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Terminales FSRU

Simulaciones numéricas con interacción entre naves

Charles Fournier, M.Sc., MBA, P.Eng.
Wim van der Molen, PhD, MSc
Patricio Monárdez, M.Sc.
Roberto Salinas, Ing. Civil

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Introducción

- Definición clima de olas de largo plazo
- Definición clima de olas extremas
- Cálculo *downtime* FSRU con/**sin** interacción

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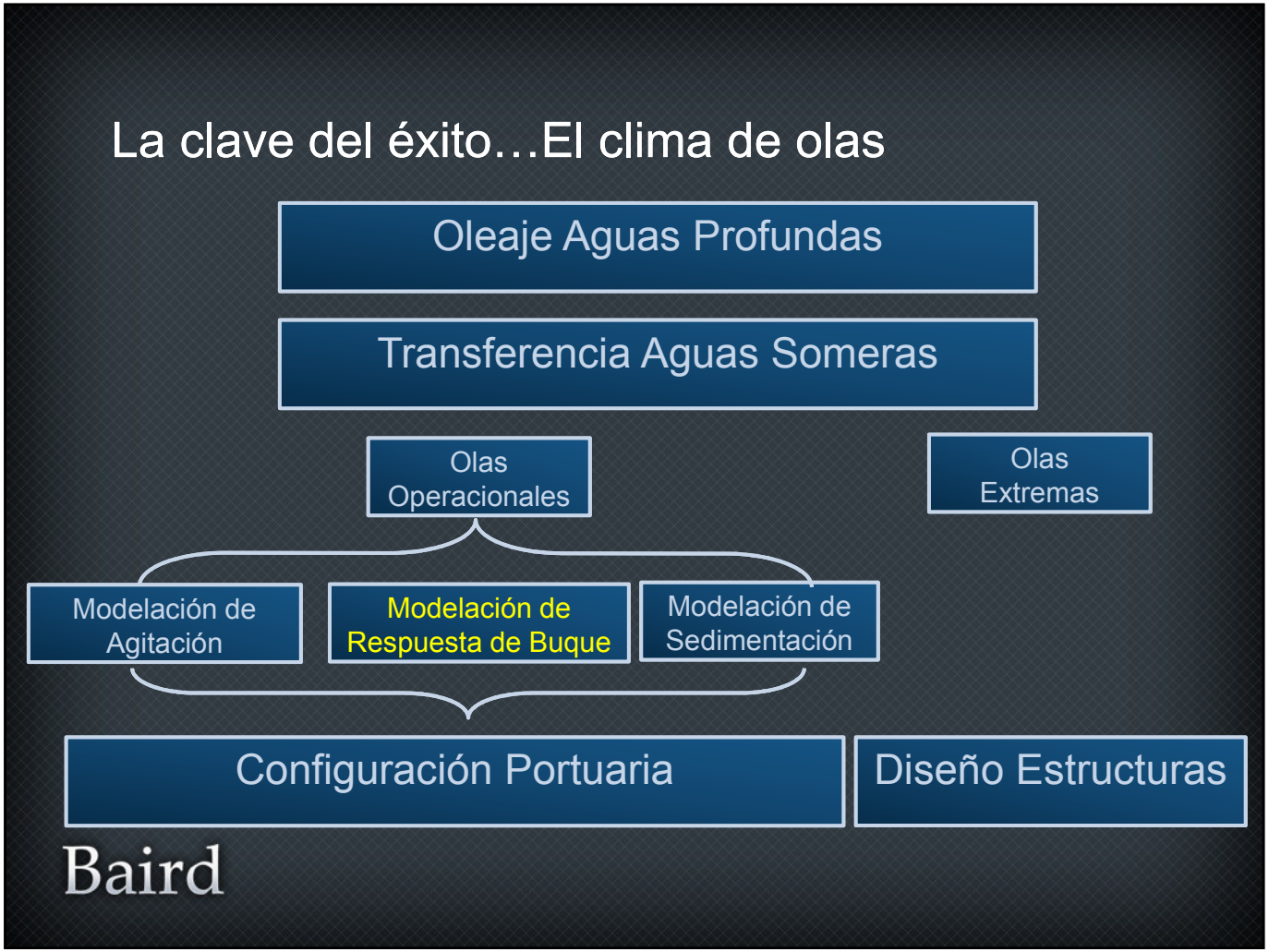
La clave del éxito…El clima de olas
Oleaje Aguas Profundas
Transferencia Aguas Someras
Olas Operacionales
Olas Extremas
Modelación de Agitación
Modelación de Respuesta de Buque
Modelación de Sedimentación
Configuración Portuaria
Diseño Estructuras
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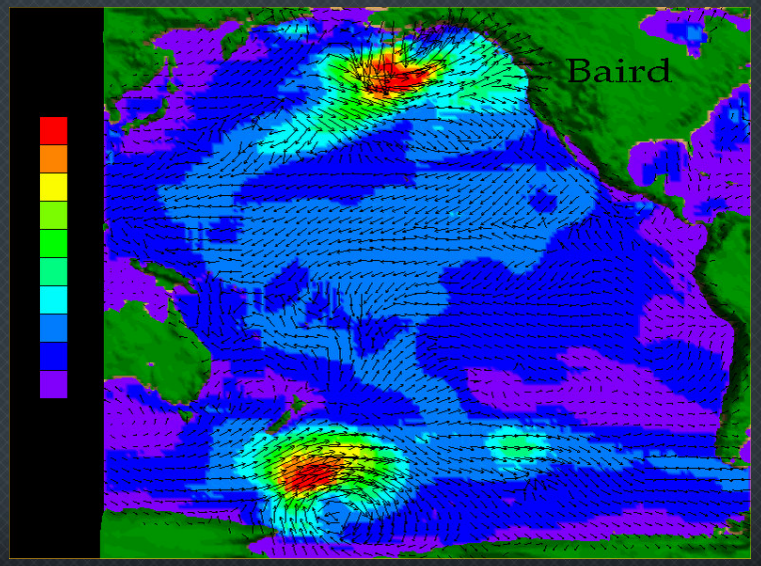
Olas en el Pacífico que Impactan Chile

