

PEMANFAATAN INFORMASI METEOROLOGI-OSEANOGRAFI UNTUK MITIGASI BANJIR ROB (PASANG SURUT)

FAJAR SETIAWAN

Analisis & Prakirawan Meteorologi Maritim Tanjung Perak Surabaya

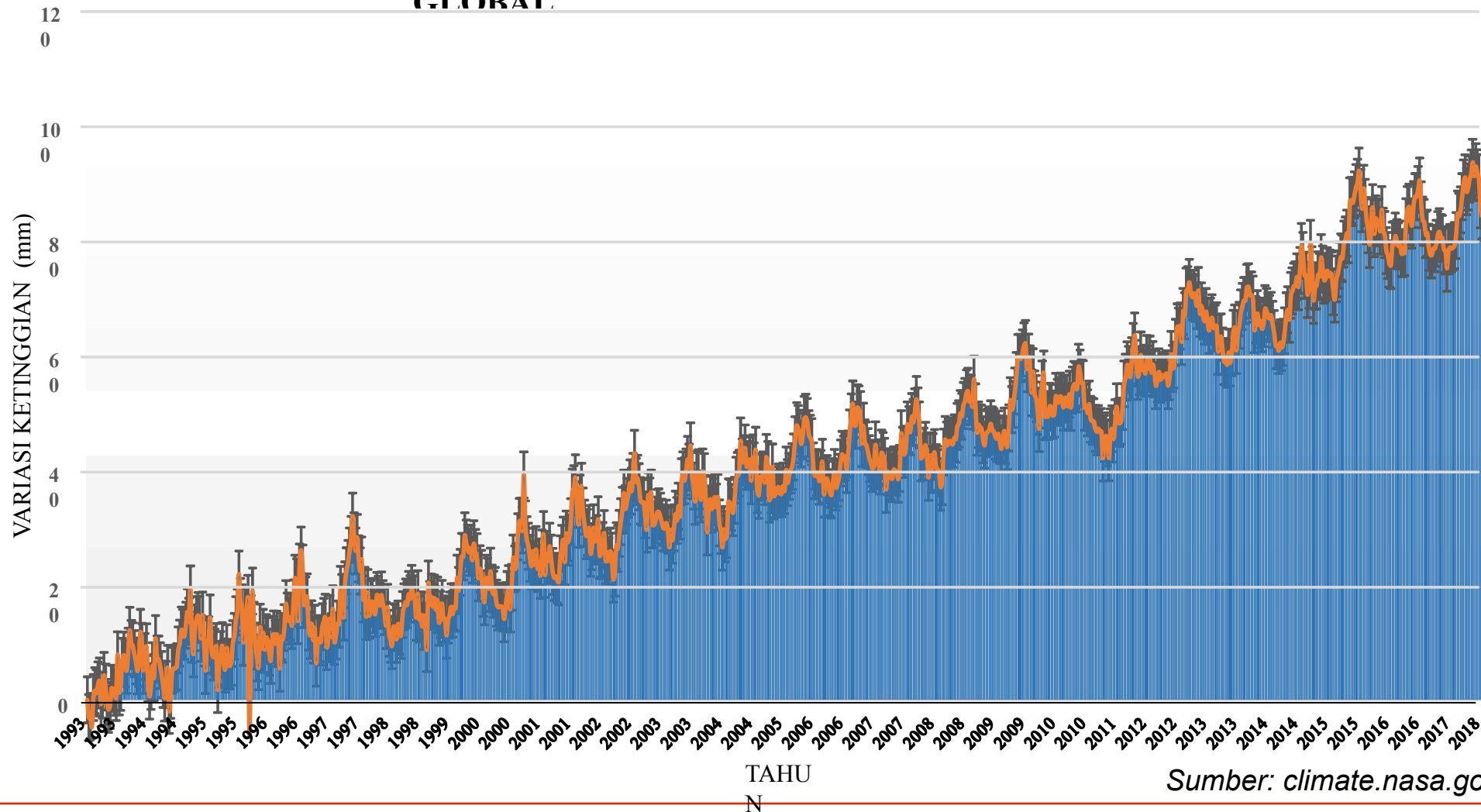


SURABAYA, 18 JUNI 2022

BMKG MARITIM TANJUNG PERAK SURABAYA

PERUBAHAN TINGGI MUKA AIR LAUT

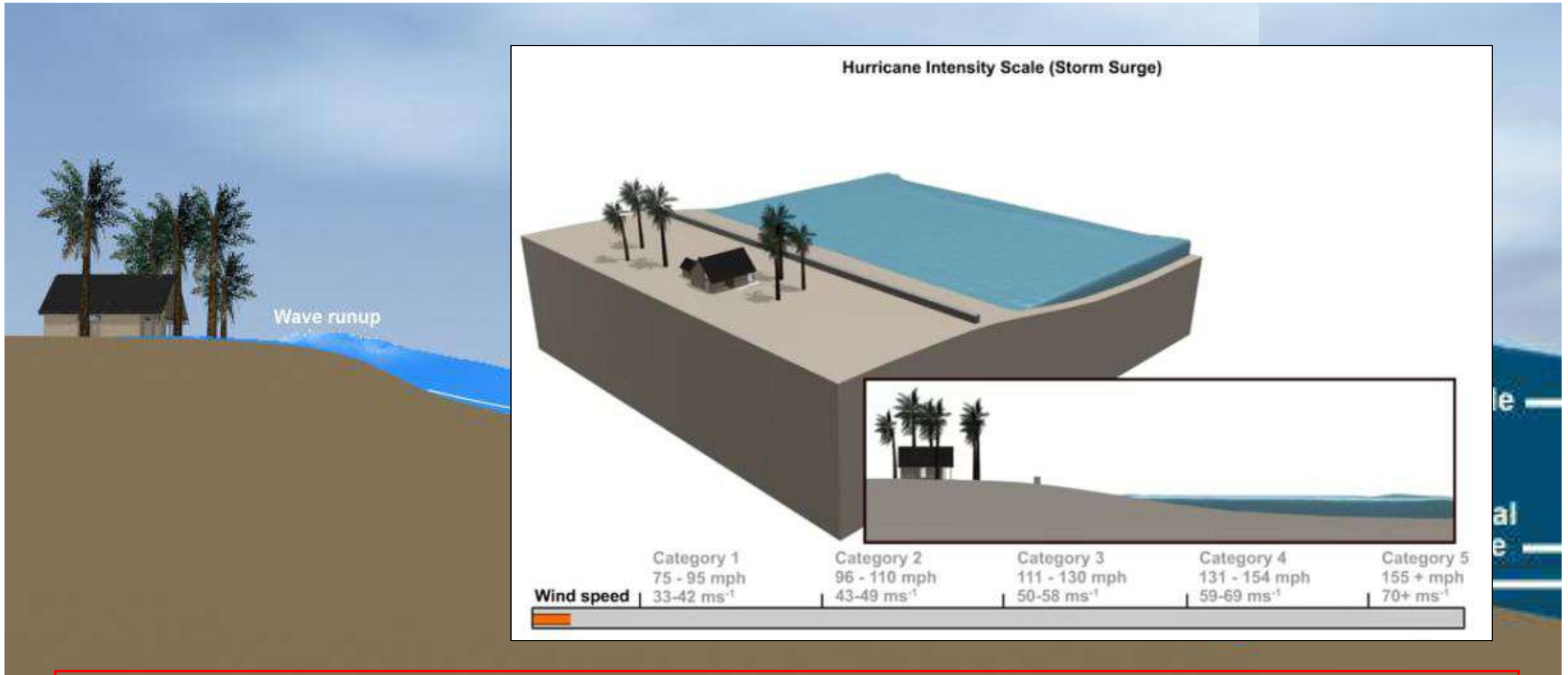
KENAIKAN MUKA AIR LAUT SECARA GLOBAL



Kenaikan sejak 1993:

