Joining Land and Sea: The Indonesian Digital Elevation Model

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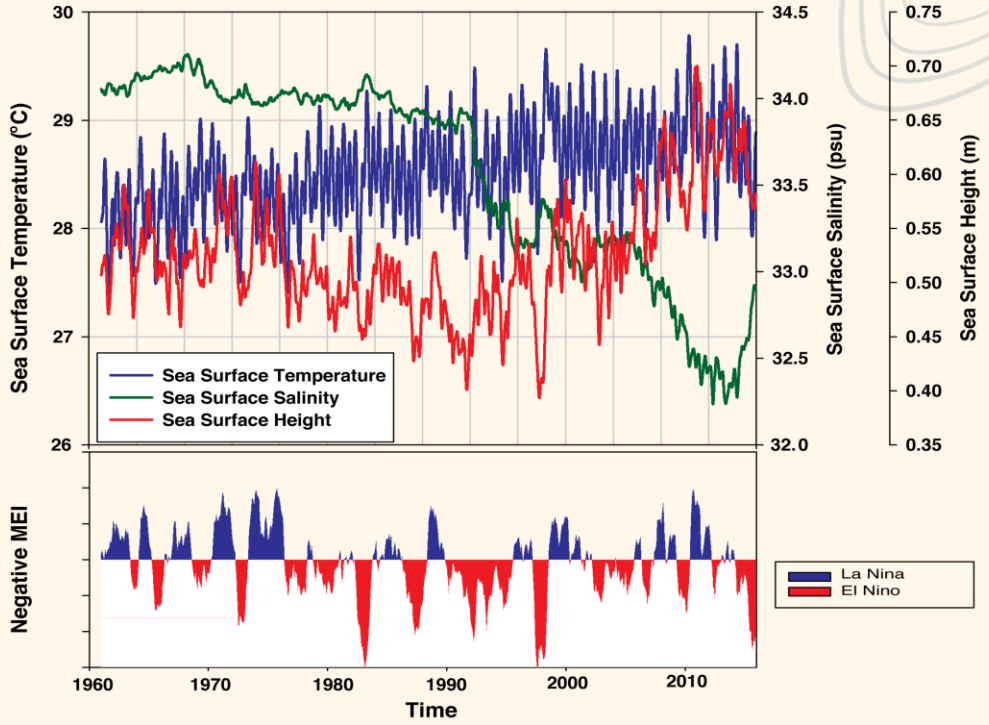
Introduction

Global Warming, Climate Change and Sea Level Rise

- The Intergovernmental Panel on Climate Change (IPCC) concluded that the warming of the climate system is unequivocal.
- IPCC also concluded that increasing in anthropogenic Green House Gasses (GHG) is very likely causes increasing of global temperature.
- Various observation data showed increasing in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level during the 20th century.
- The warming temperature affects on many natural systems at all continents and most oceans.

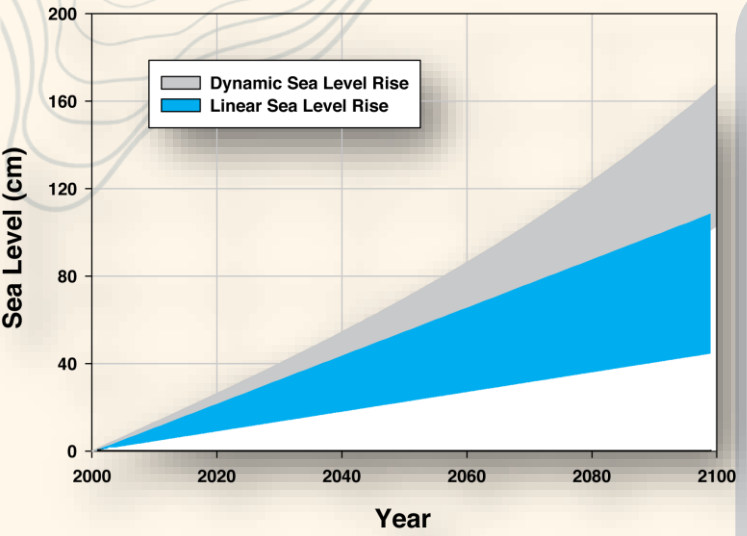


(Sofian, TNC 2015)

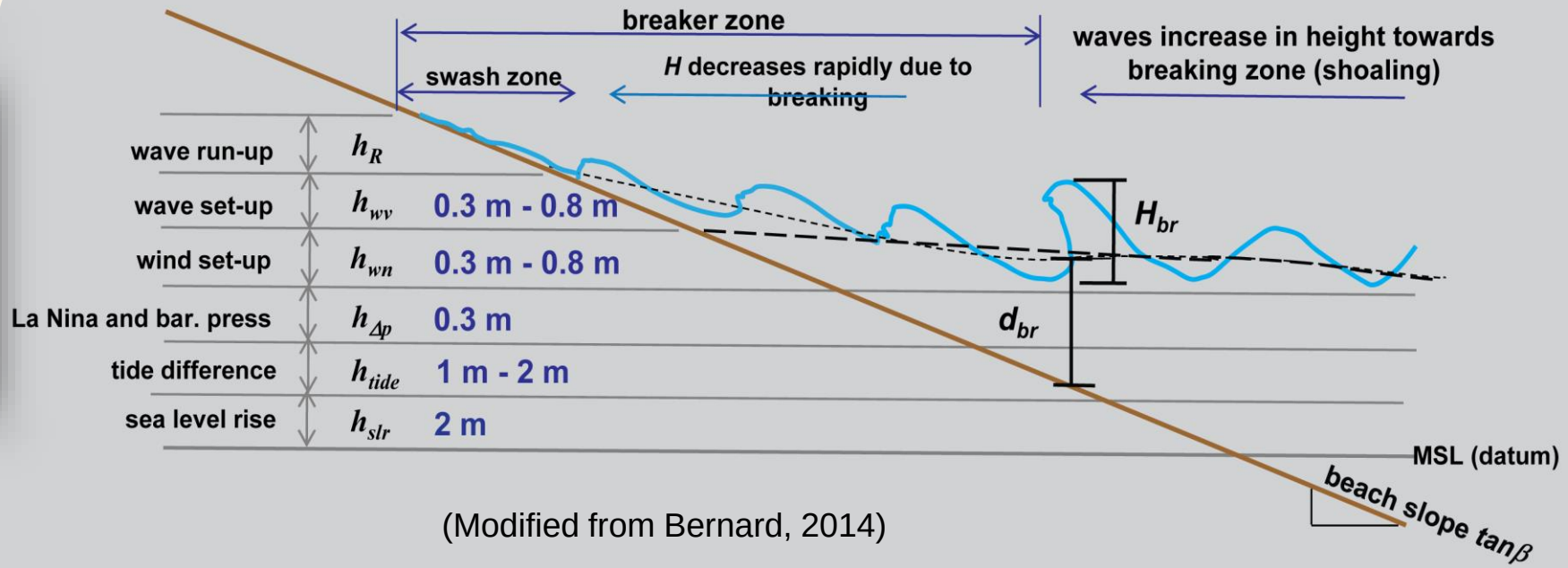




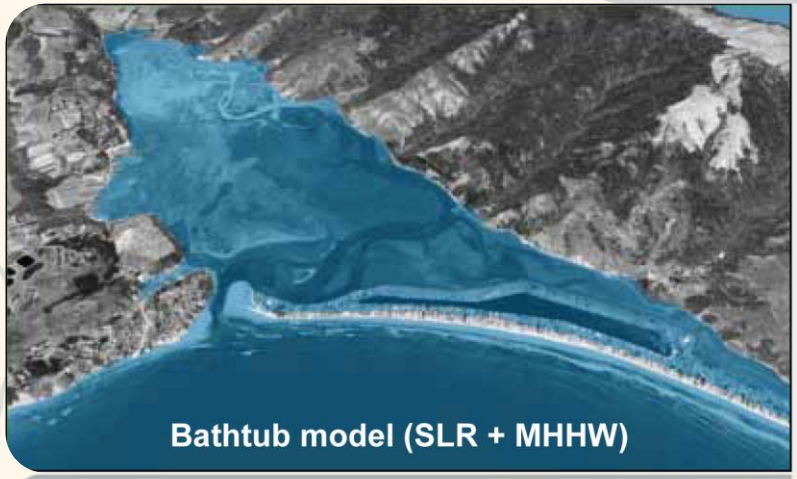
Component of Total Water Level Prediction

