# Addendum Page (Changes to Chapters 3 and 11)

## Changes to Chapter 3, Final draft Report (22 October 2000)

3.1 introduction, para 1, last sentence: Atmospheric $CO_2$ concentrations have been measured **directly** with high precision since 1957

3.1 introduction, para 2, second sentence: First, atmospheric $O_2$ is declining at a rate comparable with fossil-fuel emissions of $CO_2$ **(combustion consumes $O_2$).**

3.2.2.1, 4th paragraph, 3rd sentence: Annual NEP **flux** measurements

3.2.2.1, 4th paragraph, last sentence: the current biased distribution of **flux** measuring sites

3.2.2.2, "savannas ..." subsection, 5th sentence: *remove* **Queensland,**

3.2.2.3, 2nd para, third sentence from end: add reference Oechel *et al.*, 2000

3.2.2.4, 4th para. Insert new sentence after second sentence: **Increased $CO_2$ concentration may also stimulate nitrogen fixation (Hungate *et al.*, 1999; Vitousek & Field, 1999).**

3.2.2.4, 5th para, insert text at end of first sentence:... water saving **and interactions between the carbon and nitrogen cycles**

3.2.2.2 7th paragraph, 6th sentence,: However, field experiments suggest a more complex picture with $C_4$ plants doing better than $C_3$ under elevated $CO_2$ due **to** improved WUE at the ecosystem level

3.2.2.2 7th paragraph, remove 8th sentence: **Experiments in forests are expensive and technically challenging thus there is insufficient long-term data**

3.2.2.2 7th paragraph, 9th sentence: Long-term field studies on young trees have **typically** shown a stimulation of

3.2.2.2 8th paragraph, replace with: At high $CO_2$ concentrations there can be no further increase in photosynthesis with increasing $CO_2$ (Farquhar *et al.,* 1980), except through further stomatal closure, which may produce continued increases in WUE in water-limited environments. The shape of the response curve of global NPP at higher $CO_2$ concentrations than present is uncertain because the response at the level of gas-exchange is modified by incompletely understood plant- and ecosystem-level processes (Luo *et al.,* 1999). Based on photosynthetic physiology, it is likely that the additional carbon that could be taken up globally by enhanced photosynthesis as a direct consequence of rising atmospheric $CO_2$ concentration is small at atmospheric concentrations above 800 to 1000 ppm. Experimental studies indicate that some ecosystems show greatly reduced $CO_2$ fertilisation at lower concentrations than this (Körner, 2000).

3.2.2.5, last para, last sentence, replace $O_3$ with ozone

3.2.2.6, 1st para, 1st sentence, replace $O_3$ with ozone

3.3.1, 1st para, last sentence, replace last three words with: relevance to the **atmospheric $CO_2$ response to emissions over the next hundred years**.

3.3.3, para 1, last sentence, insert text: . Preliminary $\delta^{13}C$ measurements **(see Box 3.6)** suggest

3.3.3 2nd para, these are two separate paragraphs ending: "..trends consistent with the ice-core records." and beginning "Figure 3.2b shows the.."

3.5.2, 5th para, remove **definitive** in third sentence: but there is no **definitive** proof of any connection between these events.

3.6.1, 1st para, remove words in brackets: Models can be run with prescribed inputs such as observations of surface climate and $CO_2$ or **(for scenario analyses)** the output

3.6.1, 1st para, last sentence, add text: They can also be directly coupled to atmospheric **general circulation** models (Cox *et al.*, 2000),

3.6.2.1, 1st para, last sentence, replace **first order** with **resonable**

3.6.2.1, 2nd para, last sentence, replace **a wide range** with **conflicting**

3.6.2.1, 3rd para, 3rd sentence replace **considerable divergence** with **differences**

3.6.2.1, 4th para, 4th sentence, add reference:... climate (**Denning *et al.*, 1996**; Hunt *et al.*, 1996; Heimann *et al.*, 1998; Nemry *et al.*, 1999).

3.6.2.1, 5th para, 1st sentence, add reference: (Kindermann *et al.*, 1996; Heimann *et al.*, 1997; Gérard *et al.*, 1999; **Ito and Oikawa, 2000;** Knorr, 2000; Prentice *et al.*, 2000).