100.8 mm (update 2022)

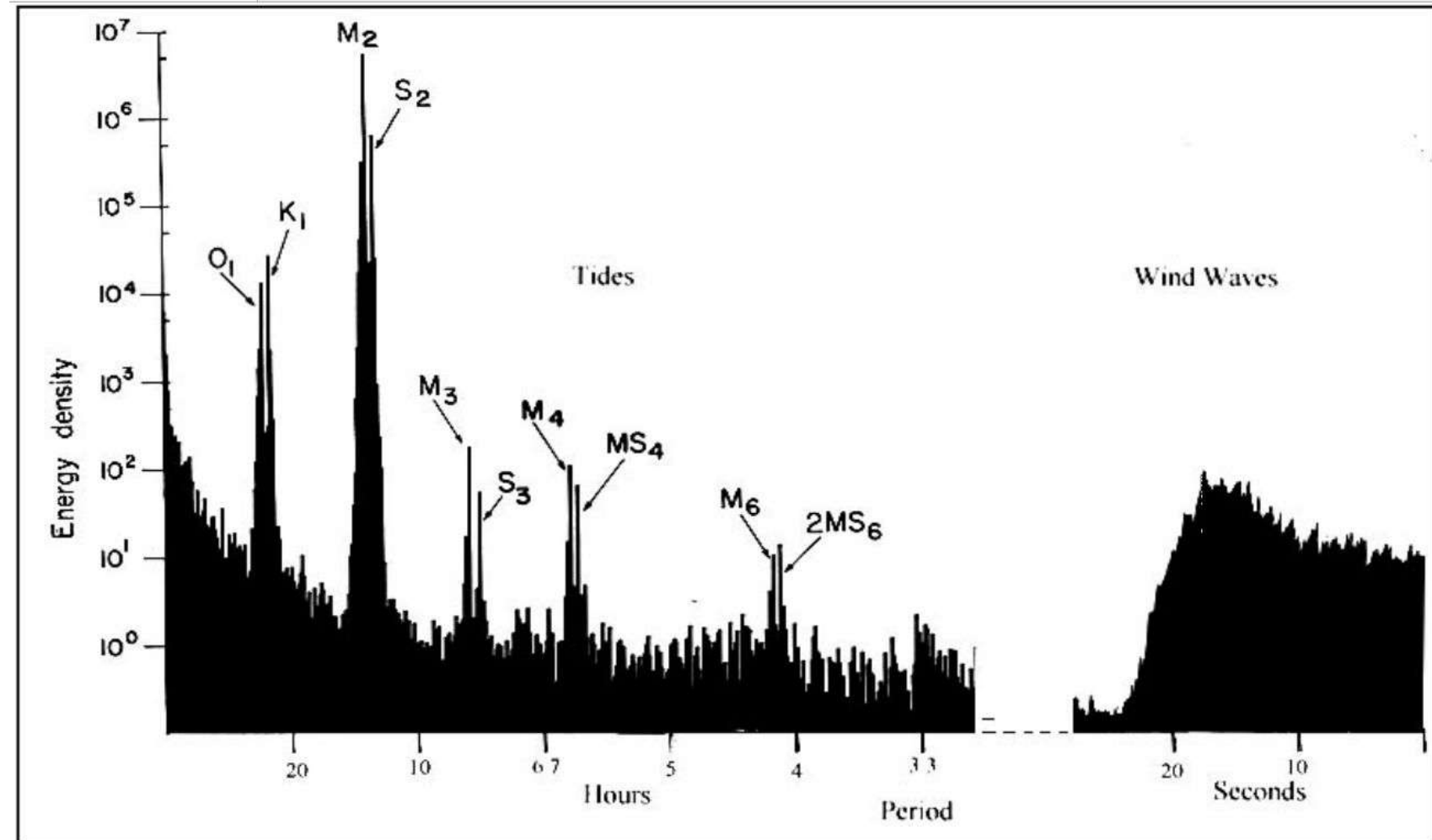
BANJIR ROB (BANJIR PASANG)



TOTAL WATER LEVEL RISE = STORM SURGE + TIDES + WAVE SETUP + FRESH WATER

VARIASI MUKA LAUT PASANG SURUT

- Variasi muka laut disebabkan oleh berbagai sumber yang biasanya dibedakan berdasarkan periodenya

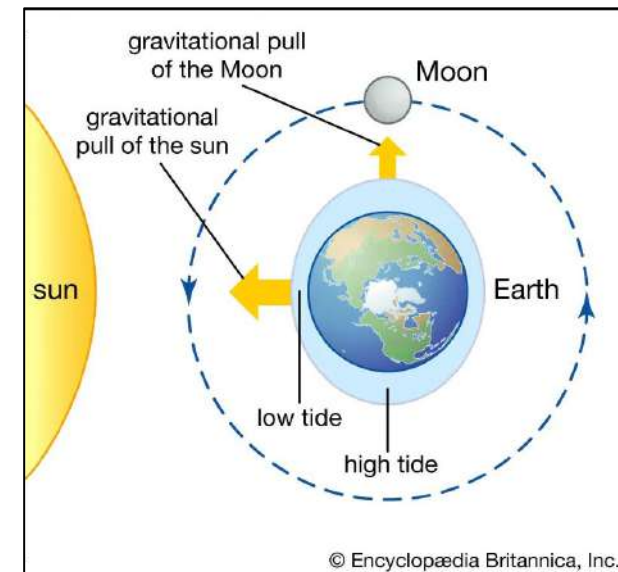
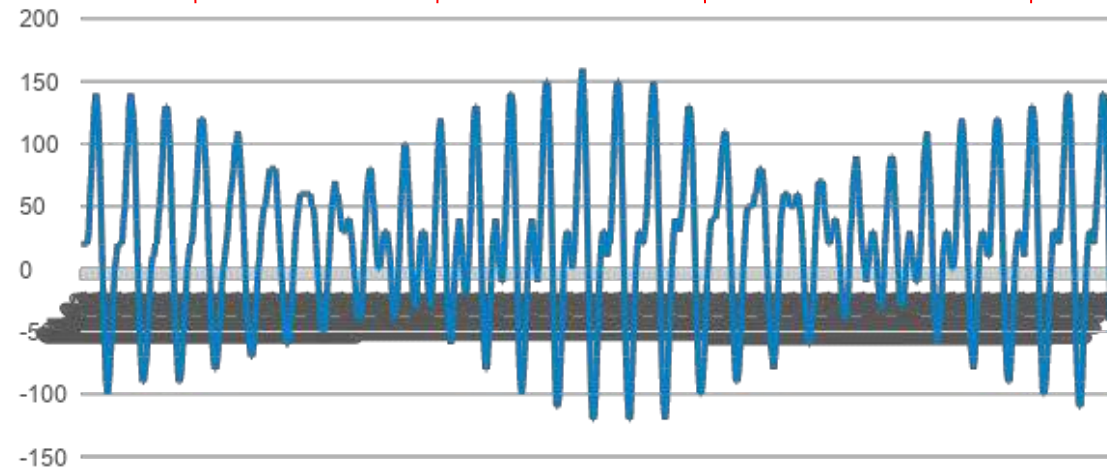
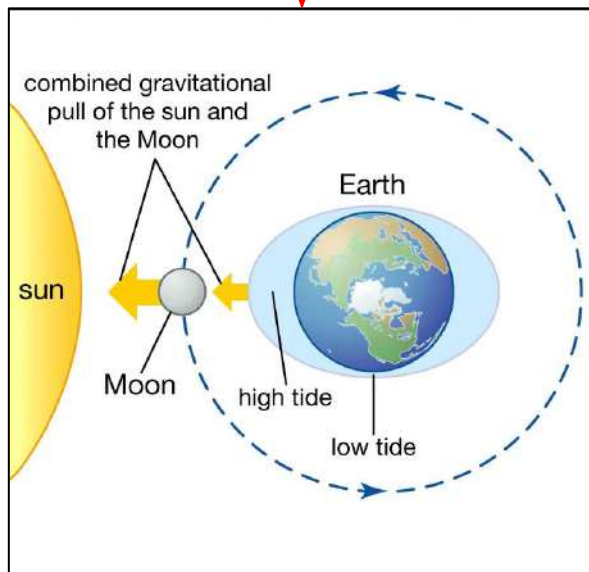