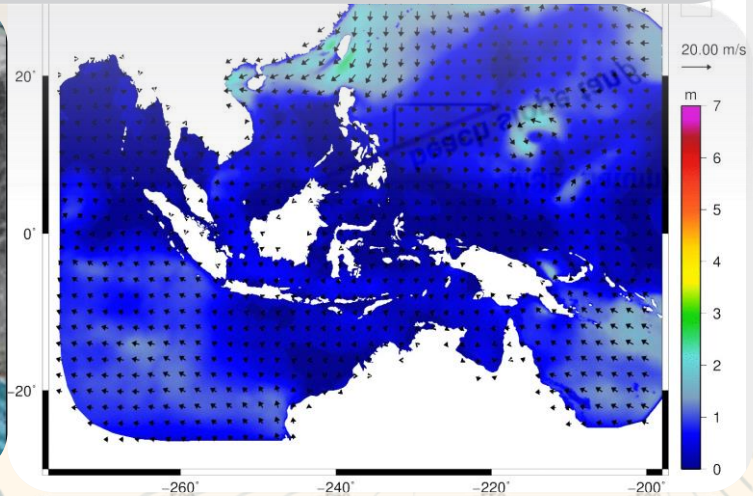


Sea level rise projection in Indonesia



(Modified from Bernard, 2014)

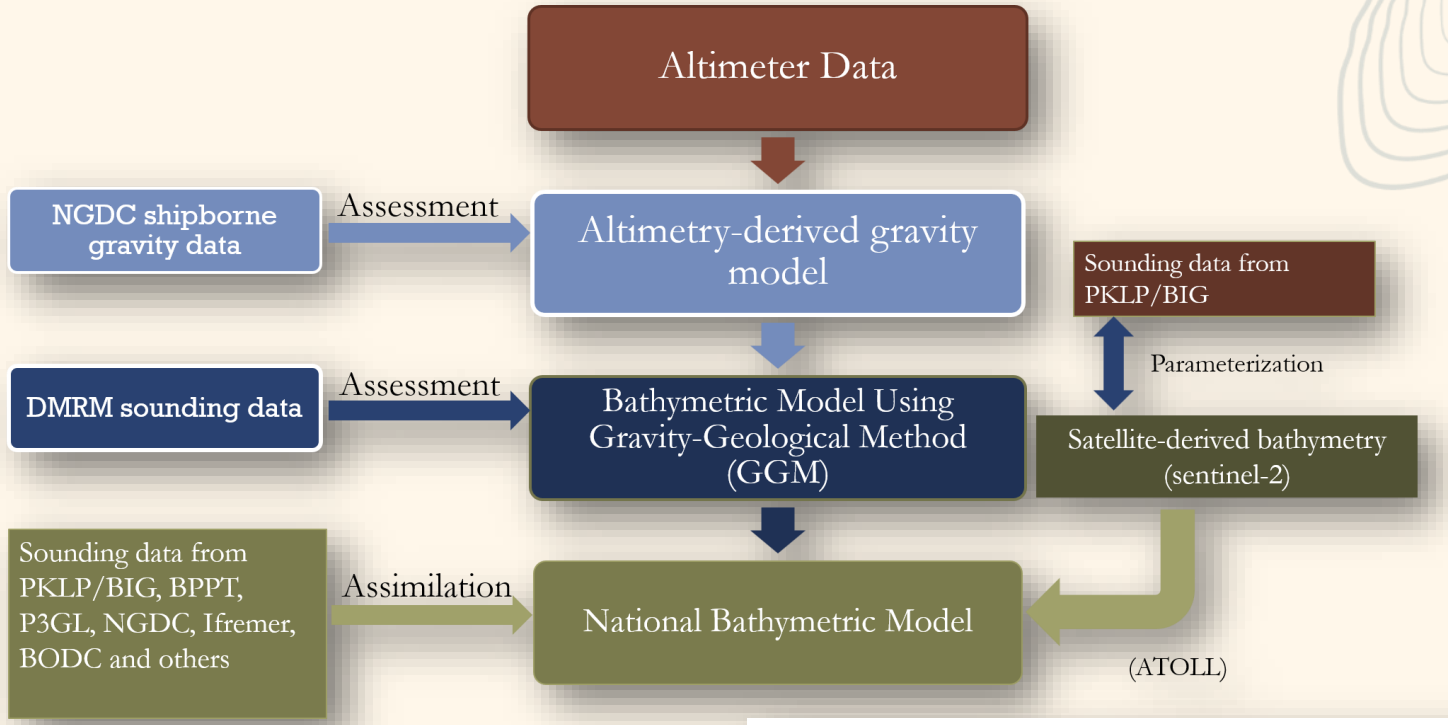


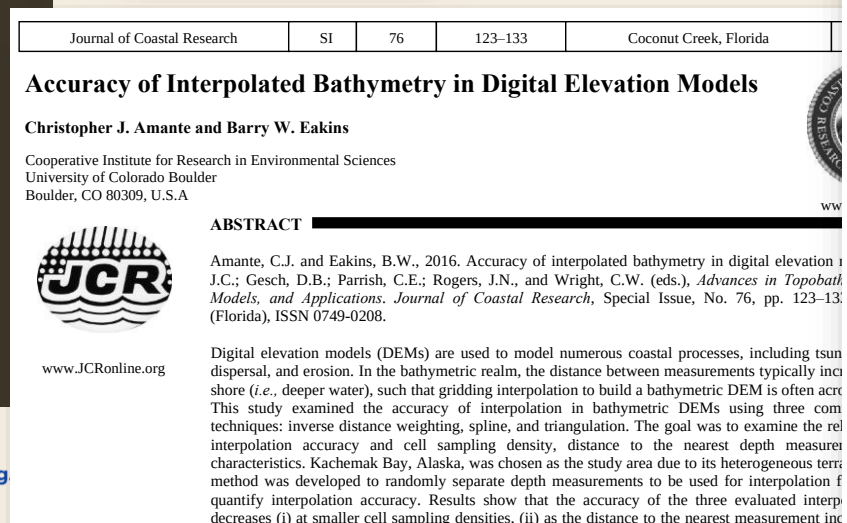


National Bathymetric Data

Application of Bathymetric Data

- Reconnaissance for submarine cable and pipeline routes.
- Application for numerous modeling including tidal, ocean circulation, tsunami hazard, coastal flood and ocean biogeochemical process.
- Improving the model accuracy of hazard forecasting models.
- Improving the marine gravity mapping.
- Assessing the potential territorial claims under the United Nations Convention on the Law of the Sea (UNCLOS)
- ....
- ....





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Accuracy of Interpolated Bathymetry in Digital Elevation Models

Christopher J. Amante and Barry W. Eakins

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ABSTRACT

Amante, C.J. and Eakins, B.W., 2016. Accuracy of interpolated bathymetry in digital elevation
J.C.; Gesch, D.B.; Parrish, C.E.; Rogers, J.N., and Wright, C.W. (eds.), *Advances in Topobath
Models, and Applications*. *Journal of Coastal Research*, Special Issue, No. 76, pp. 123–13
(Florida), ISSN 0749-0208.

