Optimization of Ship Routes
With The Aid of
Numerical Ocean Current Prediction Models

Jason C.S. Yu & Dan H.C. Yu
Dept of Marine Environment & Engineering
NSYSU, Kaohsiung, Taiwan
jasonyu@mail.nsysu.edu.tw
Ship emissions

- For 2007
  - 3.3% of global CO2 emissions
  - 2.7% international shipping
  - 870 million tones CO2

- Can increase to 18% by 2050, if we do nothing!

(IMO, 2009)

Shipping and CO2

- Although international shipping is the most carbon efficient mode of commercial transport (30x more efficient than cargo aviation),
- total emissions are comparable to those of a major national economy, necessitating emission reduction (ICS, 2009)
Commitment

• The consensus of opinion within the global industry is that it will be possible for shipping to reduce CO2 emitted per tonne of cargo transported one kilometre (tonne/km) by 20% between 2005 and 2020,
• through a combination of technological and operational developments

ICS, Brochure “Shipping, World Trade and the Reduction of CO2 Emissions”

Inter-continental and Regional Link
Busy Asian Traffics

Navigation efficiency

- Less unit consumptions - mega ships
  - inter-continental + regional transfer

- Better fuel efficiency – optimized cruse speed
  - From normal (20~25kn) to slow steaming(18~20kn)
  - Minimal cost (12~15kn), lower may not lead better fuel efficiency
  - Shipping time may be the major consideration!

- Influence by winds, wave and currents
Maritime Efficiency and Environment

- ship size vs cruising speed
- Fuel consumption vs ship time
- Cost of fuel vs call frequency
- Emission vs Environment
- Global economy vs Climate Change
- Improvement of shipping technology!
- Alternative fuel? LNG is ongoing …
- Improving Operation
  - Better adaptation of the weather and sea state?

Ocean Currents in West Pacific

- Kuroshio
- Taiwan Warm Current
- China Coast Current
  - ZFCC, GDCC
- South China Sea
  - BPIOT (Branch of the Pacific to Indian Ocean Throughflow )
  - Luzon Gyre
  - Nansha Gyre
  - SCS Warm Current

(Zheng et al., 2006)
CWB - ROCFORS
– Regional Ocean Currents Forecasting OpeRational System

Pacific (OCM1)
NW Pacific (OCM2)
Taiwan (OCM3)

KUROSHIO
– A persistent ocean current system

Summer
Winter
Seasonal Variation of Currents in SCS

September

December

Tides on continental shelf
- Strong currents varying with time
Route from Singapore to North Asia through South China Sea

Against Currents

Strait Navigations (Taihongu → Kaohsiung)

Against Currents (flood)

Follow Currents (ebb)
Thanks for Your Attention