NXIC Lag Correction

PURPOSE OF APPLICATION NOTE

The purpose of this Application Note is to describe the corrector factors that FSI uses in calculating salinity in the NXIC Conductivity Cell.

SUMMARY OF APPLICATION NOTE

LAG CORRECTION FOR THE NXIC CONDUCTIVITY CELL

Slow faster flushing conductivity sensor down to match disfusion of heat in/out of temperature probe.

Conductivity delayed using single pole recursive filter:

C(t)= a . C(t-Dt) + b.Co(t);

where C(t) = filtered cond.

Co(t) = measured conductivity

Dt = sample interval

Tau = temperature sensor time constant

a = weight related to temperature sensor time constant tau = lag;

b = (1-a)

if Tau >> Dt we can estimate a using;

a = e^-(Dt/Tau) (Bendat & Piersol, 1971)

as for slow sampling rate instruments: (i.e. as Tau approaches or exceeds Dt a better estimate is provided by;

C(t)= a . C(t-Dt) + b.(Co(t)+Co(t-Dt));

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a = (1 - 2b)

b = 1/[1 + 2 (Tau/Dt)] (Mudge & Lueck, 1994)

The temperature lag Tau has 2 lowering rate = W cm/s induced components

1: The temperature sensor is mounted (Dz=4 cm from the center) at the exhaust of the NIXIC cell.

This introduces a lowering rate dependent lag Tau:

Tau(Dz) = Dz/W

examples: Tau = .25 s @ 12 cm/s

Tau = .125 s @ 25 cm/s

Tau = .04 s @ 100 cm/s 1 m/s typical ship lowering rate

2: Lowering rate effects the thickness the thermal boundary layer as follows:

Tau(W) ~ k.Dr/(W^.5) Dr radius of temp. probe & k = constant

examples: Tau = 1.30 s @ 12 cm/s Excell (Schmitt, et al JMR 63, 2005.p. 285)

Tau = 0.80 s @ 32 cm/s

Total NIXIC lag is the sum:

Tau = Tau(W) + Tau(Dz)

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