Diciembre 1998 y Enero 1999

- Las Olas se generan y llegan del SW y NW (bi-modal)
- Para definir un clima de olas, de deben considerar 3 modos de olas
  - SW
  - NW
  - Locales



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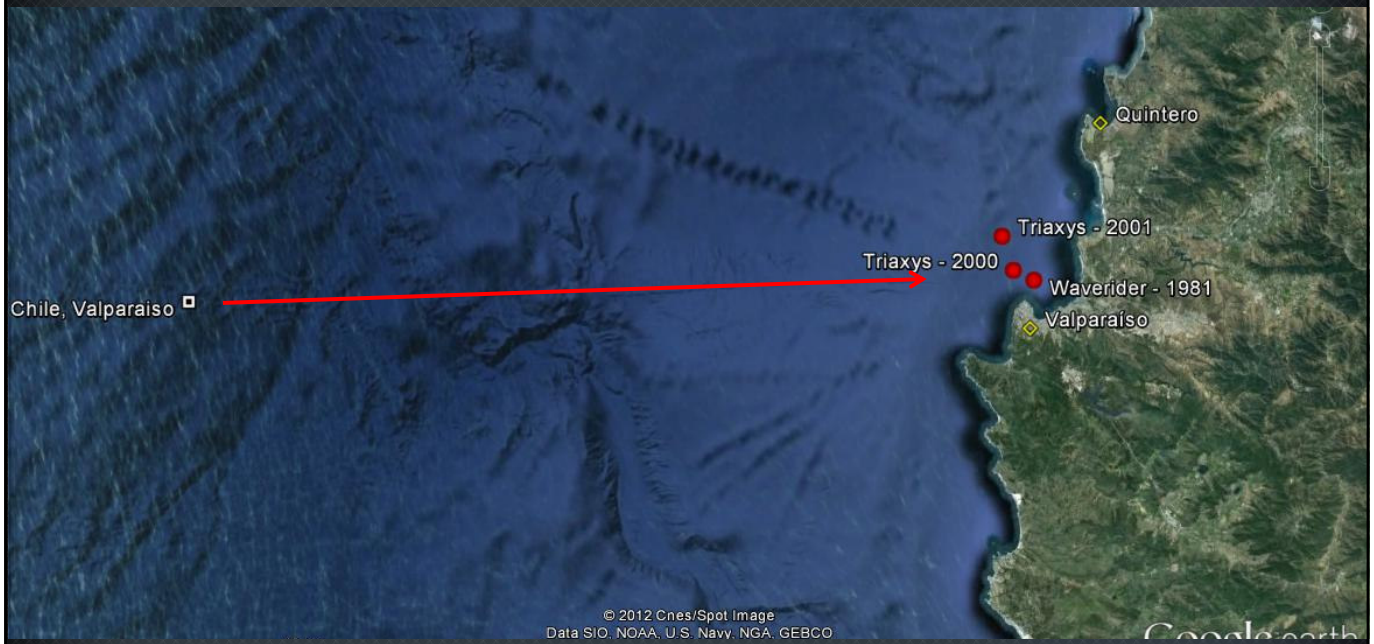
Oleaje en aguas profundas