Digital elevation models (DEMs) are used to model numerous coastal processes, including tsun
dispersal, and erosion. In the bathymetric realm, the distance between measurements typically inc
shore (*i.e.*, deeper water), such that gridding interpolation to build a bathymetric DEM is often acr
This study examined the accuracy of interpolation in bathymetric DEMs using three com
techniques: inverse distance weighting, spline, and triangulation. The goal was to examine the re
interpolation accuracy and cell sampling density, distance to the nearest depth measure
characteristics. Kachemak Bay, Alaska, was chosen as the study area due to its heterogeneous terra
method was developed to randomly separate depth measurements to be used for interpolation
quantify interpolation accuracy. Results show that the accuracy of the three evaluated interp
decreases (i) at smaller cell sampling densities, (ii) as the distance to the nearest measurement inc

Mar Geophys Res (2011) 32:493–501
DOI 10.1007/s11001-011-9141-1

ORIGINAL RESEARCH PAPER

Gridding heterogeneous bathymetric data sets with stacked continuous curvature splines in tension

Benjamin Hell · Martin Jakobsson

Received: 18 May 2011 / Accepted: 18 September 2011 / Published online: 19 October 2011

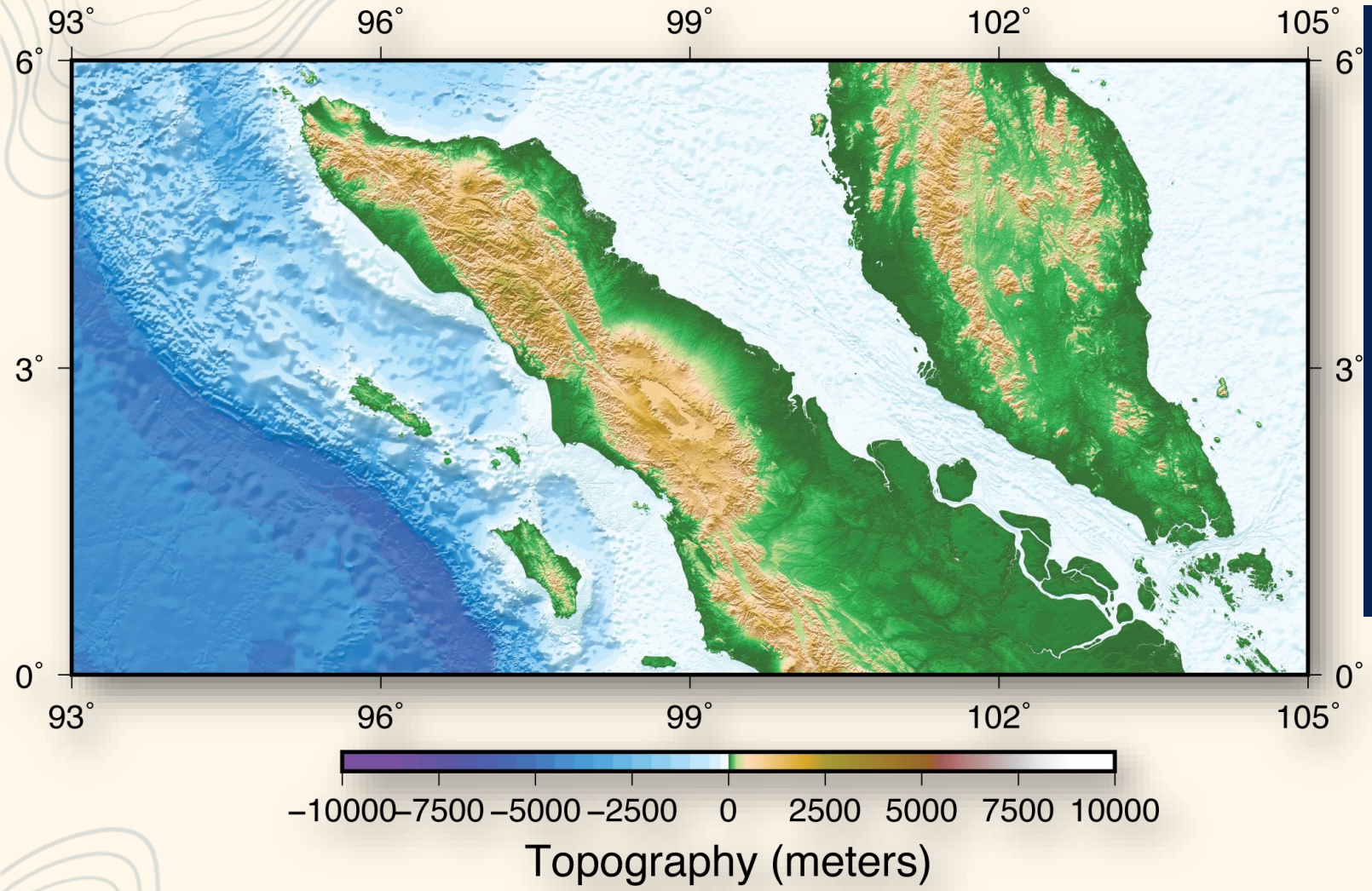
Abstract Gridding heterogeneous bathymetric data sets for the compilation of Digital bathymetric models (DBMs), poses specific problems when there are extreme variations in source data density. This requires gridding routines capable of subsampling high-resolution source data while preserving as much as possible of the small details, at the same time as interpolating in areas with sparse data without generating gridding artifacts. A frequently used gridding

Keywords Gridding · Interpolation · Digital bathymet
model · Seafloor topography · Bicubic splines in tension

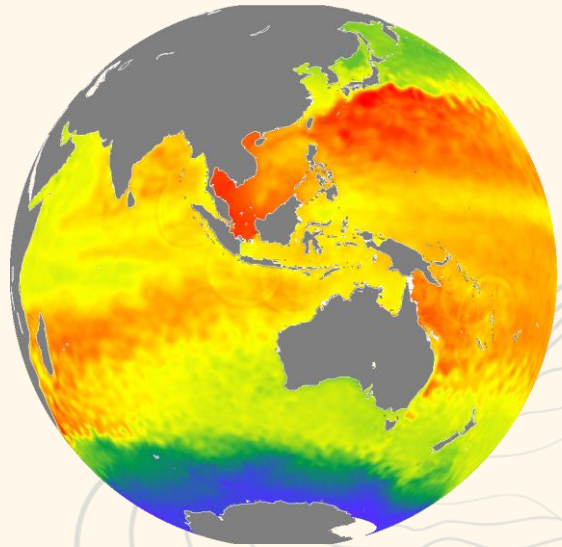
Introduction

Analysis and interpretation of geoscientific data rep
senting some property over a two-dimensional surface

National Bathymetric Data

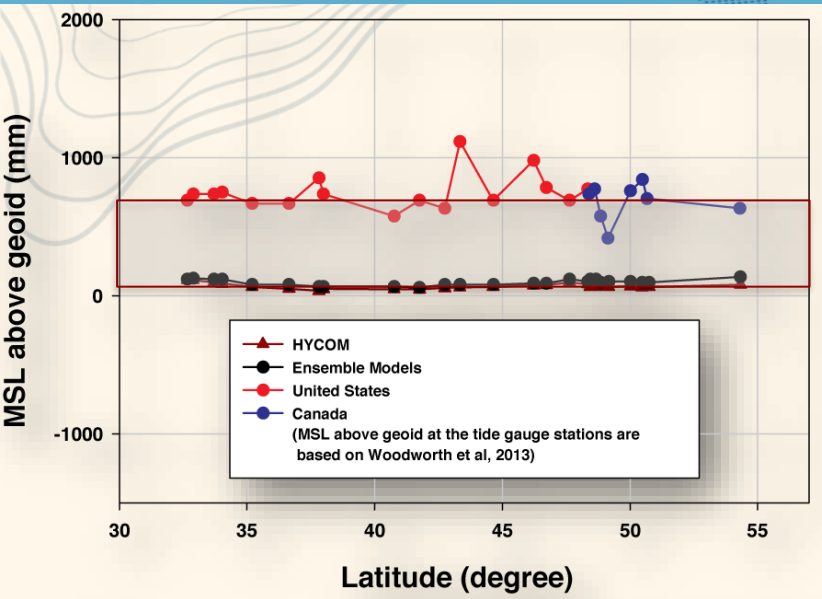


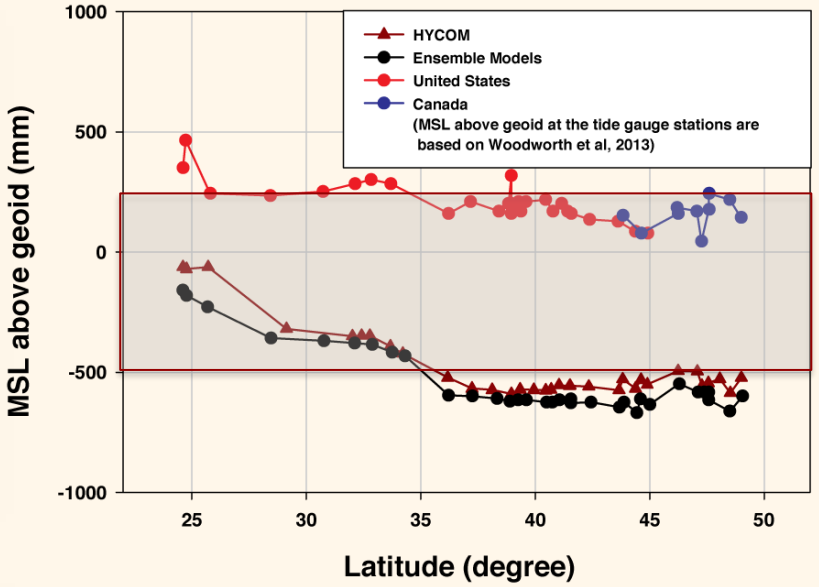
- 6arc-second resolution
- Assimilated with corrected near shore sounding data
- Model accuracy : 25m
- Vertical datum is referred to MSL
- MSL is calculated using the Hybrid Coordinate Ocean Model (HYCOM) from 1993 to 2016



