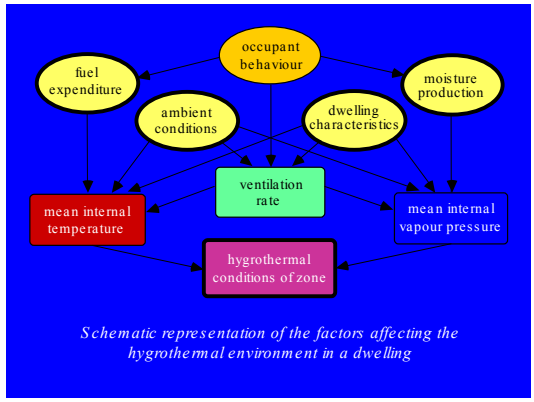
Modelling the Bed Environment

The Simple Steady State Model



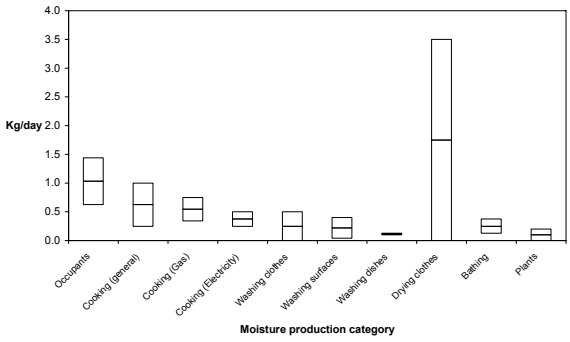
Schematic representation of the factors affecting the hygrothermal environment in a dwelling

The Simple model

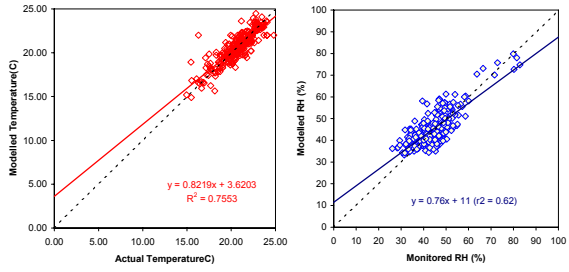
- A steady-state hygrothermal model
- Condensation Targeter II
  - Thermal model: BREDEM-8
    - A monthly domestic energy model produced and validated by the BRE
  - Moisture model: Loudon's moisture model
    - A simple steady state moisture balance which treats the dwelling as a single zone and does not deal with moisture adsorption / desorption

Condensation Targeter II

- In addition to the implementation of a moisture model within BREDEM-8 a detailed review of moisture production rates in dwellings has been carried out and a sophisticated moisture production rate calculation has been developed



Validation of Condensation Targeter II

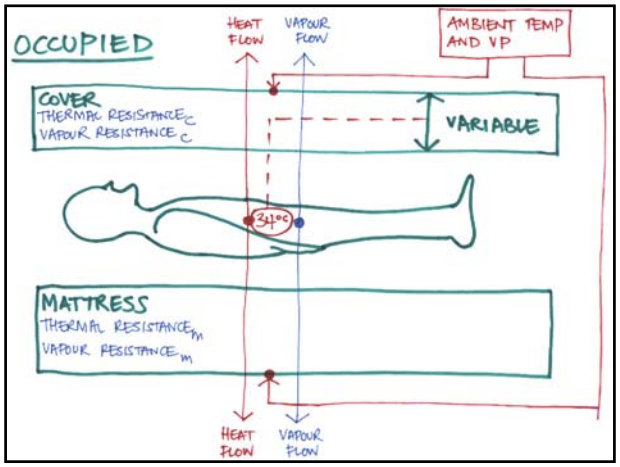


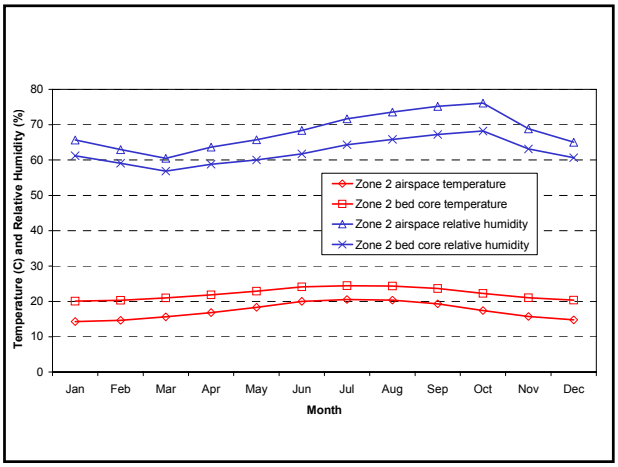
The BED3 model

- Condensation Targeter II used to predict the ambient conditions of temperature and vapour pressure within the bedroom
- BED3 model then used to determine the conditions within the bed
  - BED3 calculates temperature and vapour pressure whilst bed is occupied
  - BED3 assumes ambient temperature and vapour pressure whilst bed unoccupied

The BED3 model

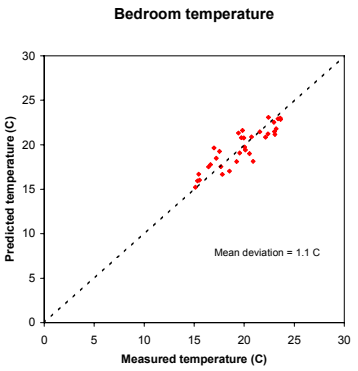
- The thickness of the cover (tog) is varied so that the comfort temperature (34 C) is always maintained whilst the bed is occupied
- Upward and downward heat and moisture movement is calculated *whilst the bed is occupied* based upon the thermal and vapour resistance of the mattress and the cover (and their thickness)
- Average temperature and RH in the bed is then determined

