USACE CODS WAVE INFORMATION STUDY (WIS)

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CODS WAVE INFORMATION STUDY (WIS)

Outline:
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2. FY23 USACE District WIS Applications
3. WIS Sources
4. WIS Data Portal Updates
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   ii. FY23 WIS Data Portal User Analytics
5. FY23 USACE District WIS Projects

WIS PURPOSE AND UPDATES

PROBLEM
- Knowledge of the wave climatology is required for planning, design, construction, and maintenance of USACE projects in the coastal zone.
- Information is scarce due to the lack of measurements at locations over timescales long enough to be statistically significant.
- This lack of information is a critical problem for USACE operations, and project maintenance near the coast.

SOLUTION
- Generation of long-term coastal wave estimates using spectral wave models forced by high quality wind fields.
- Validation of the model estimates to all available in situ and remotely sensed observations.
- Easy access to the WIS estimates and tailored, interactive products via the WIS Data Portal: https://wisportal.erdc.dren.mil, and API: https://wisportal.erdc.dren.mil/api/
- WIS email address: WISInfo@erdc.dren.mil.

IMPACT
- Fully automated forty-year hindcast of wave climatologies at pre-selected output locations for all U.S. coastal waters, including the Great Lakes.
- Applications anywhere reliable hindcast wave climate information is needed for coastal risk management, civil works operations and planning, and coastal research.
- These multi-decade hindcasts and storm event archives are generated to meet tomorrow’s coastal engineering needs today.
WIS PURPOSE AND UPDATES

- The Wave Information Study (WIS) program provides a national resource of long-term wave climatologies at pre-selected output locations for all U.S. coastal waters, including the Great Lakes.

- Full historical WIS hindcast (1980 – 2022)
- Full historical USACE QCC Measurement Archive (1980 – 2022)

WIS Data Portal Products:

- **Standard variables**: Hindcast wave estimates (height, wave period, and direction), directional spectral estimates, as well as many, many more...

- **Interactive products**: 2D Spectra, Mean-Max wave height summaries, extreme analyses and wind/wave percent occurrences (tables and plots).

- **Model inputs**: CMS-Wave beta testing phase - this tool takes wave energy spectra information from the WIS estimate station and transforms that spectrum to one that represents an offshore location which is closer to land (and at a shallower depth).

- Ultimately, these multi-decade hindcasts and storm event archives are generated to meet tomorrow's coastal engineering needs today.
Applications: Anywhere reliable hindcast wave climate information is needed for coastal risk management, civil works operations and planning, and coastal research studies.

Select FY23 uses:

1. Coastal Flooding Emergency Management - rapid estimates of potential coastal flooding at higher water levels
2. Site-specific wave climate – summary statistics for both extreme analysis and typical conditions – easy-access, visual tools to communicate to the public
3. Design of coastal structures - wave conditions at design phase and feasibility phases
4. Harbor performance metrics - Used to define deep water boundary conditions for wave modeling to determine design wave heights and evaluate harbor performance - estimate durations of time waters adjacent to the project site were calm enough for different classes of vessels to operate to support economic analysis of the harbors.
5. Revetment design – nearshore extreme wave heights and periods
6. Beach run-up simulations – offshore wave conditions
7. Rip Currents - correlation of offshore WIS data to nearshore wave data
8. Nearshore wave modeling forcing
9. Ship motion models – seaway statistics
11. Sediment Transport / Beneficial use of dredged sediment – transformed the WIS hindcasts to the nearshore and estimate the sediment transport capability of a site for the beneficial use of dredged sediment.
1. WIS Program website: https://wis.erdc.dren.mil. Informational (no data), link to the WIS Portal.

"Thank you so much. This WIS database is such a great asset for practicing engineers." — Rajesh Srinivas, project in St. John County, Florida (Oct 2022)
WIS DATA PORTAL UPDATE

Zoom capabilities to isolate a WIS or Buoy Site

- Download preset or custom POR – All Years & All Months; Select Year & All months; All Years & Select Month.
- Static and interactive product generation — For all tables and plots
- Export individual or Group products – For tables: .csv or .nc; for plots: .png, .svg. or .pdf.