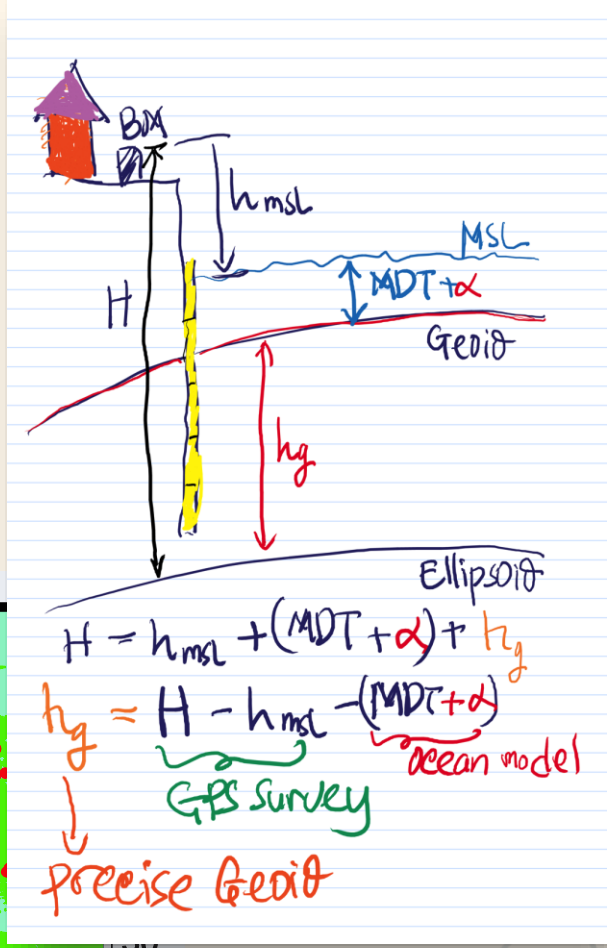
5arc-second resolutions (79°E - 161°E, 26°S - 26°N)
https://github.com/ibnusofian-sdb/INDB05S

