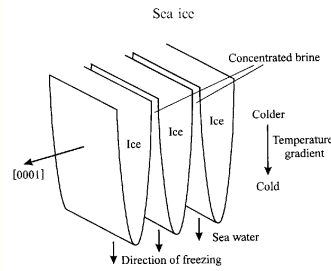
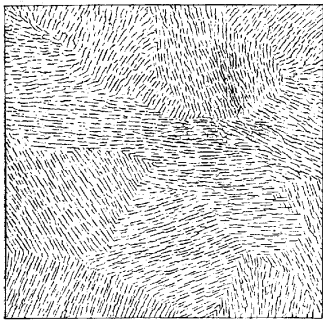


## 1 Plate spacing

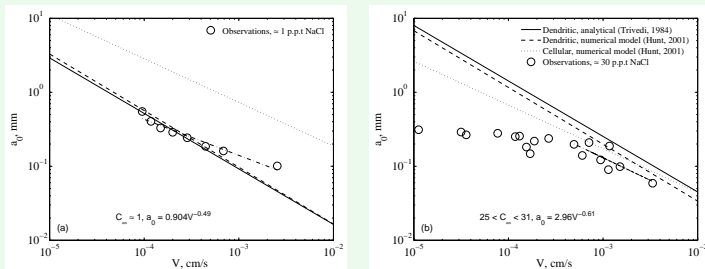


The *plate spacing* of sea ice<sup>1</sup> was already described by Drygalski (1897)<sup>2</sup>.

- Vertical plates parallel to the basal plane
- Fundamental subgrain structure of sea ice
- Basic lengthscale of salt entrapment.

Previous attempts to predict it from first principles were unsuccessful.

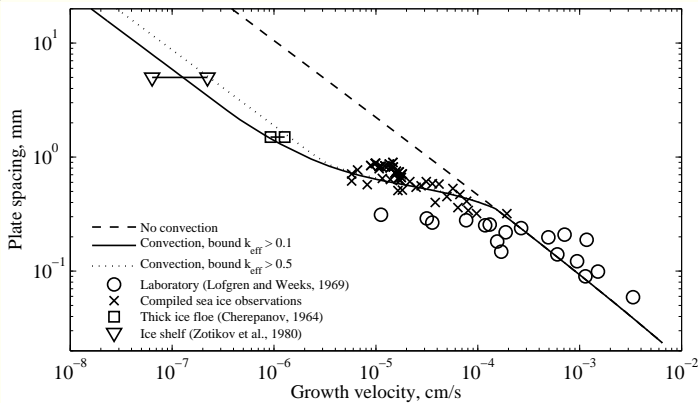
## 3 Dependence on Growth Velocity



Scaling laws from crystal growth models<sup>4,5</sup> are conceptionally important to understand the spacing selection. They

- Overpredict the growth velocity dependence
- Underestimate the plate spacing at high concentrations
- Do not account for natural free convection

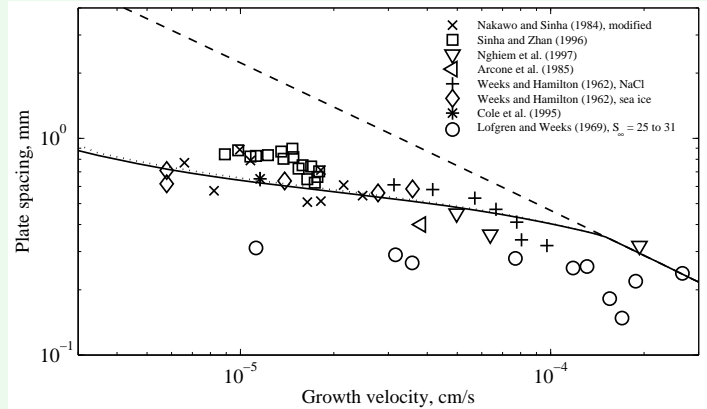
## 5 Model Predictions



The present model<sup>3</sup> predicts

- Plate spacings quantitatively
- The observed growth velocity dependence of 5 orders of magnitude
- The effects of convection on the microstructure
- Microstructural variability from rapidly growing thin ice to slowly accreting ice shelves

## 2 Field Observations

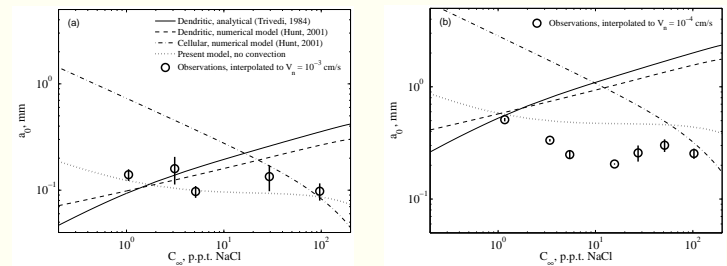


A comparison of available field observations<sup>3</sup> indicates

- A weak growth velocity dependence
- Other sources of variability (storage, observational methods) are moderate
- Large discrepancy between field and laboratory observations

The *purely diffusive* predictions of the present model approach<sup>3</sup> (dashed curve) demonstrate the importance to account for *natural convection* (solid curve).

## 4 Concentration dependence



Scaling laws from crystal growth models<sup>4,5</sup> do not predict the observed concentration dependence.

The present approach<sup>3</sup>

- Is quantitatively correct at high growth velocity (diffusive regime)
- Gives a realistic concentration dependence
- Must be modified for convection at low growth velocities

## 6 Present Model

The present model approach<sup>3</sup> is based on

- Morphological stability theory<sup>6</sup>
- Marginal stability of a macroscopic interface
- A simple turbulent haline convection parametrisation