.
2. Research Method

The research method used begins with literature study from the publication of some previous researchers, collecting secondary data in the form of Landsat TM and ETM + images, ASTER GDEM images of wind direction, currents, waves and bathymetry, retrieving primary data by conducting field survey to collect oceanographic data; Currents, wind direction, and bathymetry. Furthermore, the processing, analysis and discussion.

Many types of remote sensing satellites have good accuracy in identifying objects on the Earth's surface [8], [9]. Landsat Satellite (Land Satellite) is one of satellite resources that produce multispectral image. This satellite belongs to the United States, which was launched on July 23, 1972. Landsat 1, 2, 3 has MSS (Multi Spectral Scanner) and RBV (Return Beam Videocon) sensors, Landsat 4 and 5 have MSS and TM (Thematic Mapper) sensors. Landsat 6 and 7 have ETM and ETM + (Enhanced Thematic Mapper Plus) sensors. Landsat 7 ETM + has specifications such as high spectral resolution, which has 8 channels so that the ability to distinguish objects is relatively high. Landsat 7 ETM + has a temporal resolution or can record the same area every 16 days, it is very useful to obtain the latest data about the research area. The 7th generation Landsat has improved its spatial resolution with ETM + sensor in addition to generating 7-channel images such as the TM sensor, plus the 8th channel with a spatial resolution of 15 meters (panchromatic).

Method determination of abrasion and accretion area is to process Landsat image classification in 1982 and 2007 unsupervised with ER Mapper program. Enter the cropped image of the cropped image, enter the filename of the unsupervised classification result. Enter the number of iterations 100, unchanged 98.5 percent and the number of class 2 (only 2 classes because only want to do separation between land and sea).

After exiting the classification result, the next process is done with ArcView program. So the image data that has been classified needs to be exported into a format that can be read by the program ArcView. Enable layer 1982 and 2007 by ticking both layers. After the process will be generated new union results between 1982 and 2007. In view double click the union result layer and select the legend type: Unique Value and select the values field: ID. Change the color to: red = abrasion region, green = region of accretion, brown = fixed area [10]. In this Landsat image it can show the West coast of Banten Province where there has been abrasion and accretion by comparing Landsat MSS and ETM +

Figure 1. Map of research area.
in 1982 and 2007. Based on Unsupervised Methods of both imagery can be calculated the distance of abrasion and accretion, at 3 selected locations that have wide-shifted coastline changes seen from Landsat image in 1982 and 2007 (see Figure 2). That the research areas are in:

- Location 1 (Bay of Lada - Tanjung Lampe): has experienced Abrasion with the furthest distance = 274.73 m. Some regions experience Accretion with the furthest distance = 31.65 m
- In location 2 (Bay of Lada – Tanjung Dadap) has experienced Abrasion with the furthest distance = 206.69 m. Most beaches experience Accretion with the furthest distance = 111.58 m
- In the location of 3 coastal areas of Tanjung Lesung has experienced Abrasion with the farthest distance = 125.05 m, most beaches experience Accretion with the furthest distance = 68.71 m

Area that experienced Abrasion and Accretion by Unsupervised method that is in Location 1 Abrasion area = 615,022.77 m² and wide of Accretion = 9,943.14 m², Location 2 area of Abrasion = 848,492.98 m² and wide of Accretion = 24491.14 m², Location 3 Abrasion area = 106,966.98 m² and wide of Accretion = 65,841.54 m². Based on GDEM Aster image data can be calculated slope measurement (slope of the seafloor) and length of transverse incision, at 3 selected locations experiencing abrasion and accretion (see Figure 3, 4 and 5). The results of measurements in the research areas are:

**Figure 2.** Results of abrasion and accretion by unsupervised method.

Location 1: in the affected area Abrasion = Slope = 2.6°, the length of Transverse Incision = 1662 feet = 506.57 meters, in the affected area Accretion = Slope = 3.1°, Transverse Cross = 1006 feet = 306.62 meters (Figure 3a and 3b).

**Figure 3a.** Slope measurement in the abrasion

**Figure 3b.** Measurement of slope in location 1 accretion location 1

Location 2: in the affected area Abrasion = Slope = 3.3°, the length of the Transverse Incision = 1639 feet = 499.56 meters, in the affected area Accretion = Slope = 3.1°, Cross Crossover = 1231 feet = 375.20 meters (Figure 4a and 4b).
3. Results and Discussion

Based on research in the field, from 18 locations of observation (LP) of in-situ data of abrasion and accretion, the location of observation is geographically grouped into 3: Tanjung Lampe, TelukLada, Tanjung Dadap and Tanjung Lesung with the following results [11].