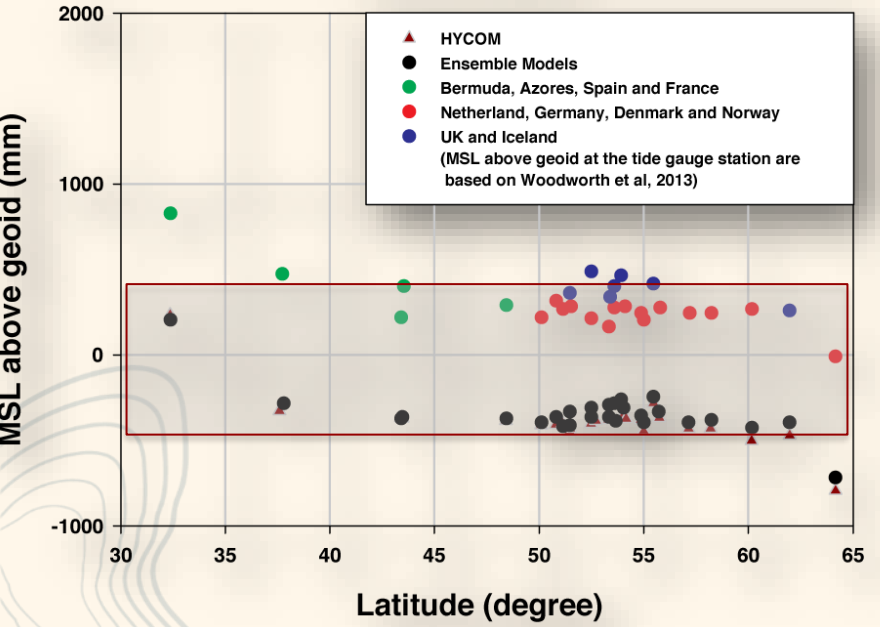
HYCOM Offset Corrections

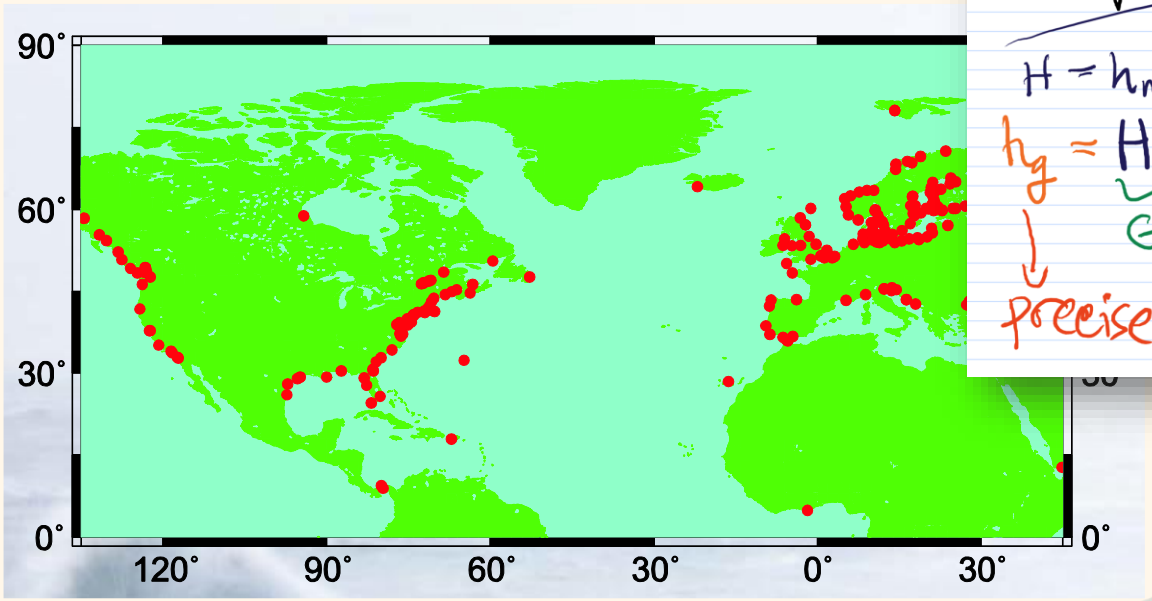




70CM offset



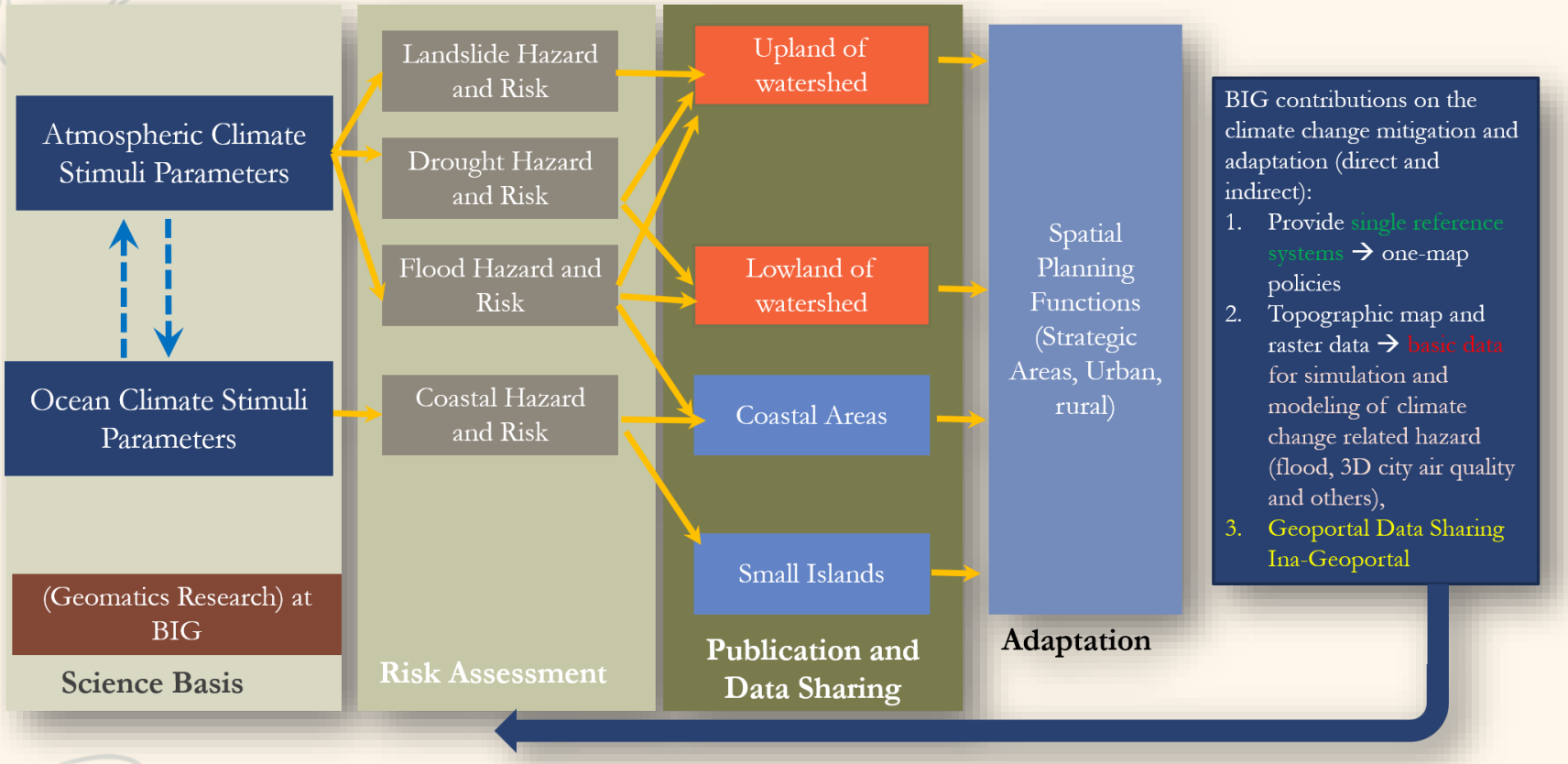




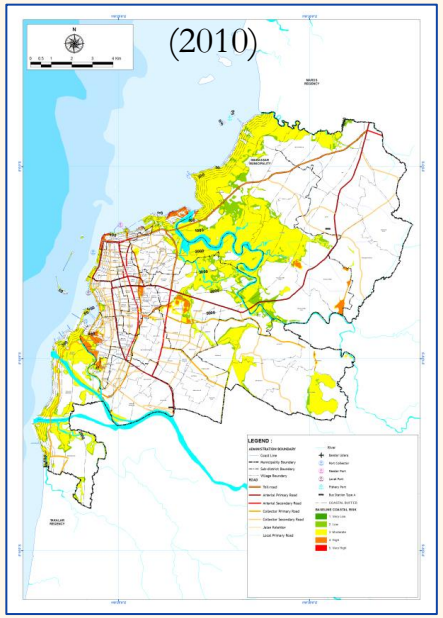
National Digital Elevation Model (Land)

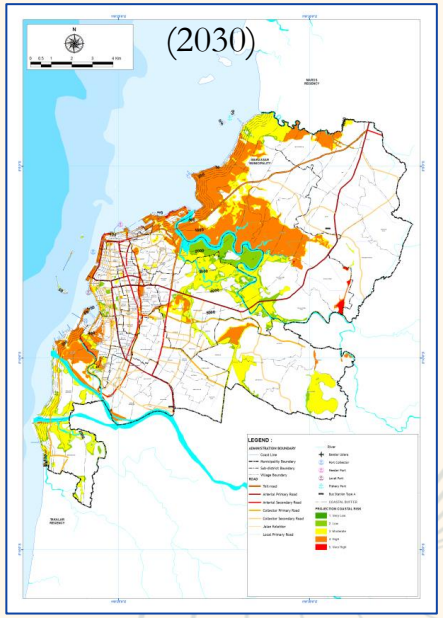
Application of Topographic Data

CONCEPT OF MULTIPLE CLIMATE-RISK, TYPOLOGY OF STUDY AREAS, AND SPATIAL PLANNING FUNCTIONS



(modified from Hadi T.W, 2015)





Sample of Baseline (2010) and Projection (2030) of Coastal Flood Hazard Map at Makassar (Latief, 2015)

Sea level rise and tidal prediction data are based on research products from BIG

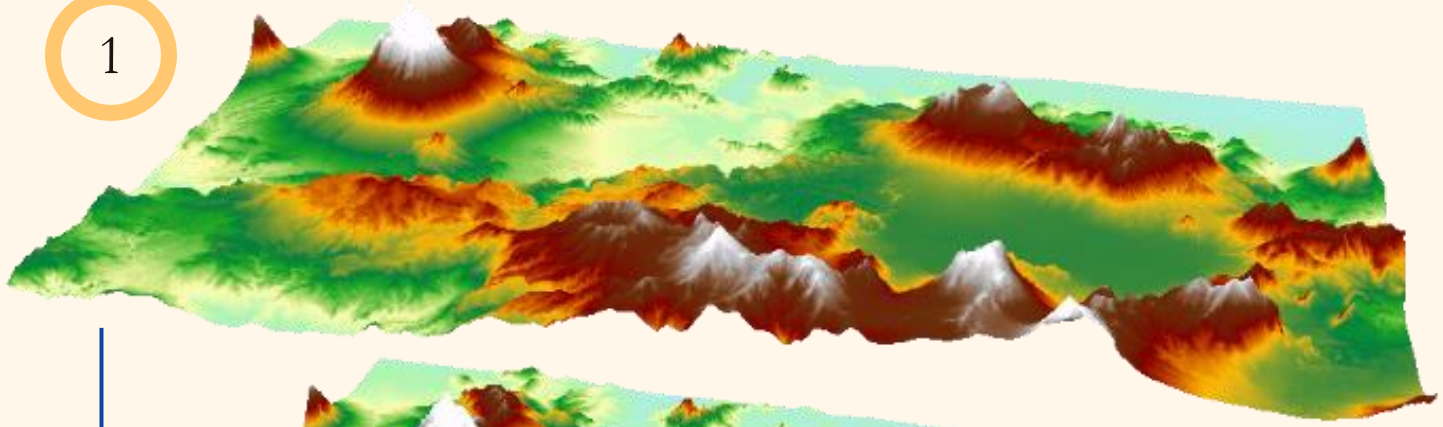
Topographic and land cover data from BIG, land use data from Public Works

Automatic DSM to DTM Conversion

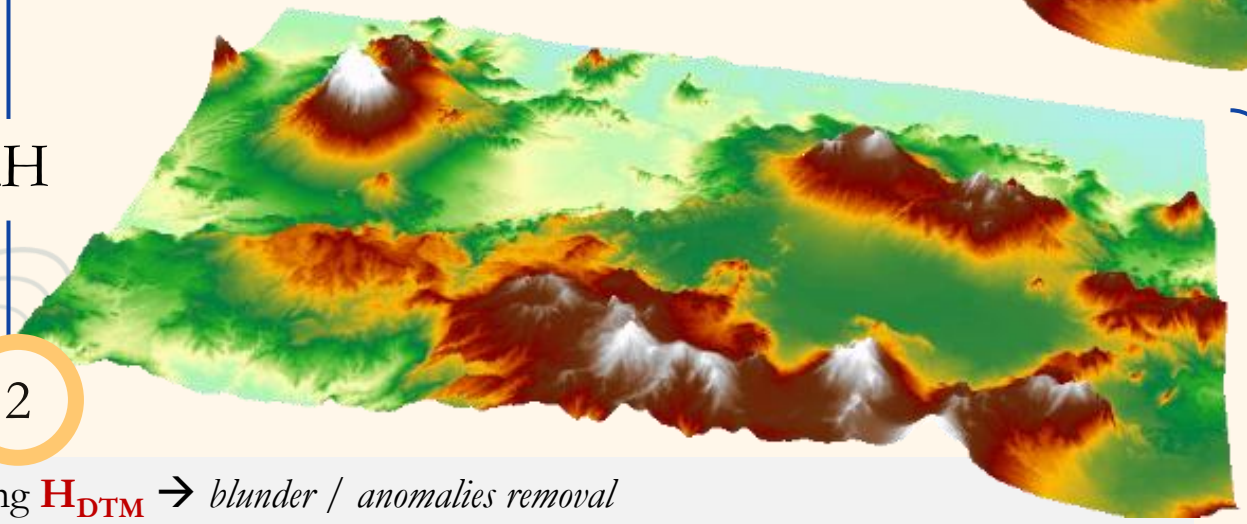
editing H_{DSM}

Spatial Resolutions
bilinear (7.5 m & 2.5 m → 8.25 m)
Datum Conversion → WGS84 & EGM2008
despeckling (spikes, void etc)

