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FVCOM-SWAVE와 ADCIRC+SWAN을 활용한 경기만 동계 및 하계 파랑 흐름 상호작용 비교 분석 (2019년 동 · 하계 case)

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연구지역, 연구목적, 연구방법

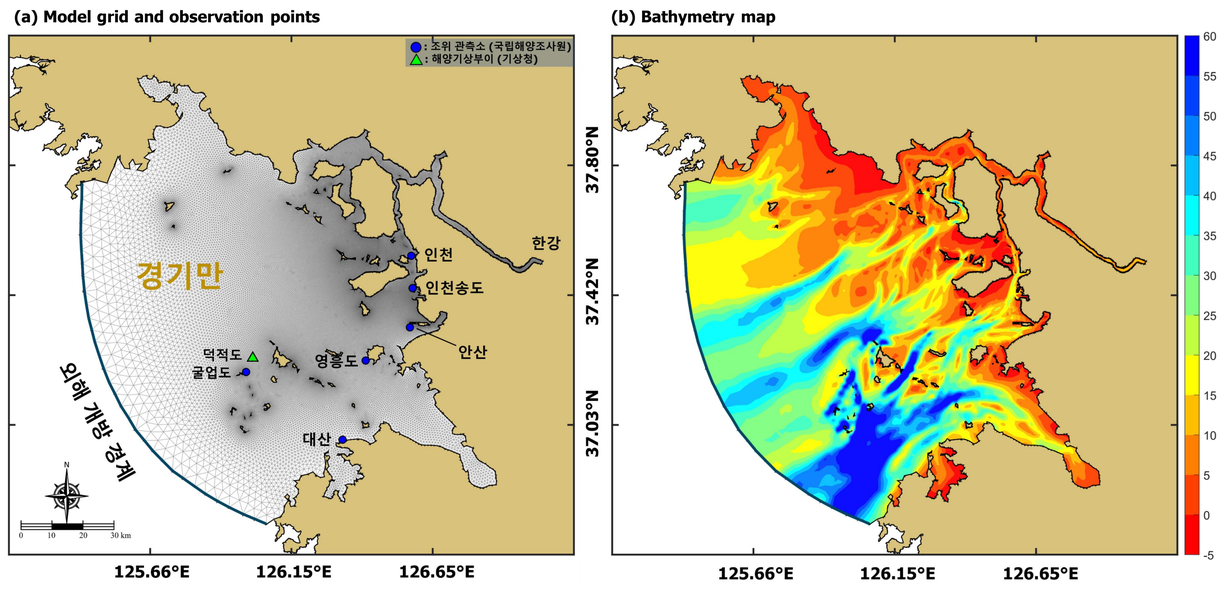


Figure 1. Study area; (a) Grid system for Gyeonggi bay and observation points (blue circle: KHOA tide station, green triangle: KMA moored ocean data buoy), (b) Bathymetry map

연구목적

1. 조석에 의한 해수면 변화에 따른 유의파고(Hs)의 변화 분석
2. 풍향과 조류 방향에 따른 유의파고(Hs)의 변화 분석
3. FVCOM-SWAVE와 ADCIRC+SWAN 비교

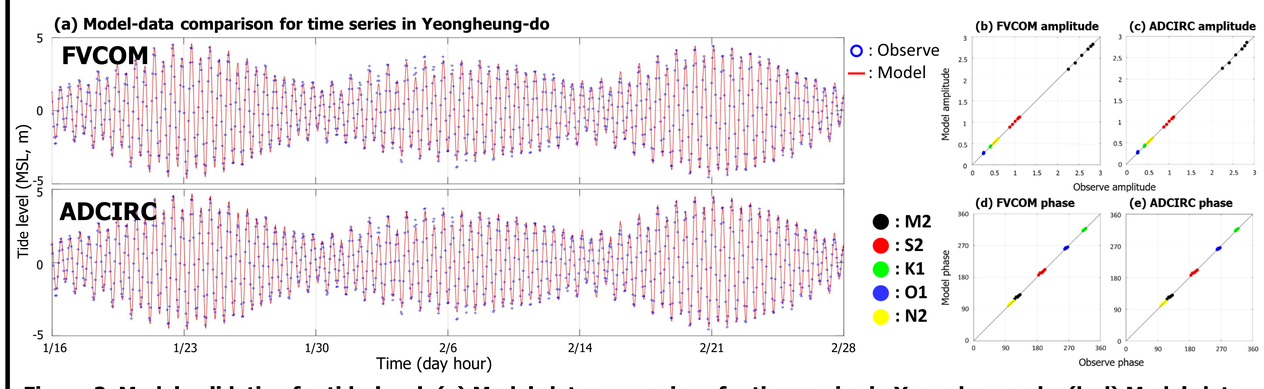


Figure 2. Model validation for tide-level; (a) Model-data comparison for time series in Yeongheung-do, (b-d) Model-data comparison for 5 tidal constituents in FVCOM and ADCIRC

