J1.6 TURBULENT FLUX COMPARISON FROM R/V MEASUREMENTS DURING CATCH/FASTEX AND FETCH EXPERIMENTS

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1. INTRODUCTION

CATCH/FASTEX (North Atalantic, 1997) and FETCH (Mediterranean sea, 1998) experiments were two campaigns partly devoted to air-sea interactions (Eymard et al., 1999 and Hauser et al., 2000). They allowed measurements on a foredeck instrumented mast, respectively on R/V Le Suroit and l'Atalante, using a similar instrumentation: a sonic anemometer (R3HS by Gill Instr.) and a refractometer which signal is primarly dependent on air humidity. These data are being added to an air-sea interaction database whose address is http://www.dataserv.cetp.ipsl.fr/FLUX. Sea state and atmospheric conditions encountered during the two experiments were very different. A motion package (335B by TSS Ltd.) allowed to correct ship motion and therefore fluxes of momentum, sensible and latent heat were calculated by the eddy correlation method. The results are compared between the two experiments, as well with results obtained by the inertial dissipation method.

2. SENSOR CAPABILITY

The quality of the wind speed measurements obtained from the Gill sonic anemometer were good enough to allow the calculation of the dissipation rates. Unfortunatly, due to the poor quality of high frequency sound speed, only very rough estimates of the temperature variance were obtained. In contrast, the air refractometer is very promissing with perfect –5/3 slopes up to 25 Hz (Delahaye et al., 2001). Indeed, calculations of turbulent heat fluxes remains a challenge, at least for routine measurements above the sea surface for rough sea state.

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The TSS motion sensor could not provide the surge and sway accelerations. Only the heave and the pitch, roll and yaw angles were measured.

3. RESULTS FROM THE INERTIAL DISSIPATION METHOD (IDM)

Concerning momentum fluxes, the observed drag coefficients were found far higher than generally reported. During the CATCH experiment for example (Eymard et al., 1999), the drag coefficient was about 20% higher than the Smith (1980) value at 20m/s wind speed. For the FETCH experiment, the Cdn values were about 10 to 15% above this value and those from the ASIS Buoy (Dupuis et al., 1999; Drennan et al., 2001). Based on the numerical simulations applied to R/V Atalante in FETCH by Fluent Inc. (Nacass, 2001), this discrepency is fully explained by flow distorsion effects. Indeed, vertical displacement of 1m and horizontal wind speed lead respectively to 5% and 9% decrease of the Cdn value at 18m/s wind speed for wind directions at the bow. The effect of the flow distorsion is highly variable with the relative wind direction. This study should now be also realized for the CATCH experiment.

Concerning the latent heat flux, a preliminary study (Dupuis et al., 1999) showed a slight increase of Cen values with the wind speed. This increase is however very small while the flow distorsion correction is applied.

4. RESULTS FROM EDDY CORRELATION METHOD (ECM)

We present here only preliminary results where flow distorsion corrections were not considered. Additionaly, the method was only applied for the FETCH experiment because in this case roll and pitch angles were small and the horizontal accelerations were therefore neglected to correct the ship motion (Edson et al., 1998). This was not the case for the CATCH/FASTEX campaign.

Concerning momentun flux, the <u'w'> values were equivalent to u^2_* deduced from IDM (before distorsion correction).

As for latent heat fluxes, the mean value of Cen was smaller than one of IDM method (1.077 10^{-3}) and independent of wind speed. This results are also valid for the sensible heat fluxes because the mean value of Chn is smaller than the IDM Chn (0.868 10^{-3}) and varies slightly with the wind speed. Furthermore the standard deviation is clearly inferior compared with the IDM method.

5. DISCUSSION

Our results shows that i) the effect of flow distorsion is important when the IDM method is applied; ii) this does not seem to be the case for the ECM method because variations of the heat fluxes with the wind speed remain negligible; iii) further computations considering the influence of flow distorsion with the ECM method and applied to the CATCH/FASTEX experiments will permit us to confirm the previous observations.

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