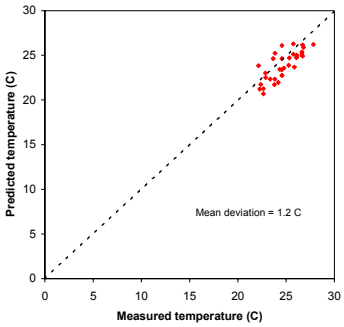


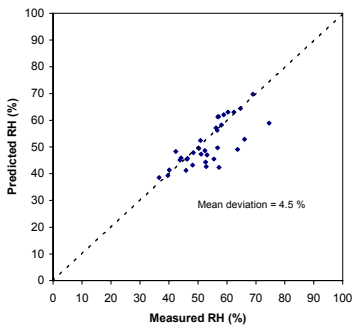


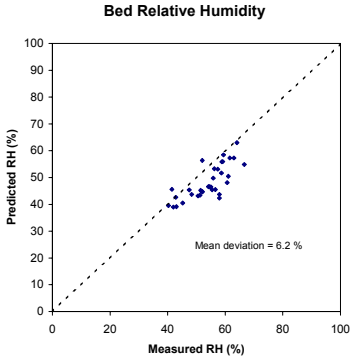
Validation of BED3

- Monitored bed conditions for a full year in three houses have been compared to the BED3 predicted bed conditions
- September 2000 to August 2001
- Monthly averages have been determined for measured conditions



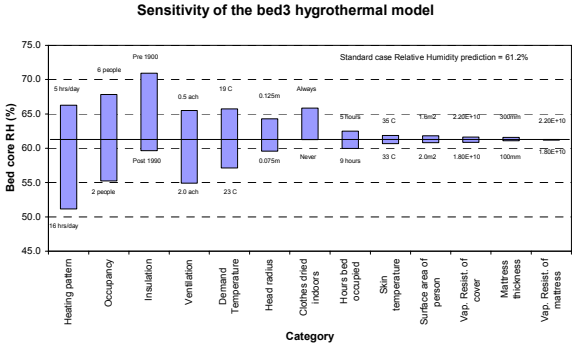






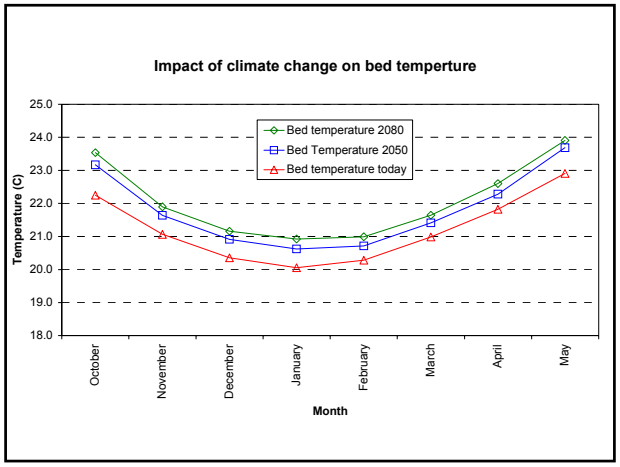
BED3 model sensitivity

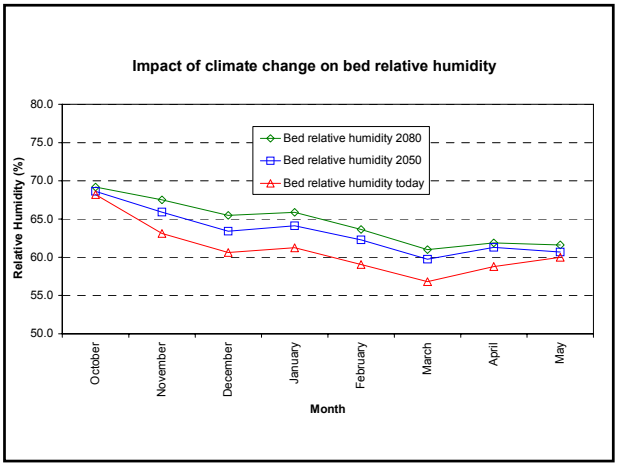
- The sensitivity of the BED3 model has been tested
- The impact of various model input parameters on the bed RH has been examined
- Building input parameters have a more significant impact on the bed core RH than occupant input parameters



Climate change analysis

- The BRE published UK climate change scenarios in early 2001 which gave an indication of the likely changes in external temperature and vapour pressure in the UK in 2050 and 2080
- Using this information the model's climatic data has been modified and the impact of climate change on the bed core conditions has been assessed
- A typical modern semi-detached dwelling in London has been modelled during the heating season
- The indications are that things are only going to


Impact of climate change on bed temperture
Bed temperature 2080
Bed Temperature 2050
Bed temperature today
Temperature (C)
25.0
24.0
23.0
22.0
21.0
20.0
19.0
18.0
October
November
December
January
February
March
April
May
Month


Impact of climate change on bed relative humidity
Bed relative humidity 2080
Bed relative humidity 2050
Bed relative humidity today
Relative Humidity (%)
80.0
75.0
70.0
65.0
60.0
55.0
50.0
October
November
December
January
February
March
April
May
Month