Data obtained in the field can be concluded that in the study area is a sediment cell belonging to the low energy environment (Low Energy environment) [12], [13]. On field observations evidenced by the presence of fine grains of fine sand - containing rough fragments (rocks and shells), has a spreading from the west in November - February because the wind is blowing west wind which gives the impact of a wave/wave is greater than the impact given by the east wind. The sediment composition identifies the source, grain sediment, slope and coastal width as well as the boundary of a transport sediment (cell), whereas secondary data such as geological maps, topographic maps and Landsat images on a certain scale are effective to indicate the process Occurs in sediment transport [14].

The cell group is also called the sediment transport system as a unit in coastline management that can ultimately manage coastal resources sustainably. In this study area there are grain-sized sediments of different sizes, so the study area belongs to a group of low-energy cells. The limits of sedimentary cells in the research area are generally a natural boundary that is the convergent boundary which is the boundary of the dynamic cell, as the meeting of the direction of the sediment load transport. Convergent boundaries can be found on the beach of Tanjung Lampe, Pesisir Pantai Teluk Lada, Tanjung Dadap and Tanjung Lesung. In general, this limit occurs because of the diffraction of the wave by the growth of the Delta and by the plains that jut into the sea.

Landsat image analysis results show that the west coast of Banten Province has changed coastline, compared to Landsat TM and ETM + in 1982 and 2007, that is the occurrence of abrasion and accretion. Symptoms of abrasion at Tanjung Lampe Beach are indicated by evidence of the remains of fallen vegetation and damaged buildings caused by waves crashing and evidence of inundation of seawater in large coastal areas, suggesting that the coast is retreating towards the mainland. While the accretion area showed the reefs and sand deposits extending to the sea.

Symptoms of abrasion in the Bay of Lada region are indicated by narrow coastal skeletons and the remnants of wavelengths and break-ups that are submerged in sea water. Accretion symptoms are indicated by widening beaches, reefs and sediments towards the sea. Some areas on the coast of
Tanjug Dadap and Tanjung Lesung show the beach backward towards the land (abrasion) that is the breaking of waves that have been destroyed and submerged in sea water. Symptoms of accretion are seen on a wide beach face.

Based on Unsupervised Methods from Landsat TM and ETM + images in 1982 and 2007 it was known for 25 years to obtain the farthest distance and wide abrasion and accretion, in 3 selected locations. Areas that have experienced Abrasion in Location 1 (Bay of Lada - Tanjung Lampe): obtained the furthest distance = 274.73 m and Area of Abrasion = 615,022.77 m². In location 2 (Bay of Lada – Tanjung Dadap) obtained the furthest distance = 206.69 m and Area of Abrasion = 848,492.98 m². In the location of 3 coastal areas of Cape Lesung obtained the farthest distance = 125.05 m and the Area of Abrasion = 106,966.98 m². Areas that have experienced Accretion Location 1 obtained the furthest distance = 31.65 m and area of Accretion = 9,943.14 m². In location 2 obtained the furthest distance = 111.58 m and wide of Accretion = 24,491.14 m². At location 3 got furthest distance = 68.71 m and wide of Accretion = 65,841.54 m²

Based on the calculation of the slope measurement and the length of the transverse incision, at 3 selected locations experiencing abrasion and accretion, measured on the image of GDEM Aster, the results obtained from the measurement in the research area located in the affected area of Abrasion at Location 1 Slope = 2.6°, length of cross section = 1662 feet = 506.57 meters, Location 2 Slope = 3.3°, length of cross section = 1.639 feet = 499.56 meters, in Location 3 Slope = 2.0°, transverse incision = 1844 feet = 562.05 meters,

Affected Area at Location 1 Slope = 3.1°, length of cross section = 1,006 feet = 306.62 meters, in Location 2: Slope = 3.1°, transverse incision = 1,231 feet = 375.20 meters, Location 3 Slope = 1.4°, length Cross section = 1.150 feet = 350.52 meters

The abrasion process occurs because the wind that blows in the west season (November - February) produces large waves, resulting in sediment along the coast affected by abrasion. As for the accretion process is likely to occur when the wind is blowing in the east wind season (March - October).

The occurrence of abrasion in some places in the study area because the lithology of the compilers is dominated by claystone. Slope is relatively steep, changes in wind direction, season and rainfall that can cause damage to the beach due to the large sea waves and sand mining activities.

The cause of accretion in the research area because this area has a relatively flat slope, and the presence of sediment transport from the surrounding river flow, lithology dominated by hard rock, at some point there are still areas of cliffs and reefs in coastal beaches. Much of the dumping is done on the coast to be a building that makes the beach forward and stable.

4. Conclusion
Abrasion is caused by the lithologic factor of the constituent dominated by claystone. Slope is relatively steep, changes in wind direction, seasons and rainfall sea waves and human activities in the form of sand mining. The accretion is caused by the lithologic factor of its constituent dominated by hard rock, the beach has a relatively flat slope and the sediment carrying capacity of the surrounding river flow and the backfill activity for the building. Aster Images GDEM images can calculate slopes in areas affected by abrasion, ie a steeper slope (2.0° - 3.3°) and the accretion area has a relatively flat slope (1.4° - 3.1°).

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