PASANG SURUT ASTRONOMI (Astronomical Tides)

Faktor:

- Rotasi Bumi
- Gravitasi (Bumi, Bulan, Matahari)
- ~~Kondisi Atmosfir (Meteorologi)~~

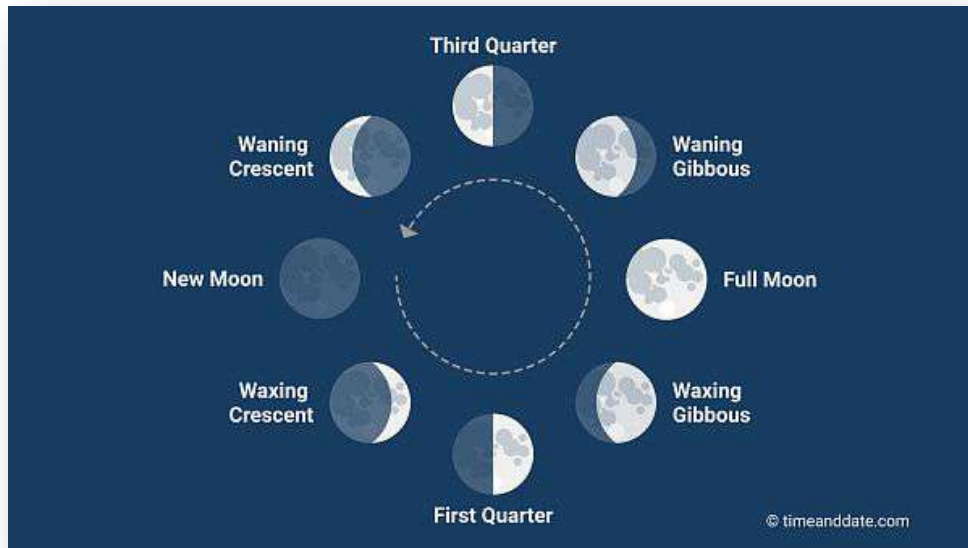
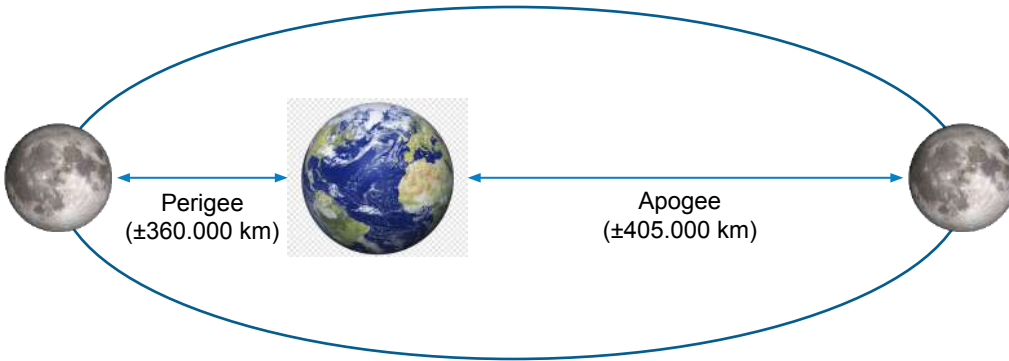
Spring Tides



Neap Tides

PASANG SURUT ASTRONOMI (Astronomical Tides)

Orbit & Fase Bulan:



2022 Moon Phases Calendar

Jan	3:●, 10:○, 18:○, 25:○
Feb	1:●, 8:○, 16:○, 24:○
Mar	3:●, 10:○, 18:○, 25:○
Apr	1:●, 9:○, 17:○, 23:○
May	1:●, 9:○, 16:○, 23:○, 30:●
Jun	7:○, 14:○, 21:○, 29:●
Jul	7:○, 14:○, 20:○, 29:●
Aug	5:○, 12:○, 19:○, 27:●
Sep	4:○, 10:○, 18:○, 26:●
Oct	3:○, 10:○, 18:○, 25:●
Nov	1:○, 8:○, 16:○, 24:●, 30:○
Dec	8:○, 16:○, 23:●, 30:○

• SUPER MOON:

- BULAN PURNAMA atau BULAN BARU;
- PERIGEE
- Kejadian:
14 Juni 2022;
14 Juli 2022;
23 Desember 2022

• MICRO MOON:

- BULAN PURNAMA atau BULAN BARU;
- APOGEE
- Kejadian:
29 Juni 2022

PREDIKSI PASANG SURUT ASTRONOMI (*Astronomical Tides*)