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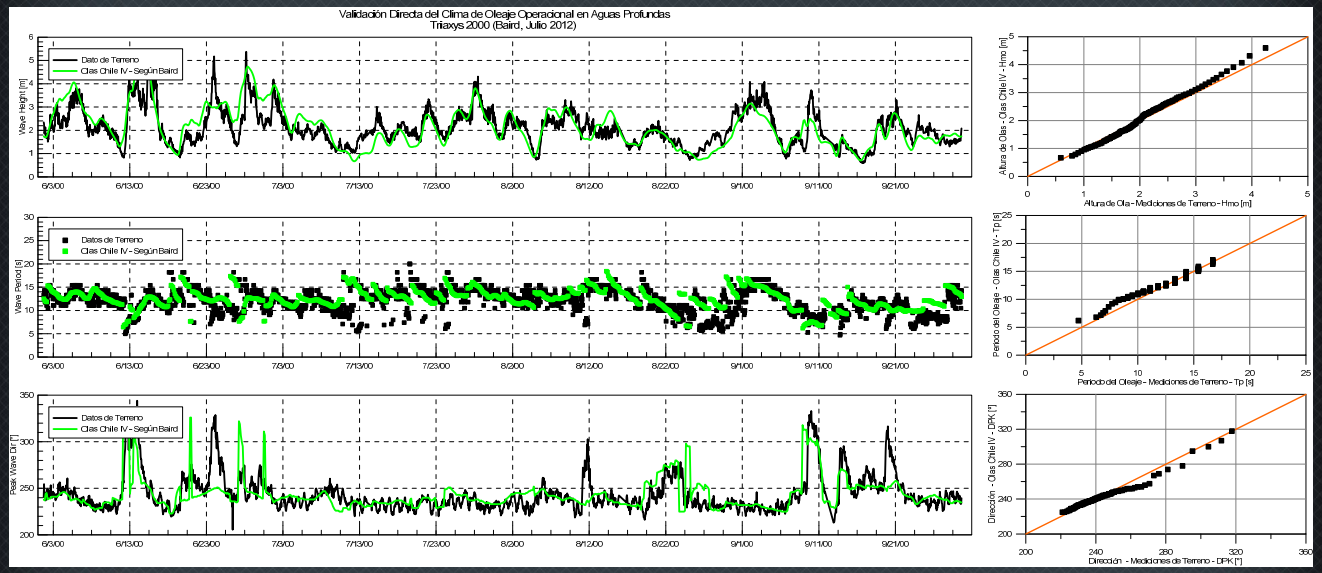
Validación Base de datos Olas Chile IV

Validación Estudio de Oleaje

Comparación en Aguas Profundas – Fuera de la Bahía



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9 años de mediciones del SHOA
Modelo con 30 años de oleaje simulado

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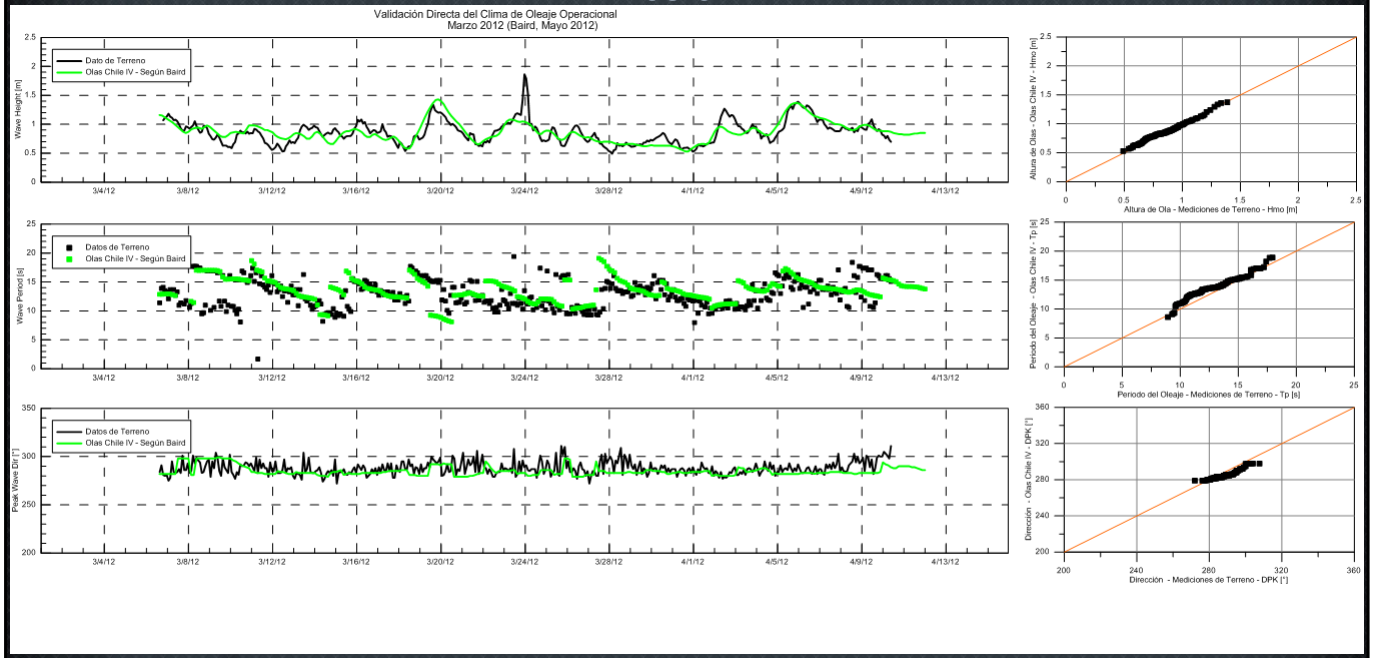
Mes 5