연구결과, 연구결론 및 향후 계획

– Result 1 : 조석에 의한 해수면 변동에 따른 유의파고 변형 (동계 case 활용)

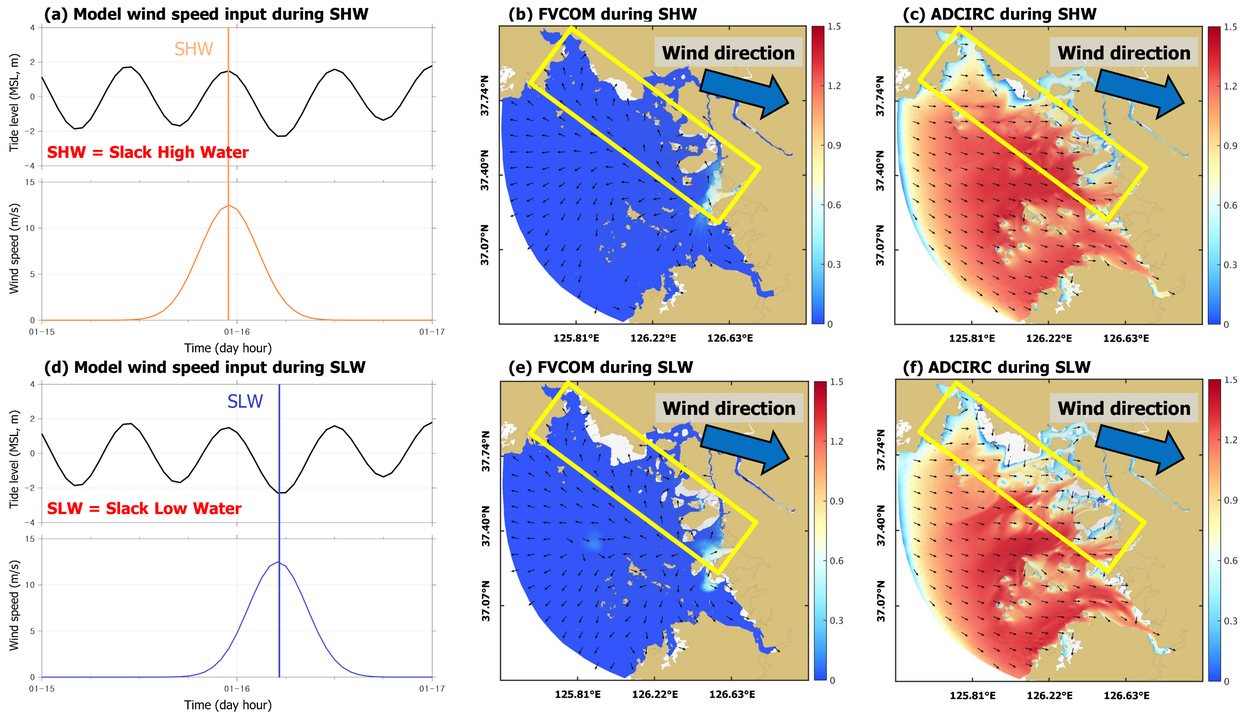


Figure 5. Temporal wind speed input and spatial pattern of the simulated wave field during SHW and SLW case; (a and d) Model wind speed input, (b-c) Spatial pattern of Hs during SHW, (e-f) Spatial pattern of Hs during SLW

– Result 2 : 풍향과 조류 방향에 따른 유의파고 변화 (동 · 하계 case 활용)