1



ΔH



2

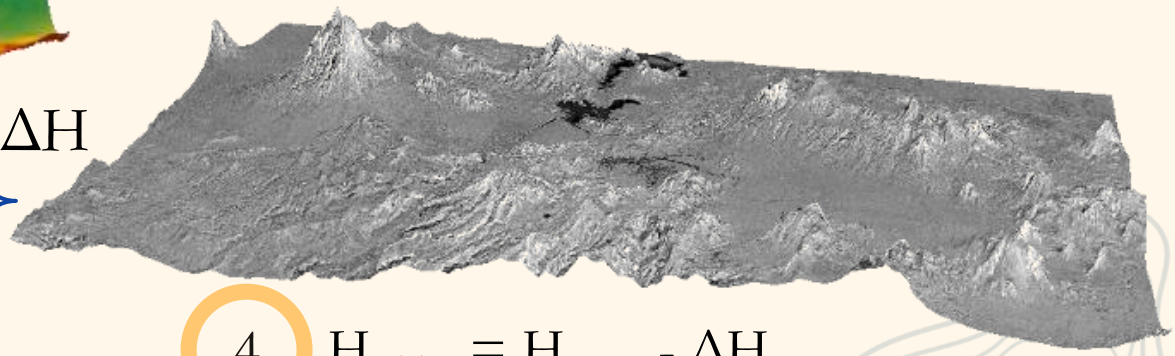
editing H_{DTM} → *blunder / anomalies removal*
Datum Conversion → WGS84 & EGM2008

ΔH

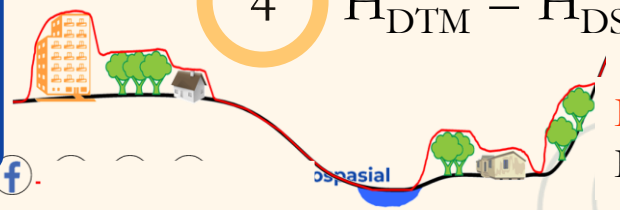
3

$\Delta H_{editted}$ → *spline interpolation*
boxcar filtering

$\Delta H = H_{DSM} - H_{masspoint}$

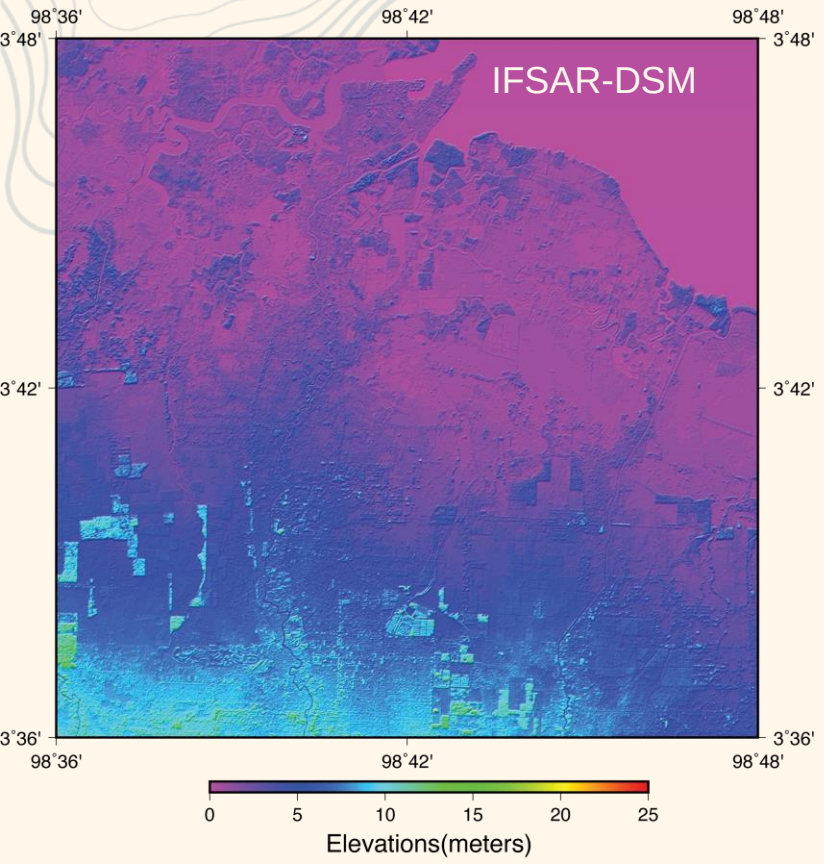


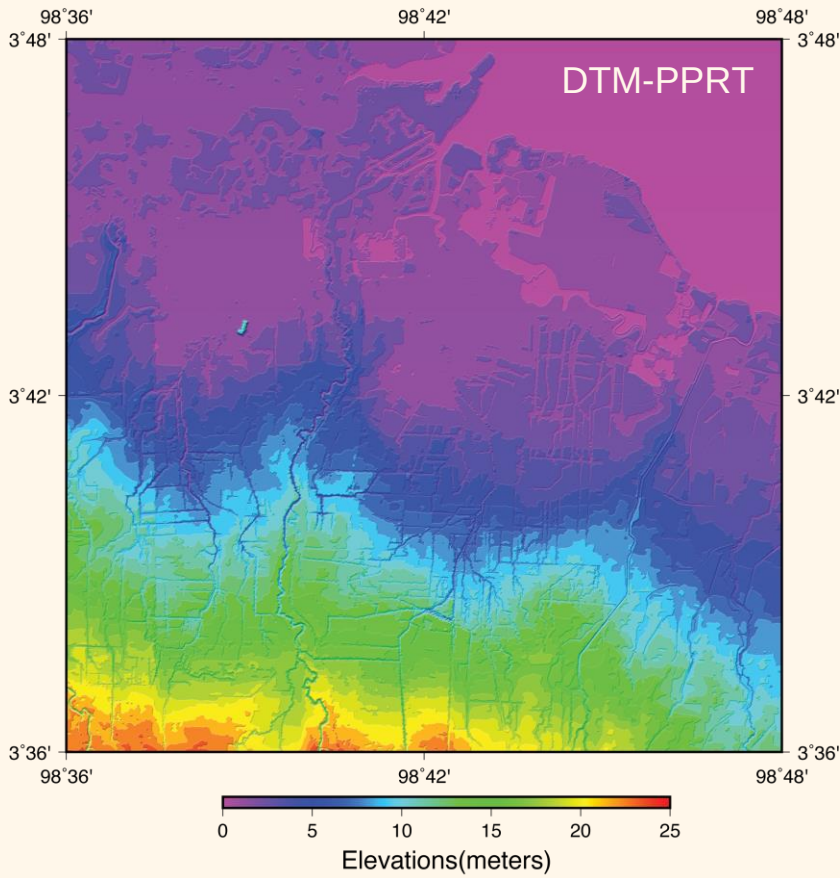
4 $H_{DTM} = H_{DSM} - \Delta H_{editted}$