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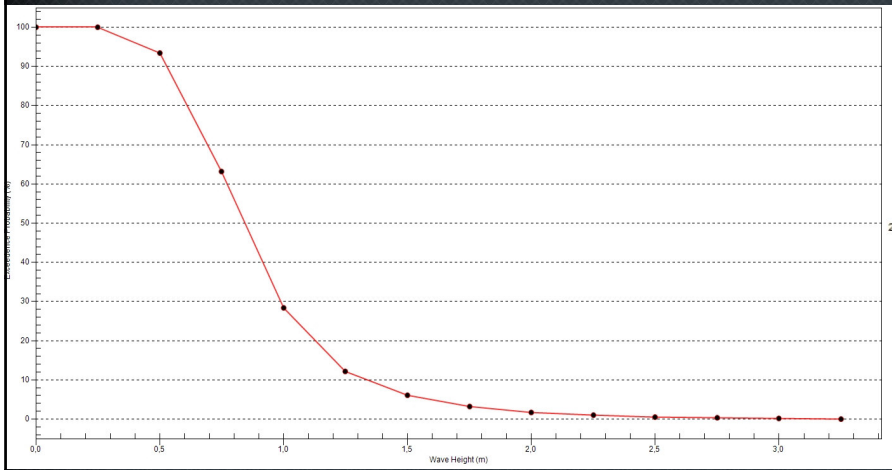
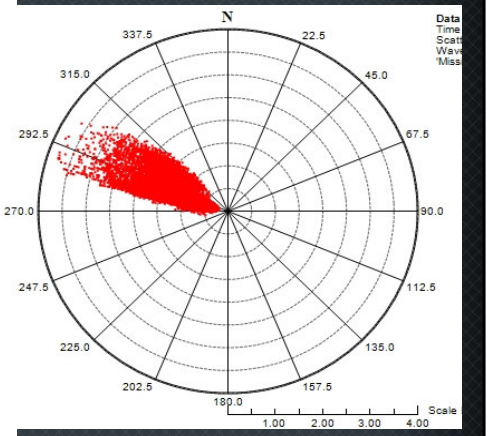
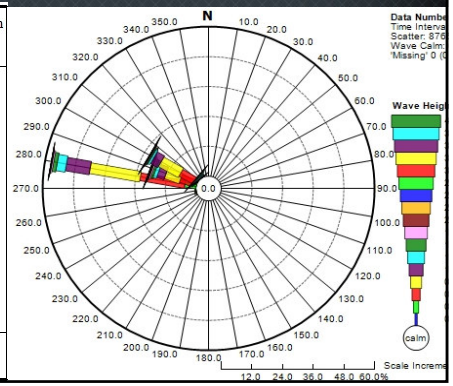
Clima de olas de largo plazo



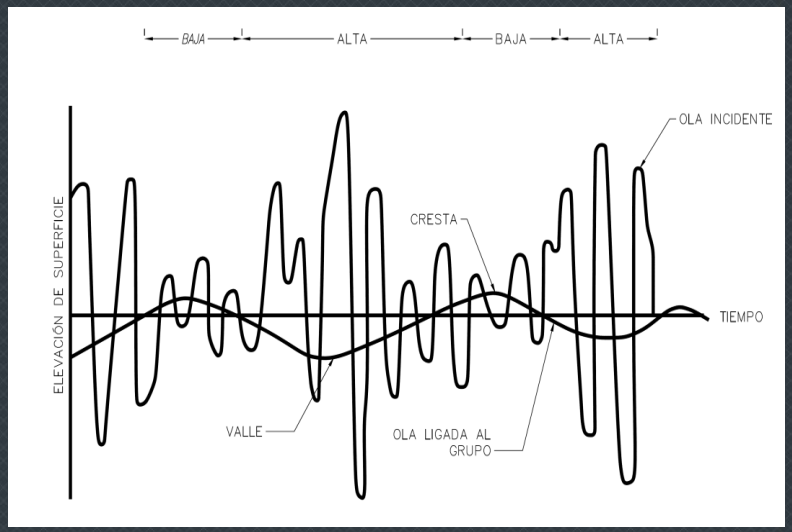


Direction	Wave Height (m) 0.00-0.25	0.25-0.50	0.50-0.75	0.75-1.00	1.00-1.25	1.25-1.50	1.50-1.75	1.75-2.00	2.00-2.25	2.25-2.50	2.50-2.75	2.75-3.00	3.00-3.25	Total	C(%)	Maximum Height (m)
0.00															100.00	
10.00															100.00	
20.00															100.00	
250.00															100.00	
260.00		0.00	0.00											0.00	100.00	0.59
270.00		0.10	0.07	0.03	0.00									0.20	100.00	1.11
280.00	0.04	4.47	17.72	19.89	9.48	3.61	1.44	0.54	0.19	0.09	0.03	0.01	0.00	57.51	99.80	3.49
290.00	0.00	1.14	5.58	6.00	3.06	1.30	0.84	0.57	0.27	0.16	0.12	0.06	0.04	19.17	42.29	3.78
300.00	0.00	0.85	6.78	8.84	3.38	0.78	0.37	0.23	0.18	0.11	0.10	0.04	0.02	21.71	23.12	3.78
310.00			0.02	0.12	0.27	0.27	0.25	0.19	0.12	0.05	0.03	0.01	0.00	1.33	1.41	3.21
320.00			0.00	0.02	0.02	0.01	0.01	0.00						0.07	0.07	1.79
330.00															-0.00	
340.00															-0.00	
350.00															-0.00	
Totals	0.04	6.56	30.18	34.90	16.21	5.97	2.91	1.53	0.76	0.41	0.27	0.12	0.07	100.00		
C(%)	100.00	99.96	93.40	63.21	28.31	12.11	6.14	3.22	1.69	0.93	0.52	0.25	0.13			