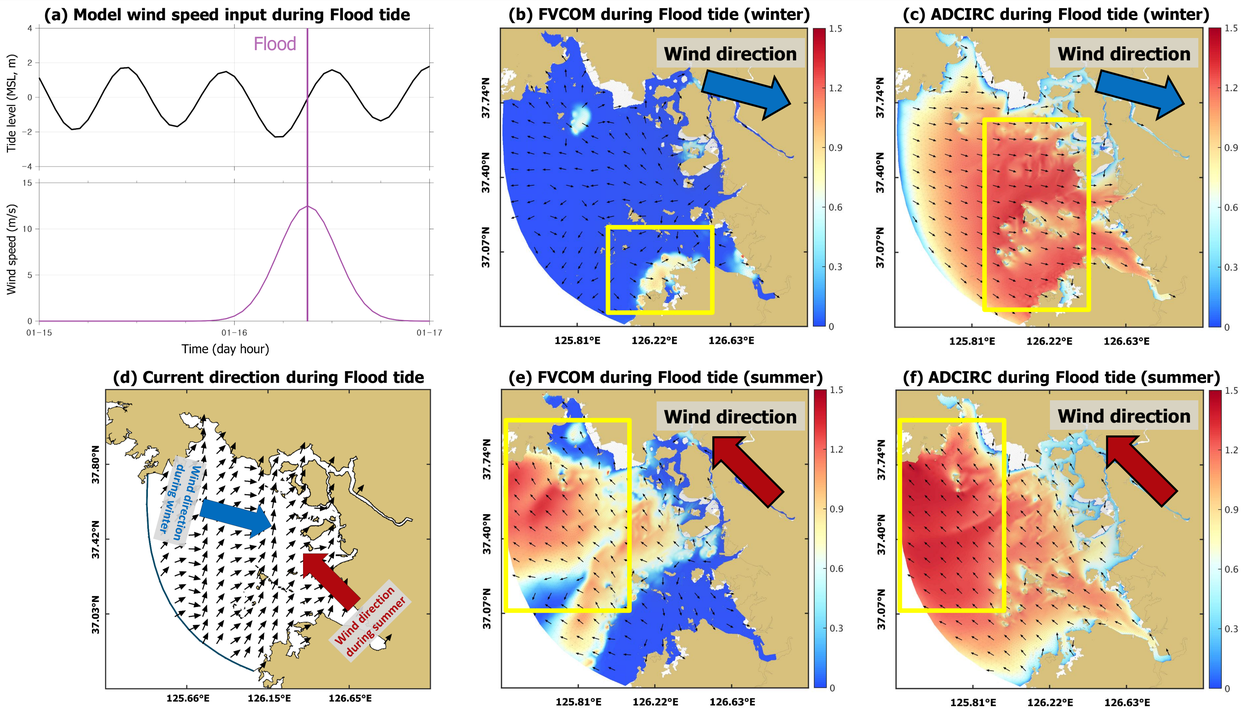


Figure 6. Temporal wind speed input and spatial pattern of the simulated wave field during Flood tide; (a) Model wind speed input, (d) Current direction during Flood tide, (b-c) Spatial pattern of Hs during Flood tide with winter wind direction, (e-f) Significant wave height during Flood tide with summer wind direction

연구방법

FDHM (Full duration at half maximum) = $| x_1 - x_2 |$ $\quad f(x_1) = f(x_2) = \frac{1}{2} * f(x_{max})$

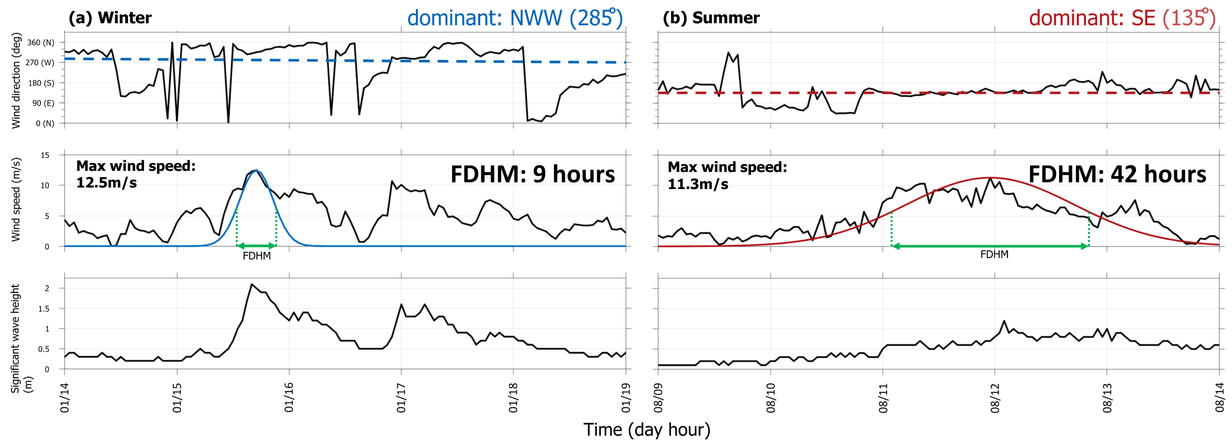


Figure 3. The observed variation during winter and summer high waves; (a) wind direction, wind speed, significant wave height during winter high waves, (b) wind direction, wind speed, significant wave height during summer high waves, showing dominant wind direction (blue and red dashed line), normalized wind speed during high waves (blue and red line)

바람 입력 자료 생성 방법

- 풍향과 조류에 따른 파랑의 특성을 분석하기 위해서 조석주기(12시간 25분)와 유사한 **FDHM**이 작은 동계의 바람 지속시간 및 풍속을 활용하였으며, 풍향은 동계와 하계의 고파랑 시기의 지배적인 풍향을 활용하여 모델 입력 자료를 구성하였다.