"We greatly appreciate your efforts and the WIS products that helps us in designing the best shore protection for the Great Lakes" – Mauricio Wesson, SmithGroup (Sep 2023)
SELECT WIS DATA PORTAL PRODUCTS

Mean and Max Duration [hrs]
2022-01-01T00:00:00Z - 2022-12-31T23:00:00Z
WIS Great Lakes Lake Ontario Hindcast: 91022
Loc: -76.24° / 43.76° Depth: 11.0 [m]

Plots
- Wind Rose
- Wave Rose
- Mean & Max Wave Height Duration
- Wave Height Duration Distribution

Duration Distribution [hrs]
2022-01-01T00:00:00Z - 2022-12-31T23:00:00Z
WIS Great Lakes Lake Ontario Hindcast: 91022
Loc: -76.24° / 43.76° Depth: 11.0 [m]

“Special thank you for taking the time to resolve, educate, and deliver the data. Your WIS portal is so valuable for what engineers do in-and-around our coastal environments. I look forward to using the data and applying the results to real-world projects” – Joel Amendolara, SmithGroup – project in the Great Lakes (Sep 2023)
SELECT WIS DATA PORTAL PRODUCTS

Storm Event Return Period of 44-yr (1979-2022) Wave Hindcast
Great Lakes Station ST91022: Lat: 43.760° Lon: -76.240° Depth: 11.0m
Linear Fit to top 44 events: $H_{1/3} = 5.41 + 0.82 \ln(R)$

Yearly Wave Height Time Series
Extremes Analysis Plot

"WIS... is exactly what I need. Thank you for your quick response." - James Austin, APTIM Coastal, Ports and Maritime project in Indian River County, Florida (Feb 2023)
| 1. | Port of Nome Modification, Phase 1 design (Alaska District) |
| 2. | Barrow Coastal Erosion, Phase 1 design (Alaska District) |
| 3. | Akutan Harbor Tribal Partnership Program Study (Alaska District) |
| 4. | Dutch Harbor Navigation Channel Feasibility Study (Alaska District) |
| 5. | Elim Harbor Tribal Partnership Program Feasibility Study (Alaska District) |
| 6. | St George Harbor GI Feasibility Study (Alaska District) |
| 7. | Kodiak Island Airport Runway Extension (Alaska District) |
| 8. | St George Breakwater Repairs (HDR, Inc., for the Alaska District) |
| 9. | Little Diomede Helipad Improvements (State of Alaska DOT) |
| 10. | East Hagatna, Guam Section 14 Study (Honolulu District) |
| 11. | Ofu Airport, Am Samoa Section 14 Study (Honolulu District) |
| 12. | Agat Mayors Office, Guam Section 14 Study (Honolulu District) |
| 13. | Agat Bay Regional Shoreline Assessment (Honolulu District) |
| 14. | American Samoa Climate Change Vulnerability Study (Honolulu District) |
| 15. | Laupahoehoe Harbor Breakwater Repair Final Design Report, Island of Hawaii (Honolulu District) |
| 16. | Haleiwa Harbor and Shore Protection Project, RSM and Section 1122 Beneficial Use Studies (Honolulu District) |
| 17. | Hilo Harbor Breakwater Resiliency Study (Honolulu District) |
| 18. | Saipan, Beach Rd. CSRM FS (Pacific Ocean Division) |
| 19. | East San Pedro Ecosystem Restoration FS (Los Angeles District) |
| 20. | San Diego County Shoreline CSRM FS (Los Angeles District) |
| 21. | Carpinteria [California] Shoreline CSRM FS (Los Angeles District) |
| 22. | Westward Beach Shore Protection Coastal Engineering Study (Los Angeles County Department of Beaches and Harbors) |
| 23. | Adamson Wall Shore Protection Coastal Engineering Study (Los Angeles County Department of Beaches and Harbors) |
| 24. | Bay Mills Feasibility Study (Detroit District) |
| 25. | Holland Rip Current Study (Detroit District) |
| 26. | Grand Haven Wave Absorber Design (Detroit District) |
| 27. | Keweenaw Stamp Sands Feasibility Study (Detroit District) |
| 28. | Lexington Harbor Planning Assistance to States Study (Detroit District) |
| 29. | Community fact sheets for outreach events with the State of Michigan (Detroit District) |
| 30. | Marshal Islands - Kwajalein Atoll Shoreline Protection (HDR, Inc. for the U.S. Army Space and Missile Defense Command) |
| 31. | Monroe County Roadway Vulnerability Assessment (HDR, Inc., for Monroe County Sustainability Office) |
QUESTIONS

For more info: WISinfo@usace.army.mil