



# MATHEMATICAL MODEL FOR CHESS BOARD WAVES

MATHEMATICAL MODELLING STUDY GROUP

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# SQUARE WAVES

- “Beautiful sight to behold...but extremely dangerous” Carla Cassella
- Can appear and reappear within minutes, therefore unpredictable
- Common in shallow waters- **“IF YOU SEE THEM DON’T ENTER THE WATER”**
- Can often be seen off the western part of the Isle of Rhe or on the beaches of Tel Aviv
- Can be as high as 3m high and often referred to as “white walls”
- They are capable of tipping over large boats and are suspects of many historical shipwrecks

# WHAT CAUSES SQUARE WAVES?

- They are caused by rip currents and riptides
- These occur at the crossing of two seas in different directions
- Seems to be caused by the interaction of two wave patterns
- What causes their chessboard-like pattern?
- In which direction do they propagate?
- How fast would they travel?

# TASK FOR THE STUDY GROUP

THE STUDY GROUP IS REQUESTED TO:

- **describe the mechanism for the formation of square waves**
- arrive at a suitable mathematical model for the square waves
- **describe the propagation properties**
- Answer the question: Why do we not see square waves at Cape Point?

## SOME MATHEMATICS THAT MAY BE USED

- Shallow water wave theory
- Nonlinear Wave Equations ( such as Korteweg de Vries (KdV), Kadomtsev-Petviashvili (KP) equation, etc.)
- Cnoidal waves, Solitary waves and solitons