Análisis de olas largas

- Qué son?
  - Ligadas
  - Libres
  - Reflejadas
  - De Orilla



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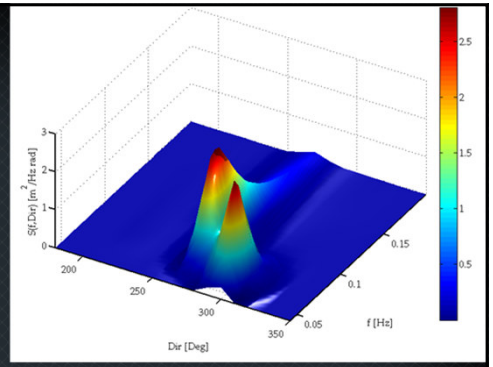
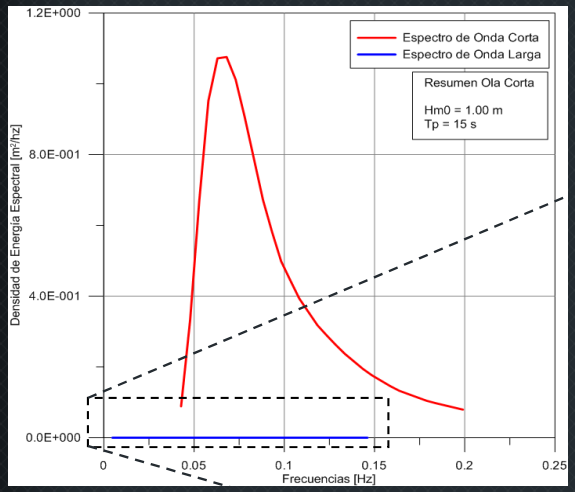
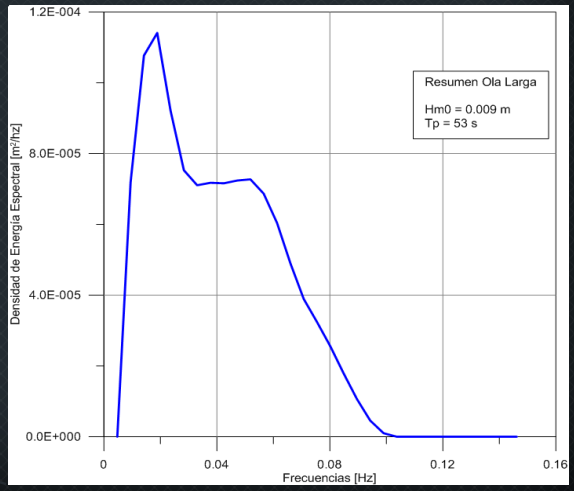
Análisis de olas largas

- Cuantificación







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Modelos Numéricos

- Wavescat: efectos hidrodinámicos en el espacio de frecuencias: Radiación-Difracción
- Harberth: efectos hidrodinámicos en el espacio temporal: Difracción y efectos del flujo ante la presencia de cuerpos
- Quaysim: Resuelve ecuación de movimiento: Interacción mecánica

Modelos Validados:

- *«Numerical Multiple-Body Simulations of Side by Side Mooring to an FPSO»,* Buchner et al, 2001.
- *«Some Aspects of Multibody Interactions in Seakeeping».* Malenica et al, 2005.

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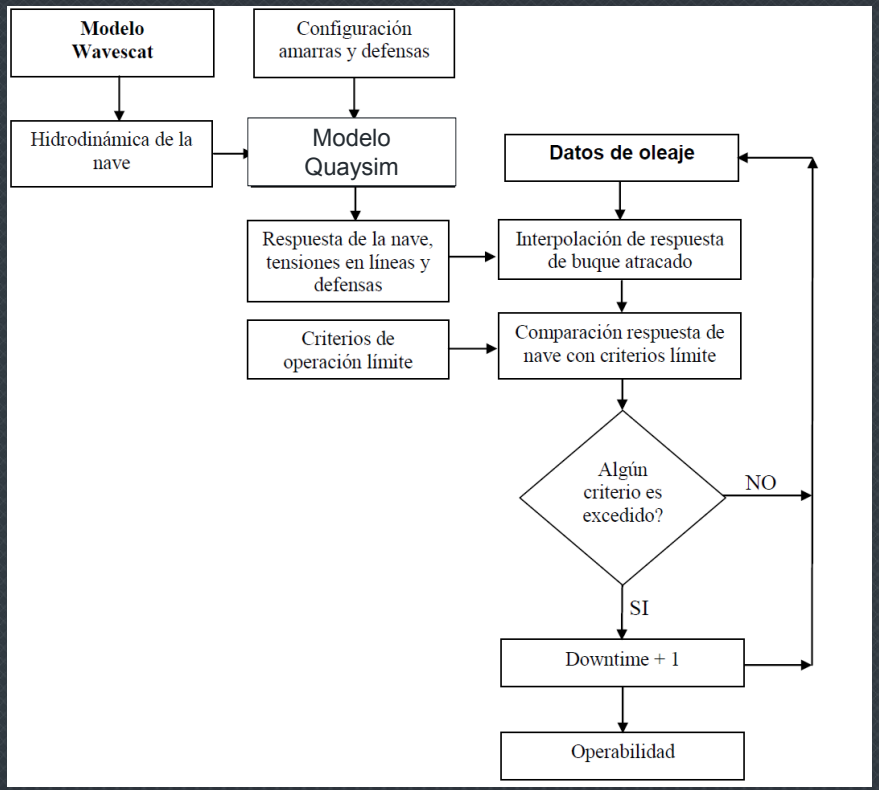
Metodología