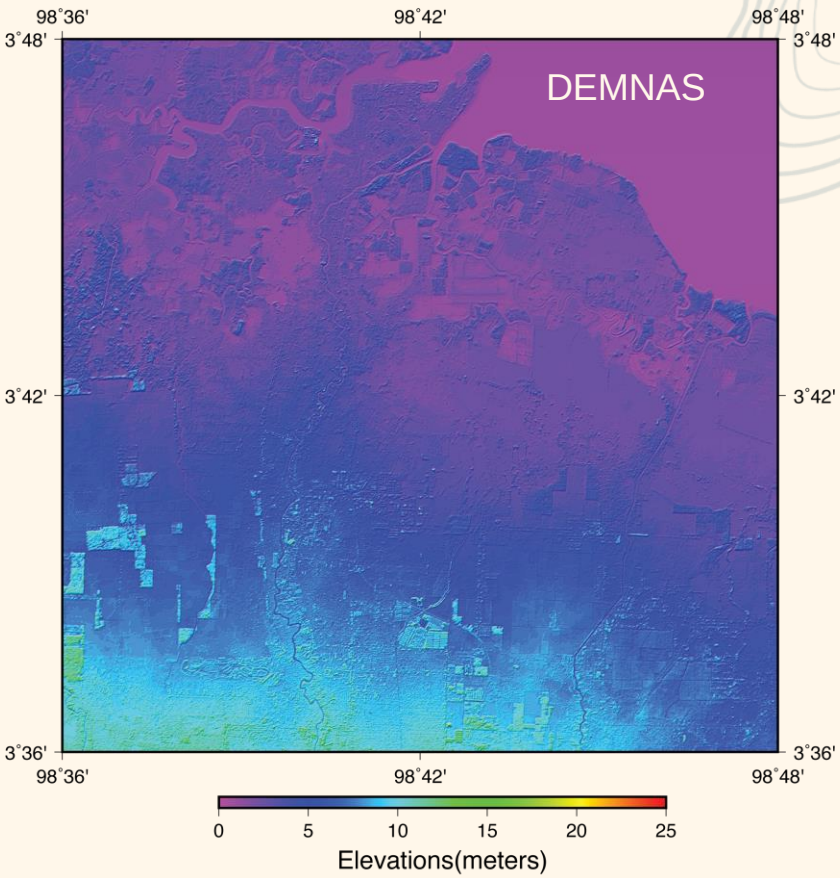


DSM – **D**igital **S**urface **M**odel
DTM – **D**igital **T**errain **M**odel

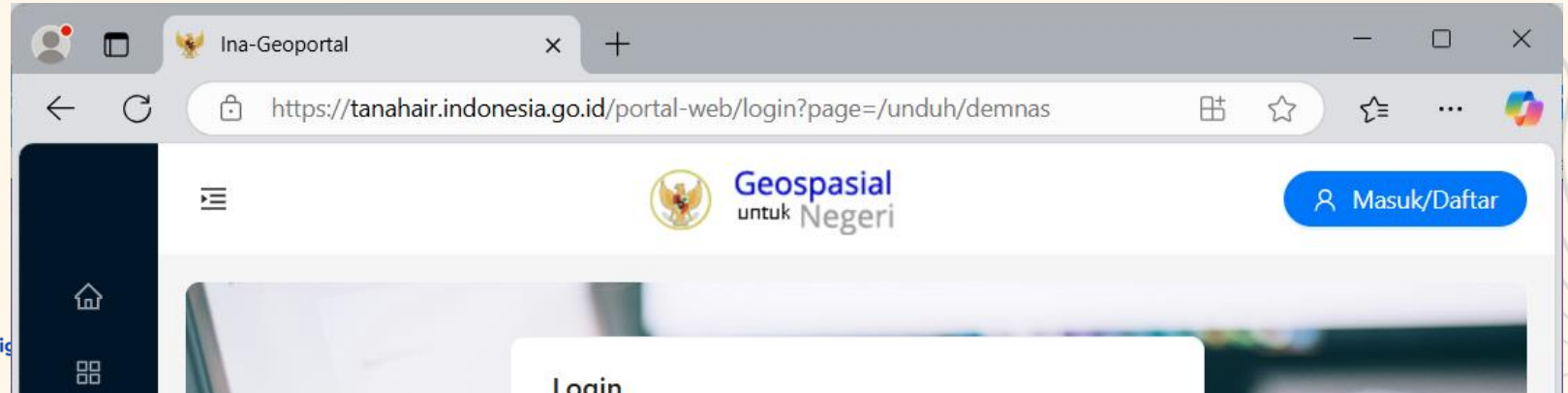
Comparison among IFSAR-DSM, DTM-PPRT and DEMNAS





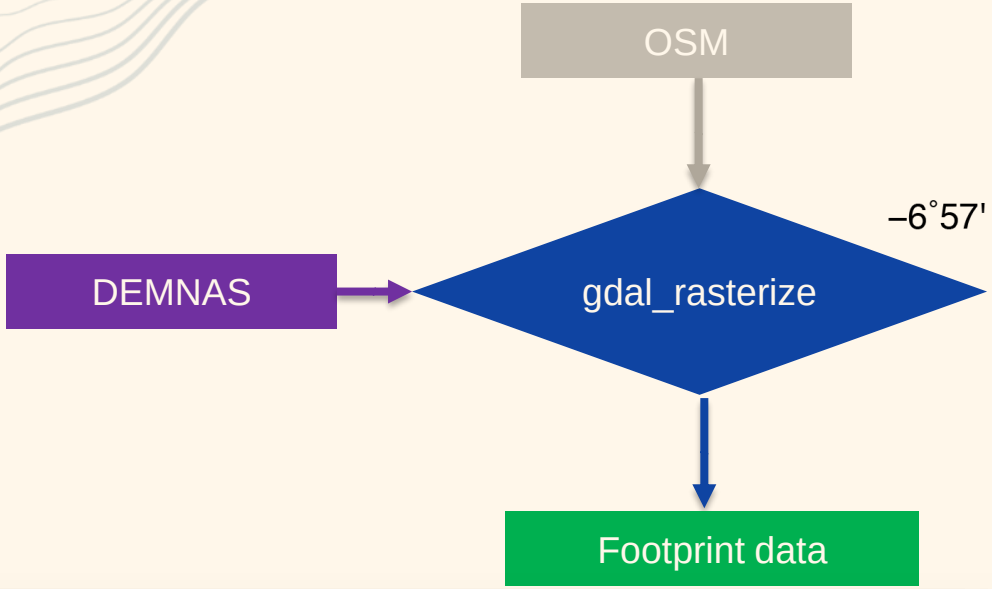


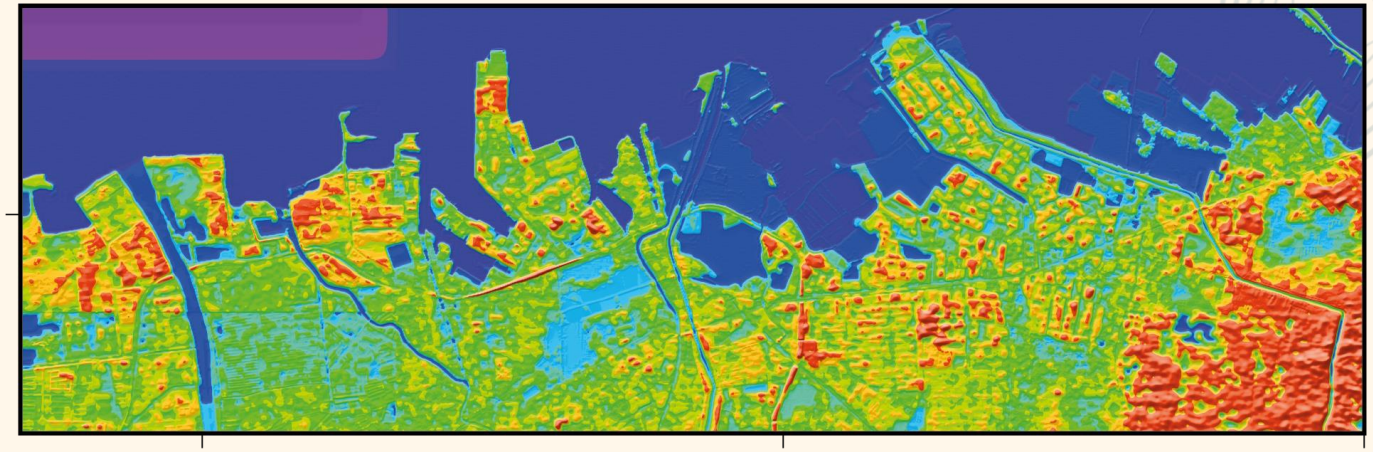
Nation-Wide DEMNAS DATA
https://tanahair.indonesia.go.id/portal-web/login?page=/unduh/demnas



