Introduction

1. Frontal meanderings ubiquitous in the ocean.
2. Accurate forecast generally a big challenge.
3. If models are sophisticated enough, what then?
   • parameter tuning—a laborious and tedious job
   • don’t know which to pick among many forecasts
4. Rule of thumb:
   • Model setting should permit the target dynamical processes
   • Parameter tuning should not hurt/alter the underlying dynamics
5. This forms constraints that
   • help model setup and parameter tuning;
   • help to pick from different forecasts the dynamically relevant one.

Underlying Dynamical Process

Take the Iceland-Faeroe front (Fig. 1) as an example, the dynamical process underlying its meandering is a **convective instability** in the west followed by an **absolute instability** in the interior (Liang & Robinson, 2004). Hence

• Model setting must admit absolute and convective instabilities,
• Parameter tuning should not hurt/alter the order of occurrence.

Application Example

• Event: The 22 August 1993 Iceland-Faeroe frontal meandering
• Model: The Harvard Ocean Prediction System (HOPS)
• Dataset: CTD measurements taken during Aug. 14-16, 1993

Conclusions

◆ Accurate prediction of a large frontal meandering requires a faithful reproduction of a convective instability in the upstream followed by an absolute instability in the interior.
◆ Parameters can be rather accurately set by analyzing the instability structure, saving numerous tedious labor of parameter tuning.
◆ If the convective/absolute instability process is not permissible, assimilating more observation and/or increasing resolution generally do(es) NOT help.
◆ Dissipation may cause instability and make a circulation more energetic!

References

Some reprints/preprints are available at http://people.seas.harvard.edu/~san/


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