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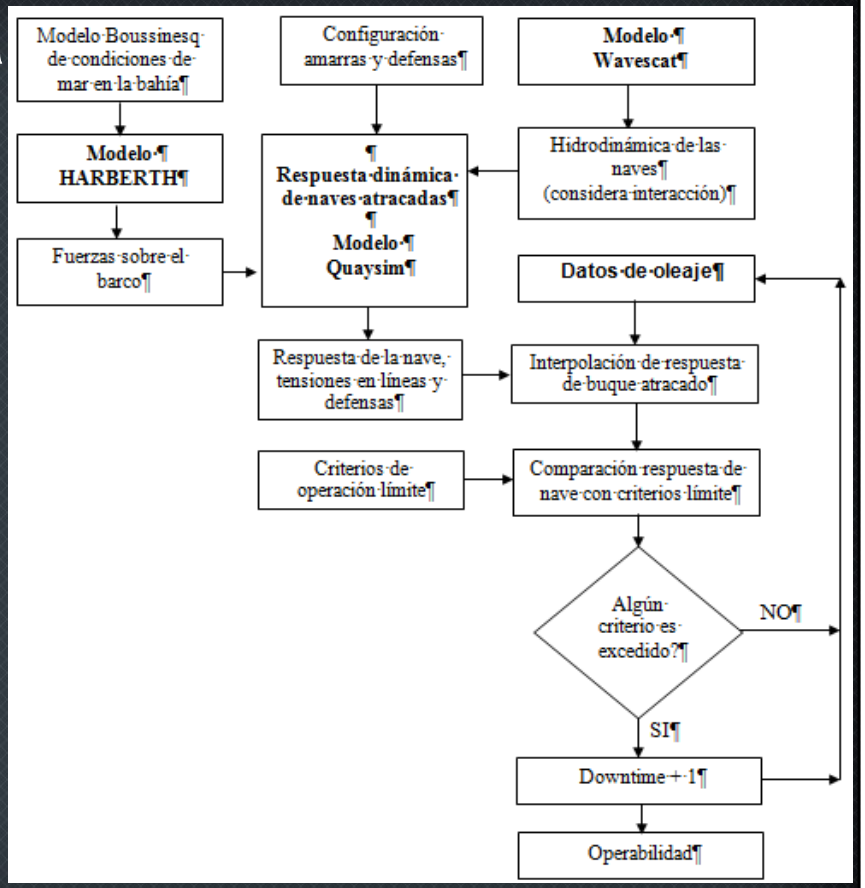
FSRU sin interacción

Metodología



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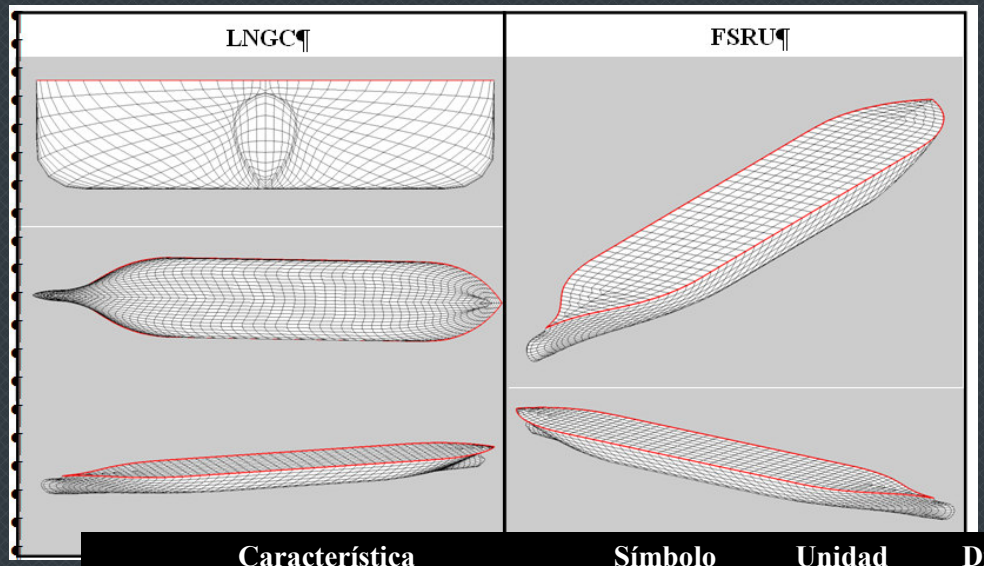
FSRU con interacción