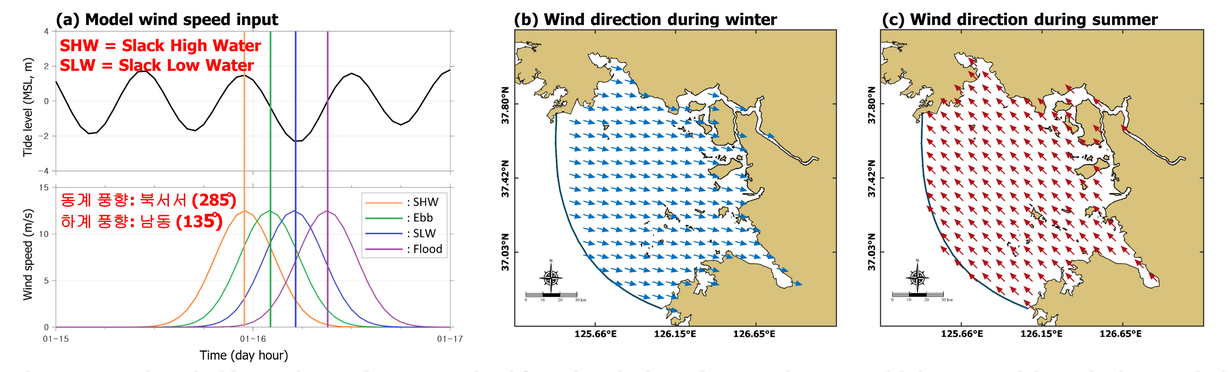


Figure 4. Model wind input data using normalized function during winter and summer high waves; (a) model input wind speed based on tidal phase, (b) model input wind direction during winter high waves, (c) model input wind direction during summer high waves

– Result 3 : FVCOM-SWAVE와 ADCIRC+SWAN 비교 (동계 창조 case 활용)