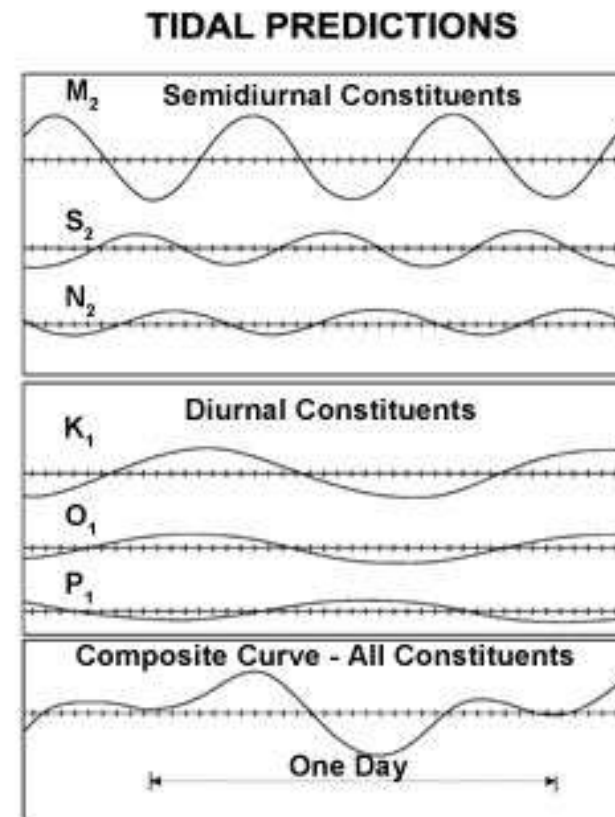
- **Admiralty:**
PUSHIDROS-AL

- **Least Square Method:**

$$\mu(t) = Z_0 + \sum_{K=1}^K A_K \cos(\omega_K t + \theta_K)$$

Dimana:

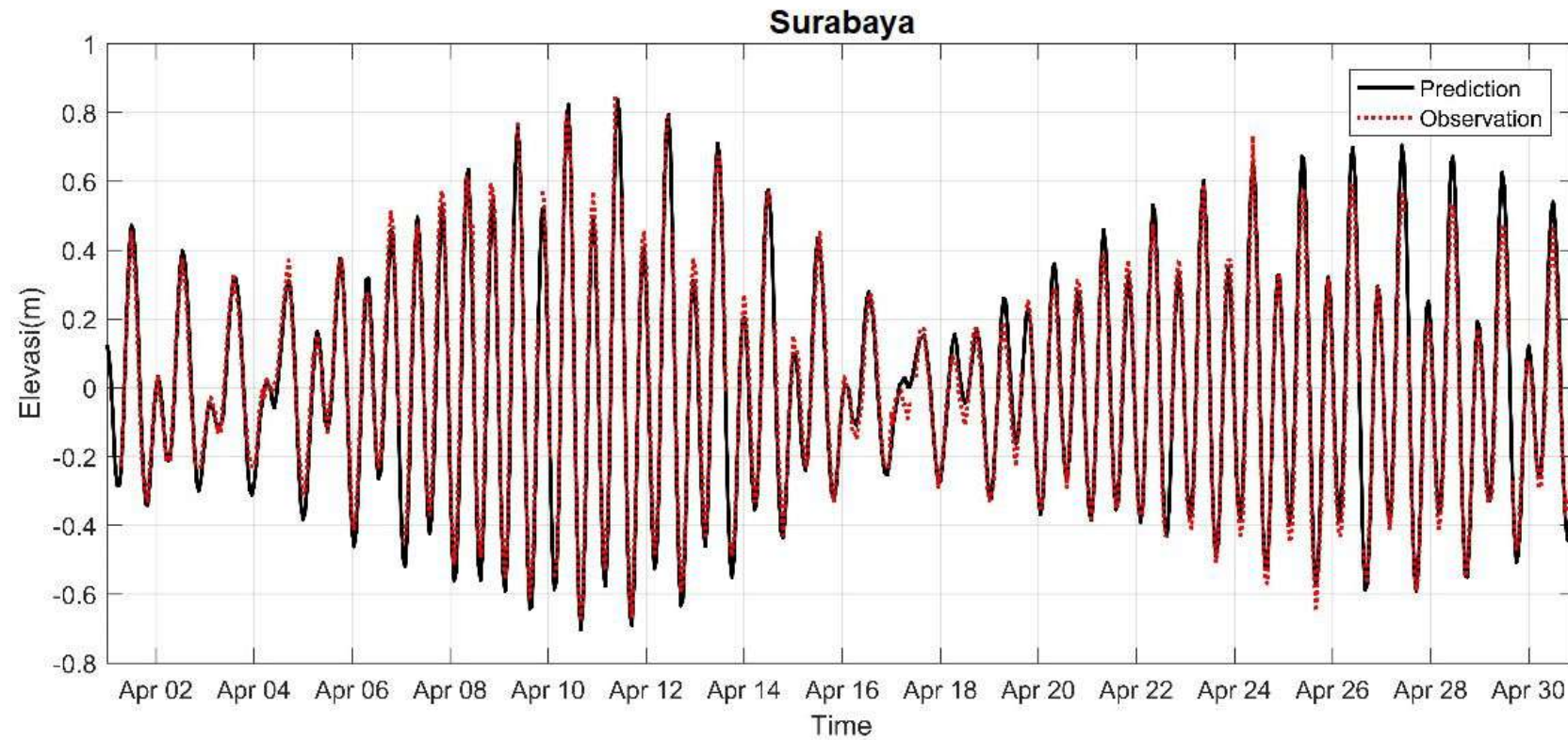
- $\mu(t)$: tinggi muka air laut di waktu ke-t
- Z_0 : tinggi muka air rata-rata (MSL)
- A_K : Amplitudo komponen ke-k
- ω_K : Kecepatan sudut komponen ke-k
- t : waktu
- θ : Beda fase komponen ke-k
- K : Komponen harmonik pasang surut



AKURASI PREDIKSI PASANG SURUT ASTRONOMI (*Astronomical Tides*)



Case Study (Prediction):
APRIL 2022



Korelasi:
98.83%

Mean Relative Error (MRE):
1.76%

Akurasi:
98.24%

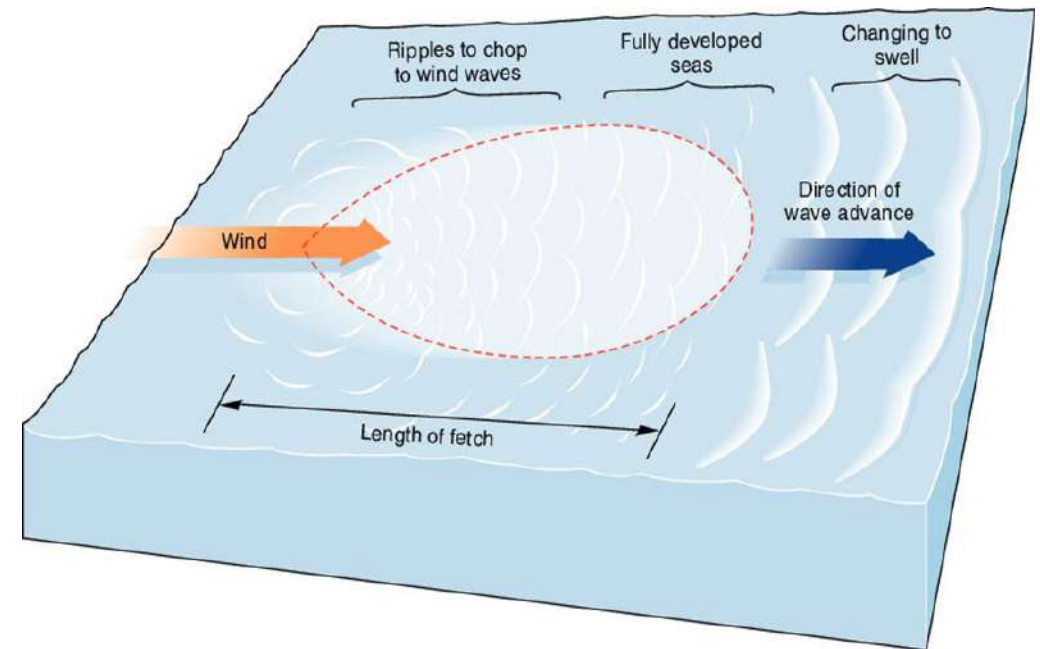
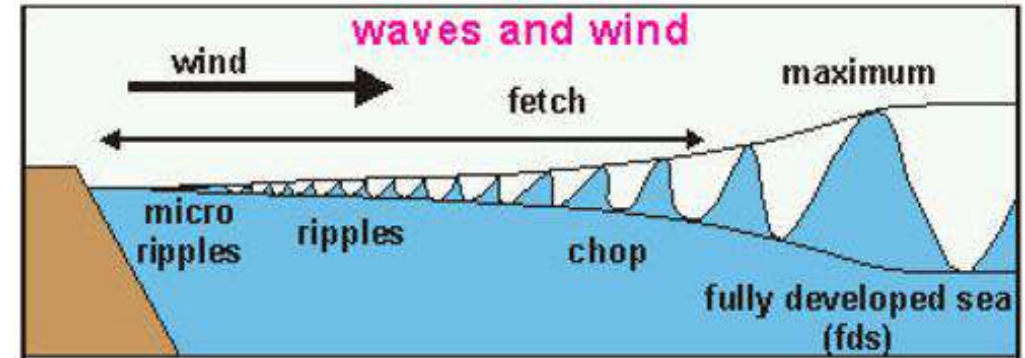
PASANG SURUT METEOROLOGI (Meteorological Tides)