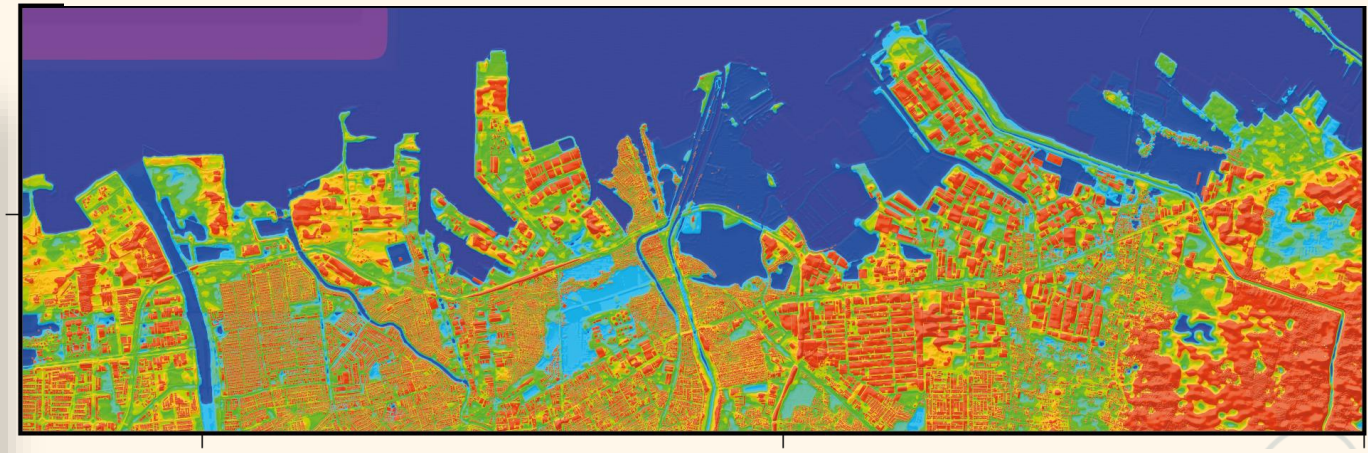
DEMNAS, BATNAS and OSM

Integration with OSM road and building

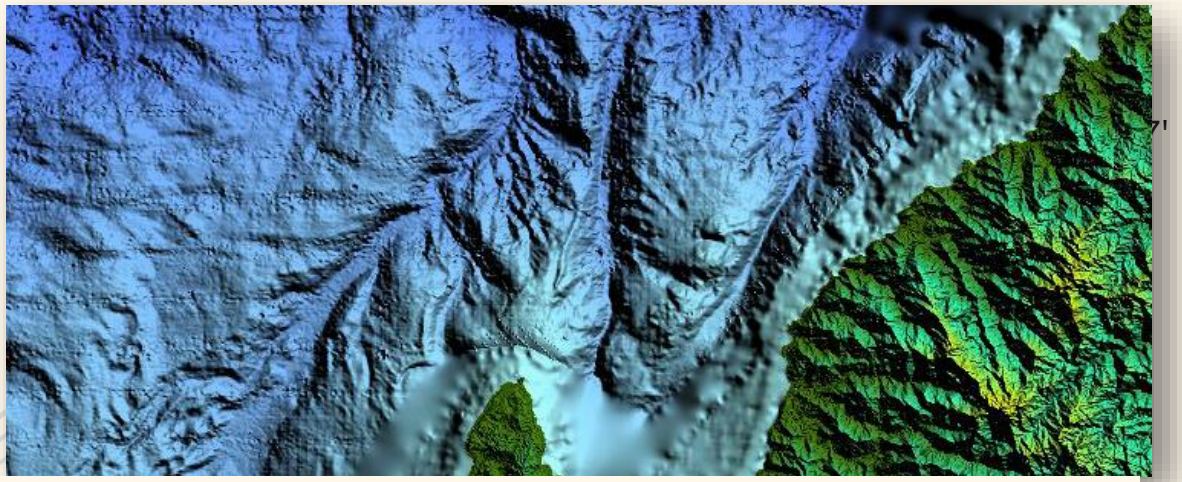




8.25m resolution of DEMNAS



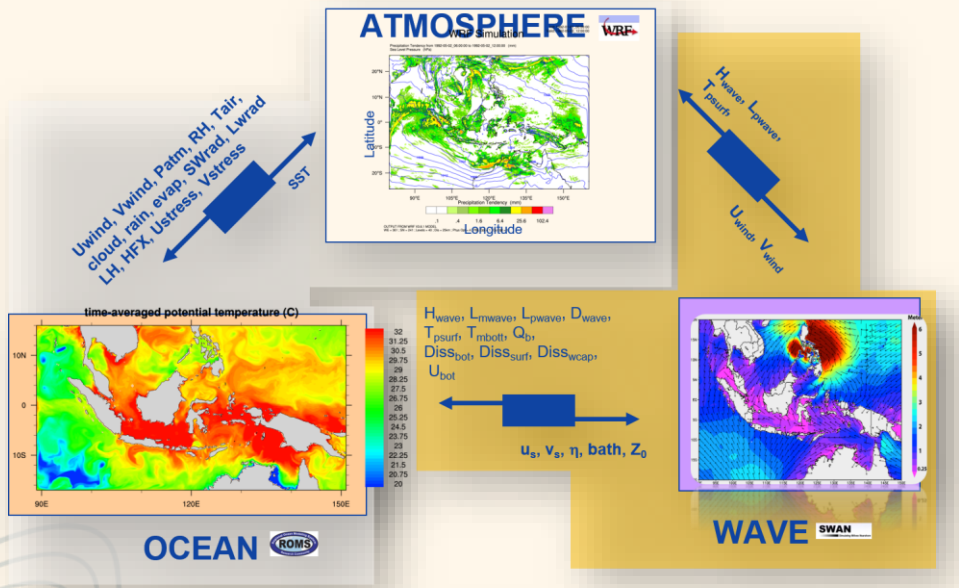
82.5cm resolution of DEMNAS



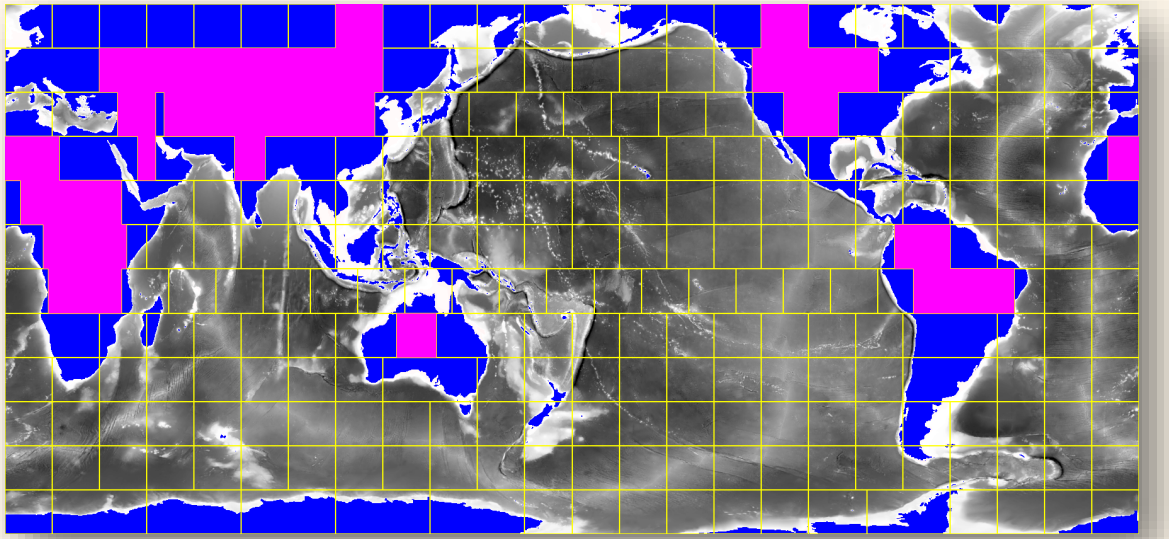
Integration between elevation (DEMNAS) and bathymetric (BATNAS) data

Future Works

- Physics-based numerical modeling system for assessing coastal hazards.
- Predicts coastal hazards for the full range of sea level rise, subsidence and storm surge or other extreme events possibilities using the most sophisticated global climate and ocean modeling tools.
- Developing coastal vulnerability assessment tools to meet the planning and adaptation needs.



Coupled WRF-ROMS-SWAN



Region Tiling of Model Domain


TERIMA KASIH