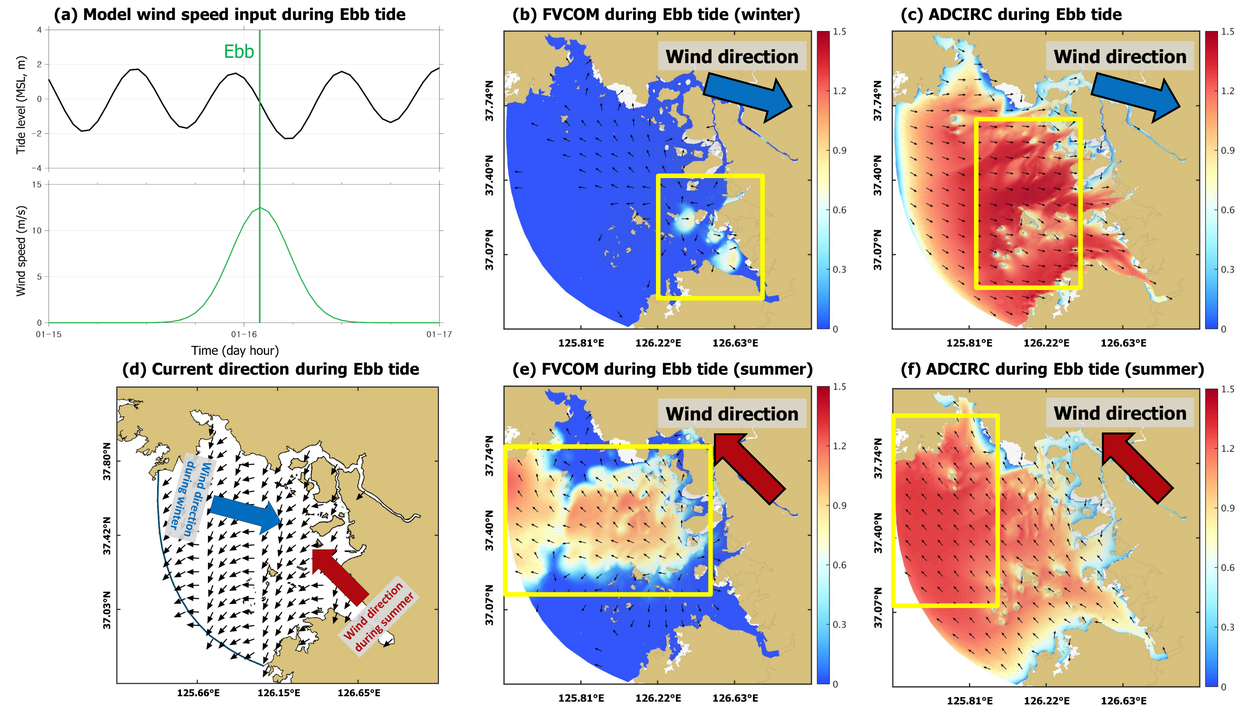


Figure 7. Temporal wind speed input and spatial pattern of the simulated wave field during Ebb tide; (a) Model wind speed input, (d) Current direction during Flood tide, (b-c) Spatial pattern of Hs during Flood tide with winter wind direction, (e-f) Spatial pattern of Hs during Flood tide with summer wind direction

– Result 3 : FVCOM-SWAVE와 ADCIRC+SWAN 비교 (동계 창조 case 활용)

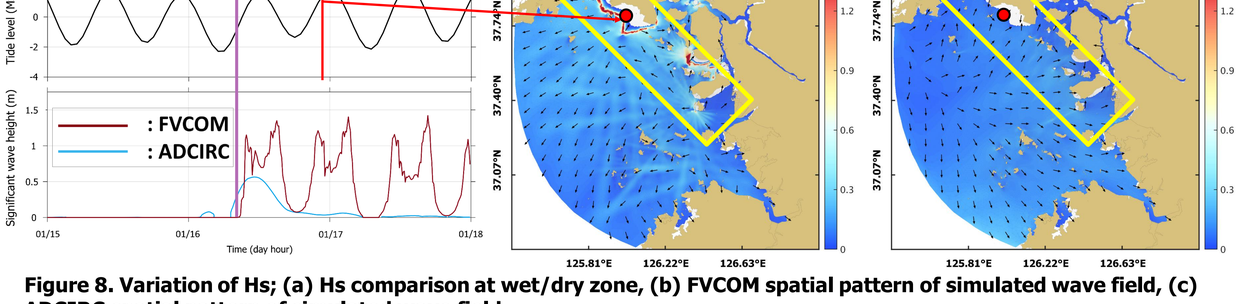


Figure 8. Variation of Hs; (a) Hs comparison at wet/dry zone, (b) FVCOM spatial pattern of simulated wave field, (c) ADCIRC spatial pattern of simulated wave field

Table 1. FVCOM and ADCIRC wind drag coefficient difference

Wind drag coefficient (C_d)				
FVCOM	$1.2*10^{-3}$	U_{10} < 11 m/s	ADCIRC	$(0.75+0.067*U_{10})*10^{-3}$
	$(0.49+0.065*U_{10})*10^{-3}$	11 m/s ≤ U_{10} ≤ 25 m/s		
	$2.115*10^{-3}$	U_{10} > 25 m/		

(Mao et al., 2017)

연구결론 및 향후계획

- **FVCOM**과 **ADCIRC** 모델 모의 결과에서 조석에 의한 해수면 변화는 유의파고 변형 위치를 결정하고, 파랑과 조류의 방향이 유의파고의 크기를 결정하는 요인으로 파악되었다.
- **FVCOM**과 **ADCIRC**의 성능차이는 **FVCOM**이 조간대에서 과대 모의되며 뚜렷이 나타났다. 이는 **FVCOM**은 **Thin film**의 **wet/dry scheme**를 사용하고, **ADCIRC**는 **element removal**의 **wet/dry scheme**를 사용하며 발생한 차이로 추정된다.
- **FVCOM**의 파랑 모의 결과가 **ADCIRC**의 파랑 모의 결과보다 과소 모의되는 것이 확인되었으며, 이는 **FVCOM**과 **ADCIRC**의 **Wind drag coefficient** 산정 방식이 서로 다름이 원인으로 추정된다(**Table 1**).
- 추후 **FVCOM**과 **ADCIRC**의 **wind drag coefficient**와 **wet/dry scheme**에 관한 수치 모의를 진행하여 원인을 파악할 계획이다.

참고 문헌

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2. Kang, K.R., and Daniela Di Iorio, Depth- and current-induced effects on wave propagation into the Altamaha River Estuary, Georgia, Estuarine, Coastal and Shelf Science., Vol.66(3-4), pp. 395-408, 2006
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