Kondisi Atmosfir:

- Angin (Gelombang)

WIND WAVES GENERATOR

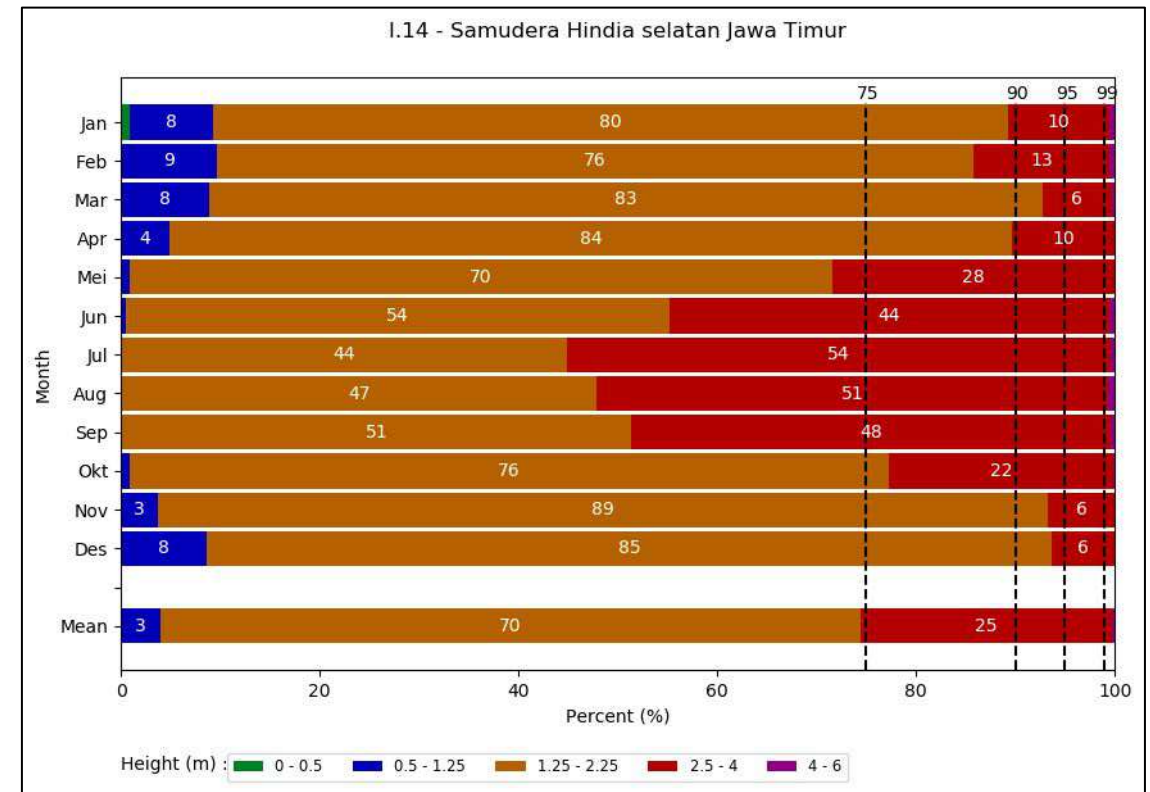
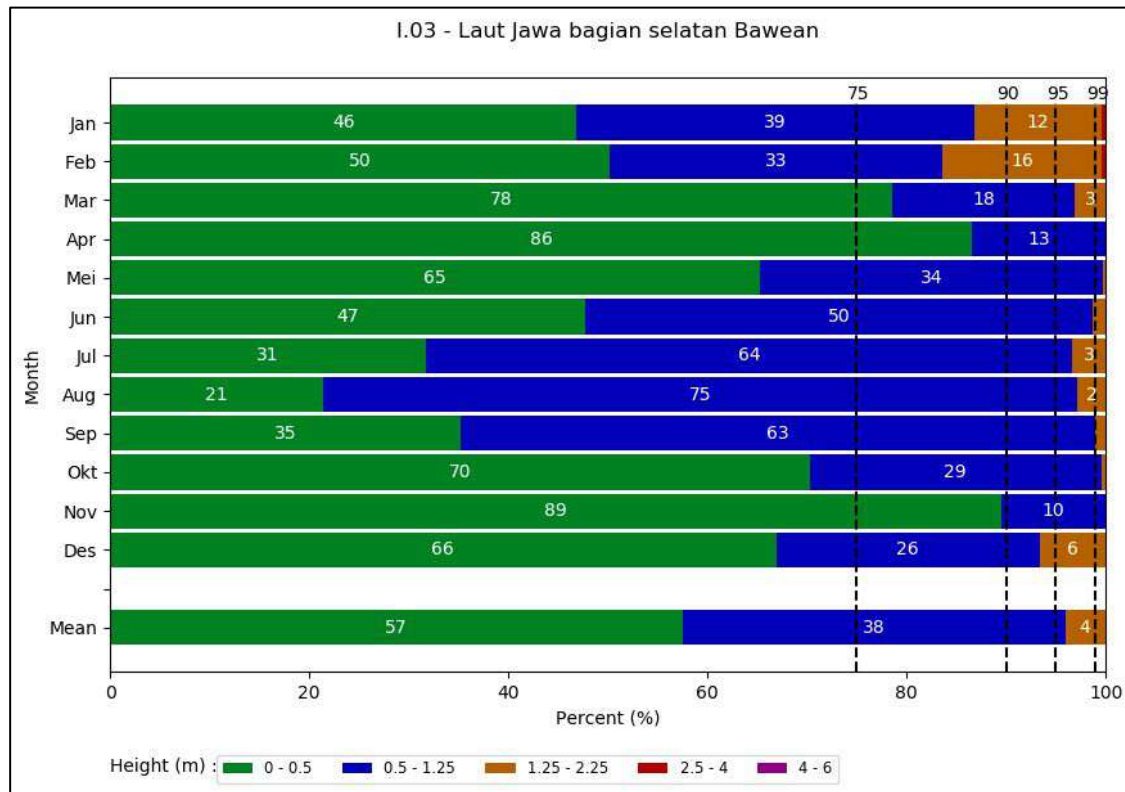
- Wind Speed;
- Wind Blowing Duration;
- Length of *Fetch*;
- Depth of sea (on shallow water, $d/l \leq 0.05$)
 - Refraction
 - Diffraction
 - Shoaling
 - Wave breaking