Análisis de la respuesta de la nave

- Nave estudiada



Característica	Símbolo	Unidad	Dimensión
Eslora	L_{OA}	m	291
Largo entre perpendiculares	Lpp	m	280
Manga	B	m	43.4
Calado	T	m	11.6

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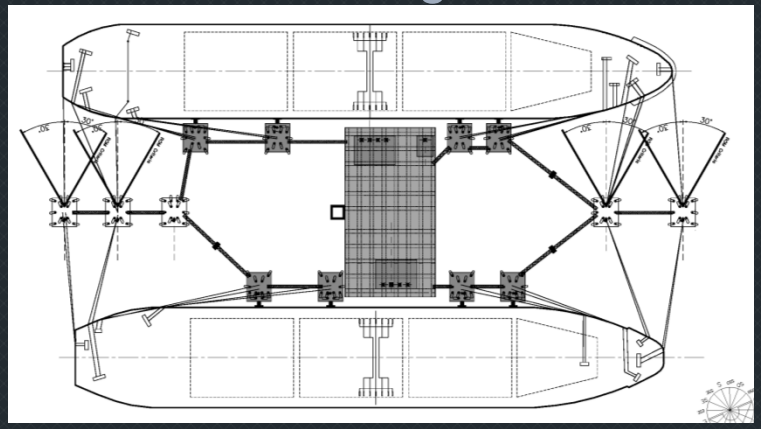
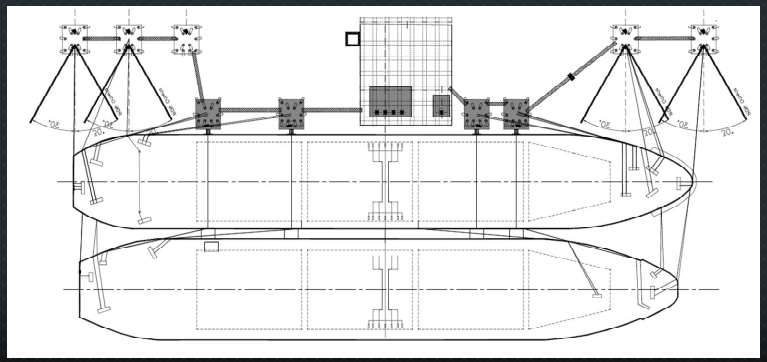
Análisis de la respuesta de la nave

- Terminales estudiados – configuración final

Atraque doble
Double jetty
Cross jetty



Abarloado
Ship to ship



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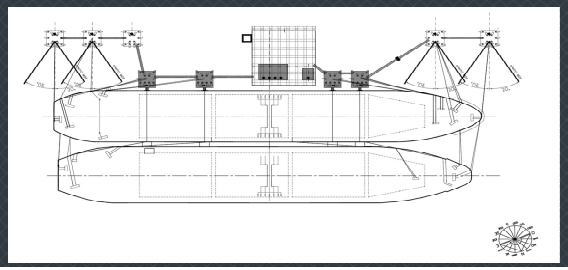
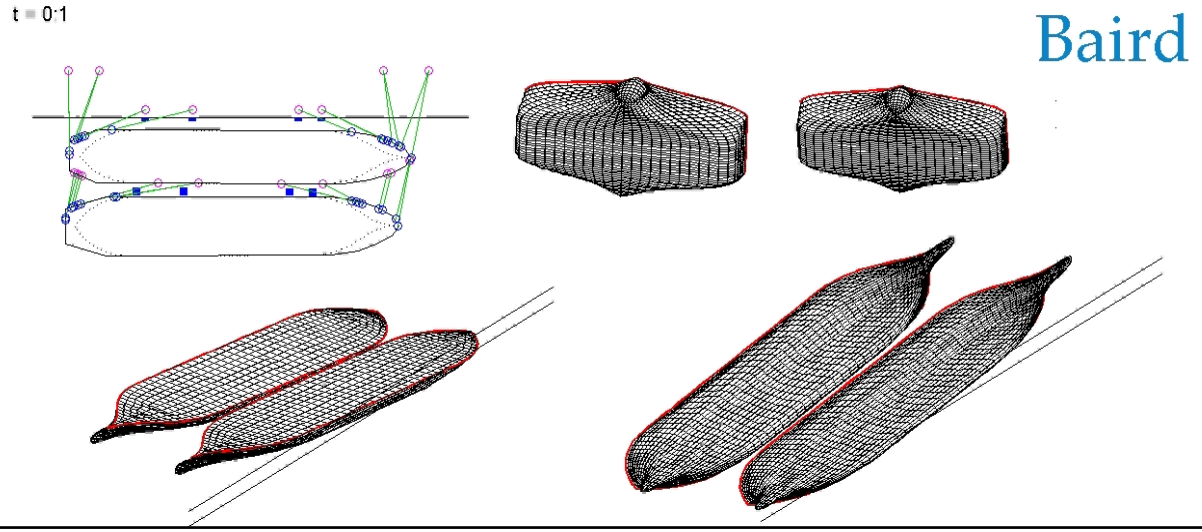
FSRU y LNGC

