Climate Change

C3S for Global Shipping

PICO presentation at C3S General Assembly Berlin
WHAT and for WHO?

• “C3S for Global Shipping” will be:
  – A CDS service for maritime end-users providing practical information (products) for improving *operational planning* and *strategic decision-making*
  – Information is provided on multi time-scales for a multitude of *indicators relevant to the shipping industry* (Climatology, Seasonal Forecast and Climate Projection)
WHAT and for WHO?

- Chemical tankers
- Cruise ships
- Bulk carriers

Iceberg collision risk

Tropical Cyclones, Storms, Hurricanes

Wind

Air temperature

Waves

Optimised routes at different times of year

Sea ice extend

Variations in route ETA

Sea surface temperature

Extreme events for wind, waves and precipitation

Precipitation

Barometric pressure

And more...
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- **Envisioned End-Users are:**
  - Commercial shipping companies
    - Potential for both liner service and tramp service activities
      - Tankers
      - Container vessels
      - Car carriers
      - LNG Floating Storage and Regasification Unit
      - Chemical tankers
      - Cruise ships
      - Bulk carriers
      - ...
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  - …
- Maritime Policy makers
  - IMO (International Maritime Organisation)
  - Classification societies
  - Port authorities
  - Protection & Indemnity Clubs
WHY and expected BENEFITS

More efficient Operational Planning
- Smarter route planning for more “Fuel Savings” potential.
- Better route planning for increased “Safety”.
- Better itinerary planning for commercial cruising.
- Fleet planning for efficient use of ship resources in different locations.
- Special activity planning such as ocean floor cabling.

Informed Strategic Decision-Making
- “Company financial planning”, e.g. quotations, ticket sales price, number of ship crew, etc., adapted to expectations of metocean conditions.
- “Infrastructure” design and construction to withstand climate change.
- “Ship Design” adapted to climate change and changing metocean conditions.
- “Business Planning” related to new routes becoming available for transport and cruising or existing routes becoming easier to navigate.
- “Fleet Renewal” taking into account changes in metocean conditions for years and decades to come.

Smarter Policy Making
- Improve maritime policy for sustainability of the shipping industry
E X A M P L E a p p l i c a t i o n s

Climatological probability of finding waves higher than user-defined threshold, in January (ERA5)

Percentage of sea states exceeding 3.65m Hs in January
EXAMPLE applications

Climatological significant wave height and seasonal forecast anomalies along a route (Estimated from ERA5)
Route optimization for evaluating Route Cost. The optimized route adjusts itself to the high waves for less resistance. (Significant wave height from ERA Interim.)
Northerly and southerly Northeast Passage as defined in [Mulherin et. al. 1999] and created by using historical voyages together with a route optimization model based on ice and weather information.
EXAMPLE applications

Left: Northeast passage division and corresponding regions used to calculate sea ice area in the regression. Right Projected sea ice concentration along North East Passage.
EXAMPLE applications

Left: Northeast passage division and corresponding regions used to calculate sea ice area in the regression. Right: Correlation between the monthly mean average sea ice area and average sectional sea ice concentration along the route.
Temporal evolution (1 year) of very large icebergs. Drifting started near Labrador coasts, volume shrinking indicated with colors (yellow=large, blue=small)
Probability of icebergs, tested for year 2015 based on icebergs drift numerical simulations from 2013 to 2015.
EXAMPLE applications

Percentile distribution of the total required energy along a route for New Panamax containership at 15kt (route: Bimini Island to Bishop Rock)
Example applications

Tropical cyclones indicator (CNR) [e.g. Gualdi et al., JC, 2008] based on the detection of cyclones in gridded data using the new ERA-5 reanalysis.
Thank you

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