PASANG SURUT METEOROLOGI (Meteorological Tides)

Kondisi Atmosfir:

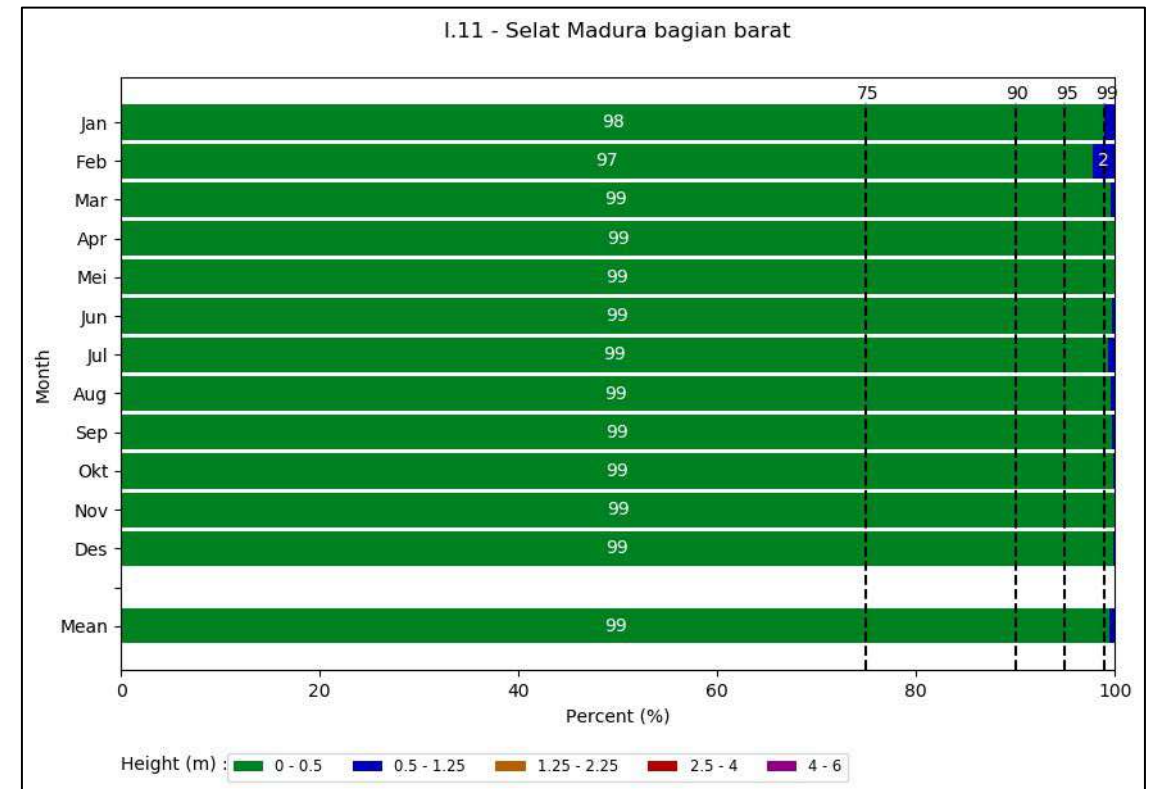
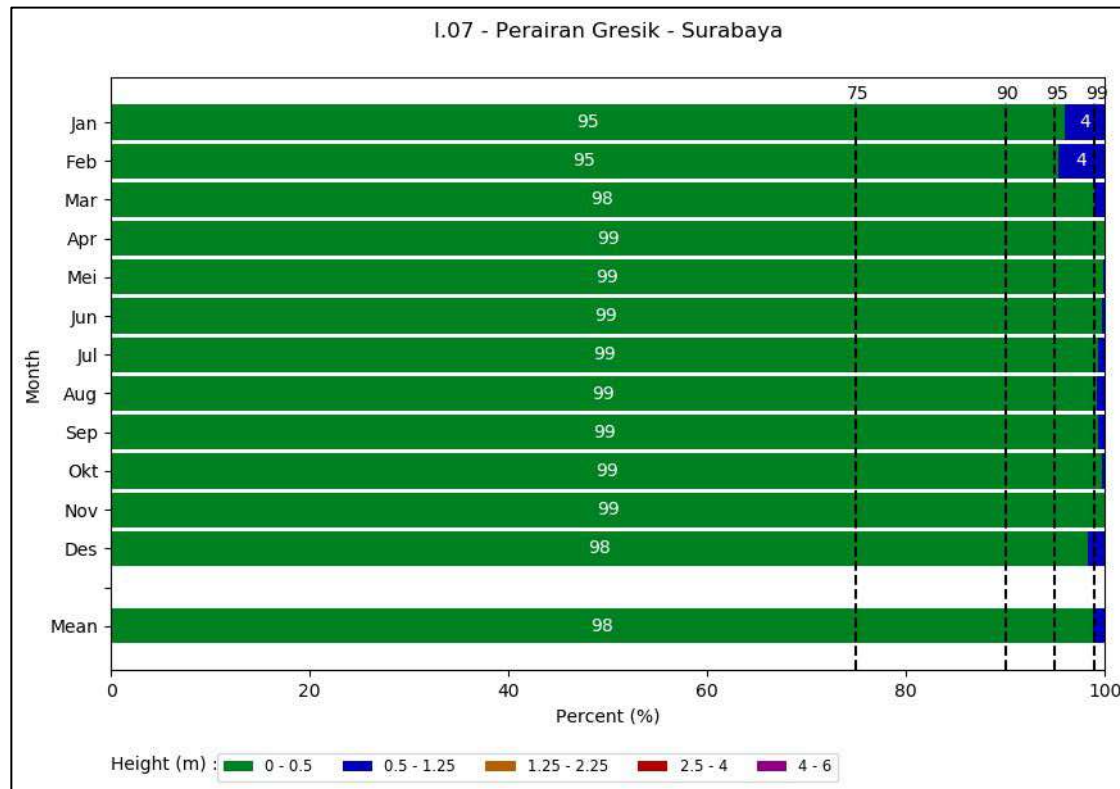
- Angin (Gelombang)



PASANG SURUT METEOROLOGI (Meteorological Tides)

Kondisi Atmosfir:

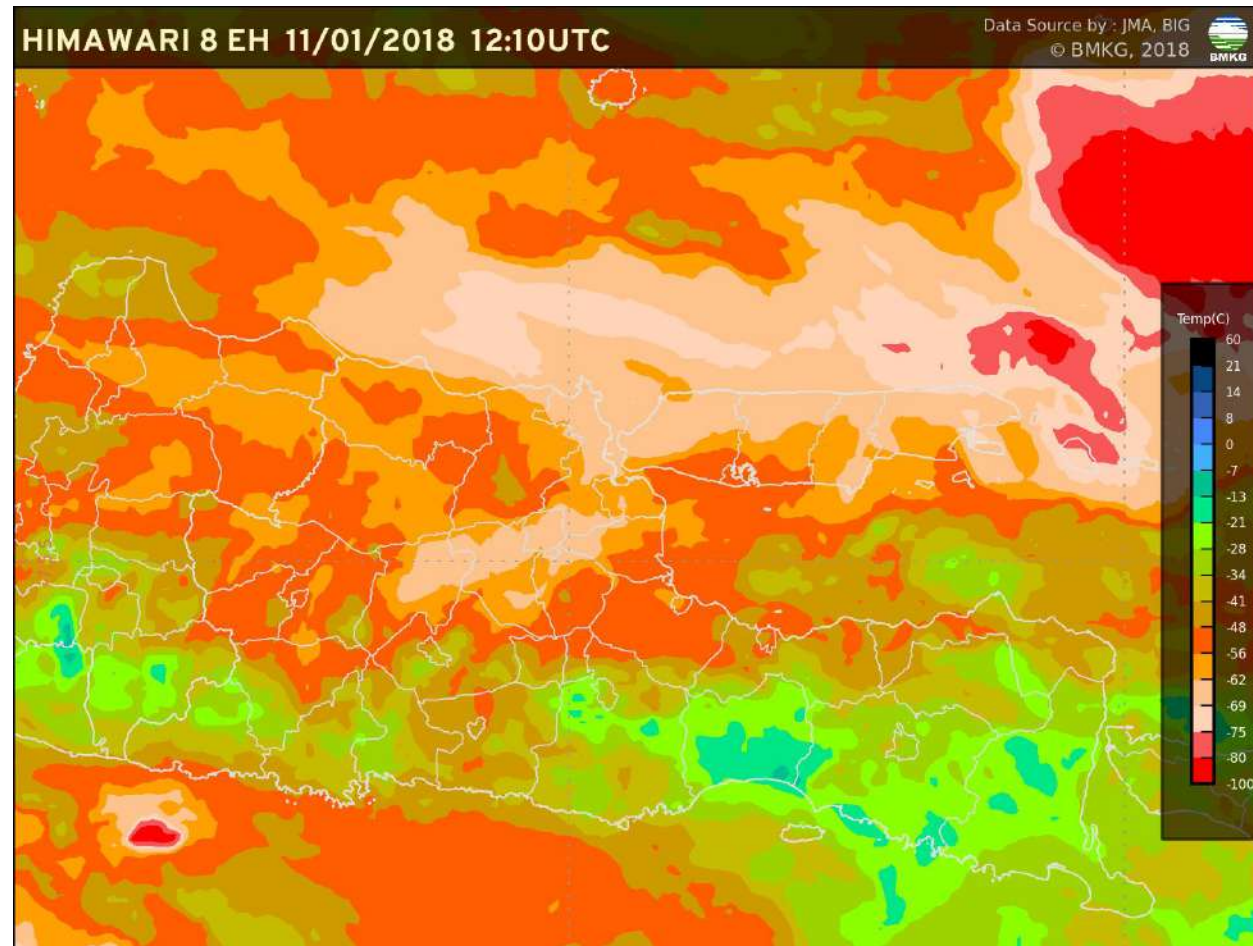
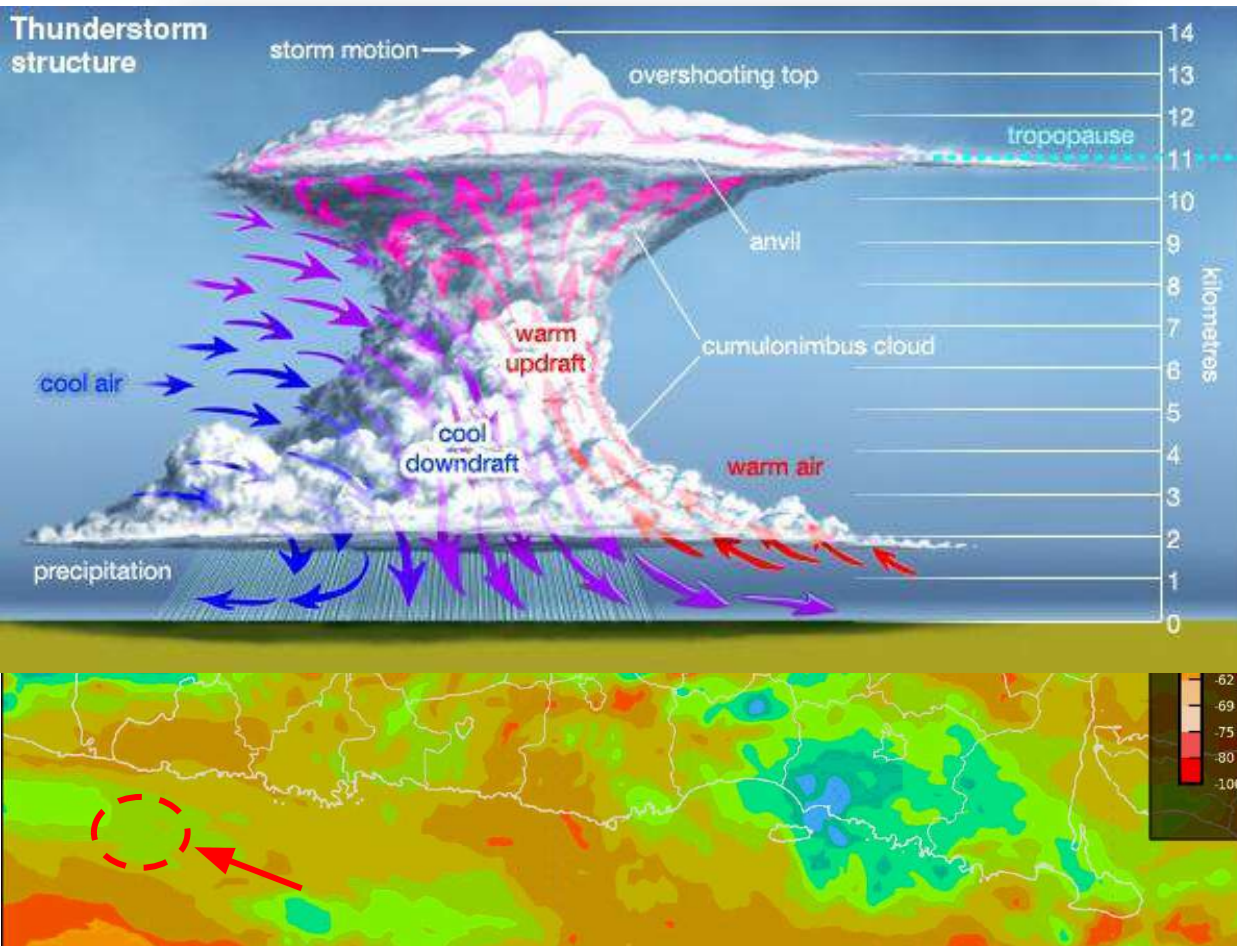
- Angin (Gelombang)