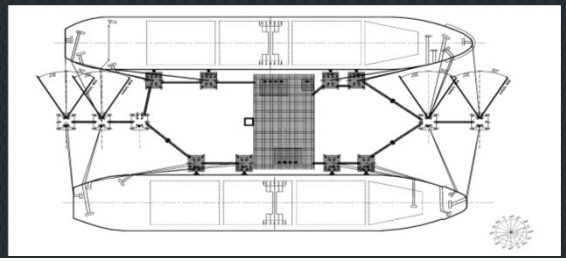
Ship to Ship

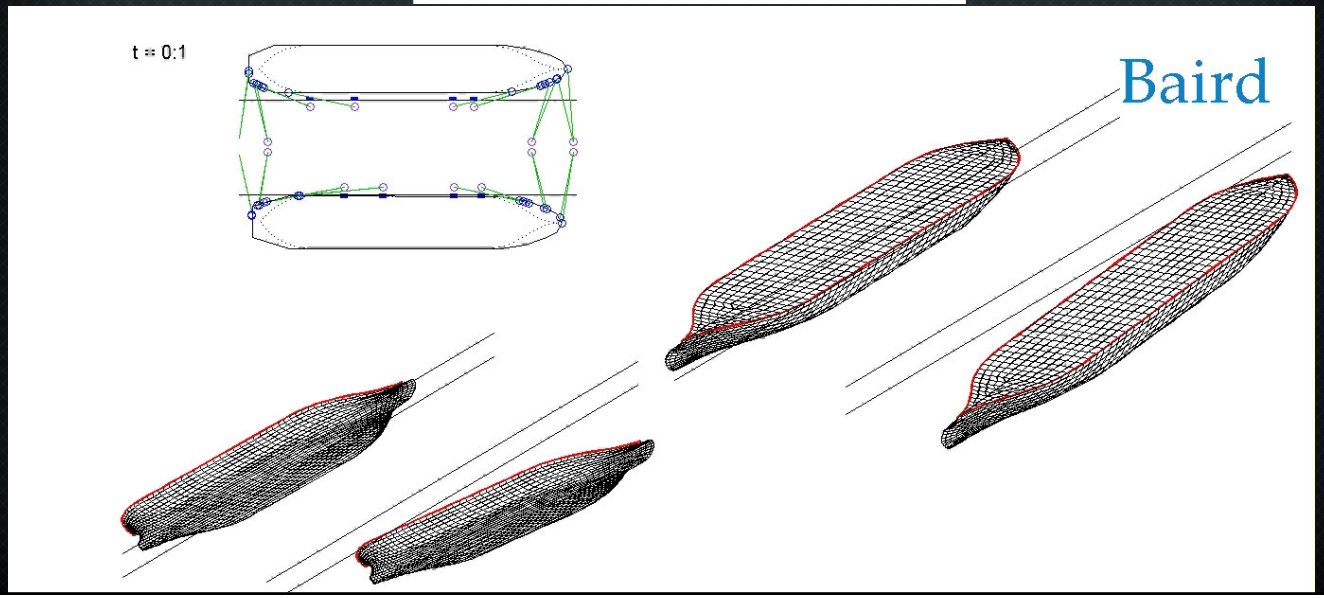




FSRU y LNGC

Cross Jetty

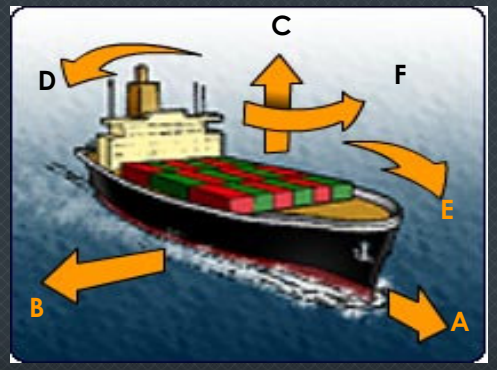




Análisis de la respuesta de la nave

- Criterios límite de movimiento

Criterio	Surge (Vaivén) A	Sway (Deriva) B	Heave (Alteada) C	Roll (Balance) D	Pitch (Cabeceo) E	Yaw (Guiñada) F
PIANC	2 m	2 m		2°	2°	2°



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Innovation and Technical Excellence • Exceptional Service • Financial Success • Client Satisfaction • Team Growth and Achievement •
Our Mission
An employee-owned company focused on outstanding client services for ocean, lake and river related projects. We take pride in our commitment to each member of our exceptional team; our collective success is realized through each individual's dedication to every client.
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Navigating New HorizonS
Our Vision
The pre-eminent company recognized worldwide for creative solutions where water meets land
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