PASANG SURUT METEOROLOGI (*Meteorological Tides*)

Kondisi Atmosfir:

- *Local Disturbance (Extreme Weather)*



PASANG SURUT METEOROLOGI (*Meteorological Tides*)

Kondisi Atmosfir:

- Hujan (Penambahan debit air)

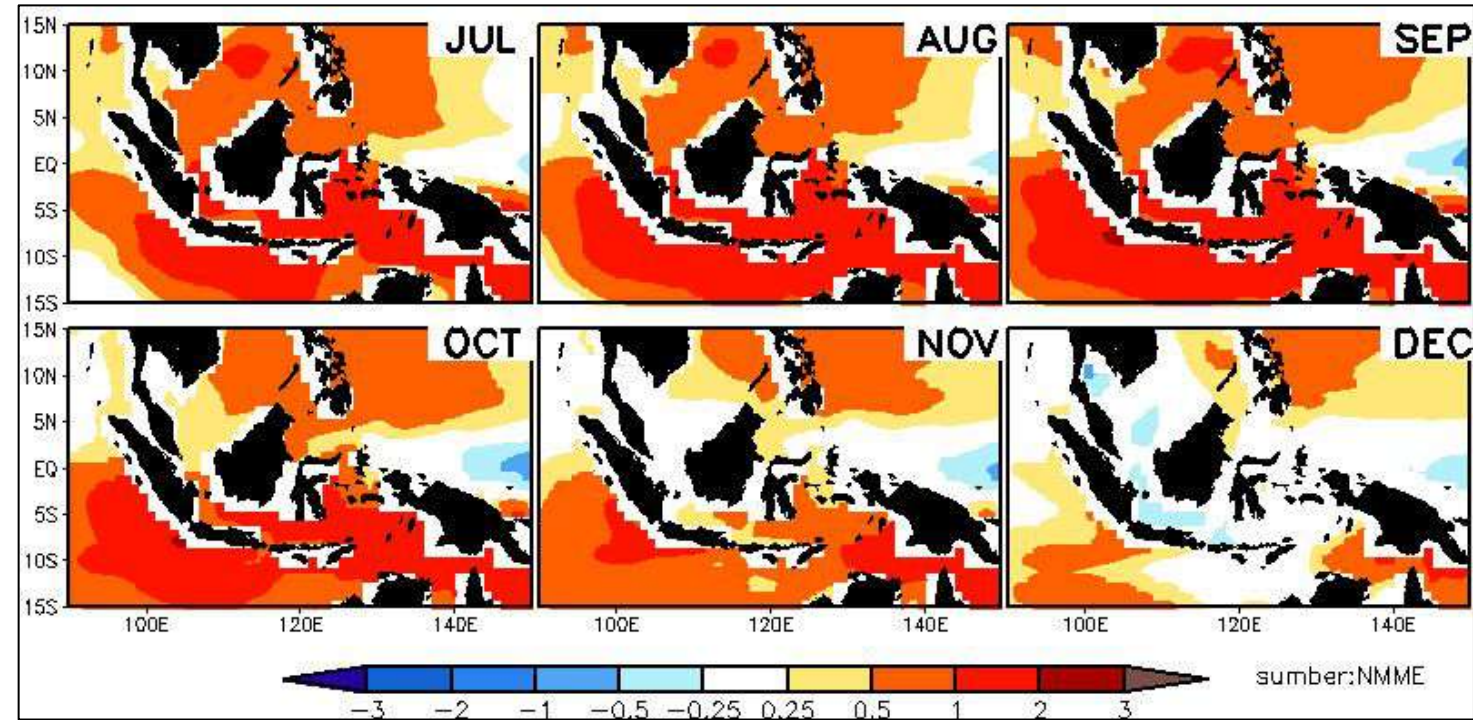
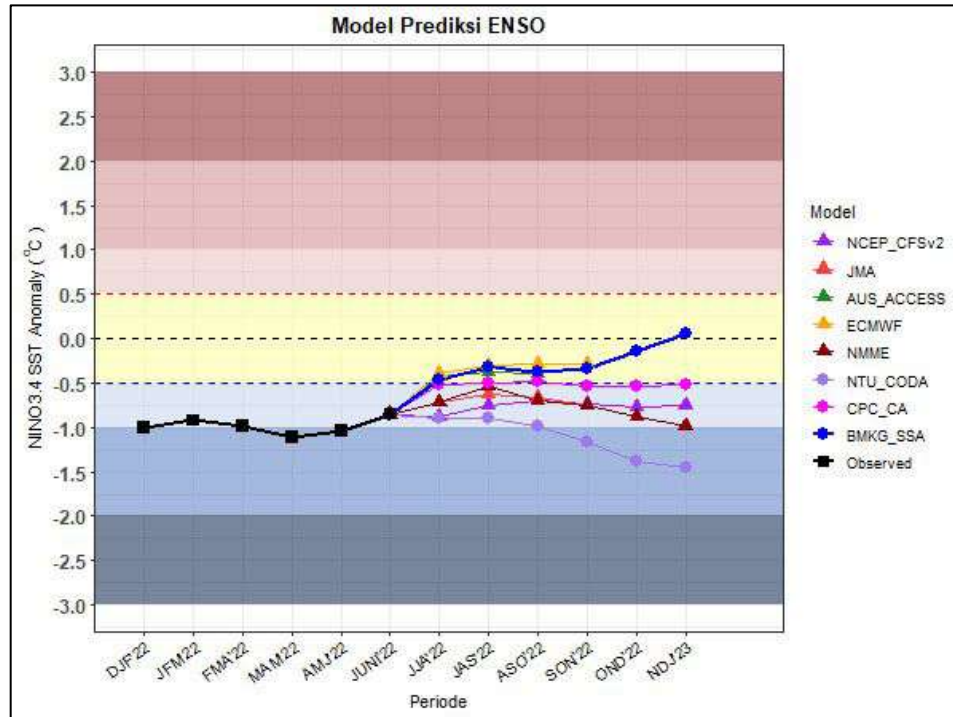


- Hujan dapat meningkatkan debit air sungai yang mengalir menuju laut;
- Posisi Pasang menghalangi aliran sungai menuju ke laut;
- Banjir dapat terjadi jika peningkatan debit air sungai menyertai pasang air laut.

PASANG SURUT METEOROLOGI (Meteorological Tides)

Kondisi Atmosfir:

- Hujan (Penambahan debit air)



- La Nina dan Anomali SST Perairan Indonesia $+1.0^{\circ}\text{C}$ s/d $+3.0^{\circ}\text{C}$ akan menyebabkan potensi hujan lebih besar di pertengahan tahun (BMKG Juanda)



TERIMA KASIH

FAJAR SETIAWAN

Analisis & Prakirawan Meteorologi Maritim Tanjung Perak Surabaya