3.6.2.1, 5th para, 3rd sentence, remove **is a robust** and **that**: This **is a robust** result **that** has been obtained with a range of models

3.6.2.1, 5th para, change last sentence to: **T**he low $CO_2$ **growth** rate during the early 1990s has been **simulated** by some **terrestrial models** (Prentice *et al.*, 2000; Knorr, 2000).

3.6.2.2, 1st para, 2nd sentence, add text and remove full stop after (2000): McGuire *et al*. (2000) used two TBMs and two DGVMs driven by changes in atmospheric $CO_2$, then **changes in** $CO_2$ with historical changes in climate (from observations), and finally **changes in** $CO_2$ and climate with land-use change from Ramankutty and Foley (2000) (Figure 3.8; Table 3.4).

3.6.2.2, 2nd para, second sentence, remove **and** and insert text: The anthropogenic nitrogen input itself (Holland et al., 1999),***and*** the fate of anthropogenic nitrogen in the ecosystem (Nadelhoffer *et al.,* 1999; Jenkinson *et al.,* 1999), **and changes in ecosystem nitrogen fixation (Vitousek and Field, 1999)** represent major sources of uncertainty.

3.7.1 1st para, 1st sentence**: P**ossible feedbacks from terrestrial carbon cycling to atmospheric $CO_2$ **were assessed** using multiple models **by Cramer *et al.*, (2000). S**ix DGVMs (Figure 3.10a) (Friend *et al.,* 1997; Foley *et al.,* 1996; Brovkin *et al.,* 1997; Woodward *et al.,* 1998; Huntingford *et al.,* 2000; Sitch *et al.,* 2000) were driven **first** by $CO_2$ concentrations according to the IS92a emissions scenario, and **then** with $CO_2$ changes plus climate changes derived from the HADCM2 **coupled ocean-atmosphere general circulation model** simulation **including sulphate aerosol effects** as described by Mitchell *et al.* (1995).

3.7.1 1st para, 2nd sentence**:** climate responses of NPP **to climate** specific to each plant functional type (PFT)

Box 3.7, part 2, remove comma after: Jain *et al.*

3.7.3.2, 1st para, second sentence: In the **SRRF** comparison of 18 global carbon cycle models (Enting *et al.,* 1994; Schimel *et al.,* 1995) the $CO_2$ **fertilisation** response of the land was calibrated to match the central estimate of the global carbon budget for the 1980s

3.7.3.4, 2nd para, 6th sentence, add reference: $CO_2$ (**Siegenthaler and Oeschger, 1978**; Maier-Reimer and Hasselmann, 1987; Sarmiento *et al.,* 1992).

3.7.3.4, 2nd para, penultimate sentence: this sink is estimated to be **smaller than** ≈ **–**0.1 PgC/yr (Archer *et al.,* 1998). [i.e. minus in front of the number]

3.7.4 2nd para, 3rd sentence: There is considerable uncertainty in **projections of** future $CO_2$ **concentration**, because of uncertainty about the effects of climate change on the processes determining ocean and land uptake of $CO_2$.

**References**

Add:

**Denning,** A.S., D. A. Randall, G. J. Collatz, and P. J. Sellers, 1996: Simulations of terrestrial carbon metabolism and atmospheric $CO_2$ in a general circulation model. Part 2: Spatial and temporal variations of atmospheric $CO_2$. *Tellus*, 48B, 543-567.

**Hungate**, B.A., P. Dijkstra, D.W. Johnson, C.R. Hinkle and B.G. Drake, 1999: Elevated $CO_2$ increases nitrogen fixation and decreases soil nitrogen mineralization in Florida scrub oak. *Global Change Biology*, **5**, 781-789.

**Ito A.** and T. Oikawa, 2000: The large carbon emission from terrestrial ecosystem in 1998: A model simulation, *Journal of the Meterological Society of Japan*, **78,** 103-110

**Jarvis**, P. and S. Linder, 2000: Botany - Constraints to growth of boreal forests. *Nature*, **405**, 904-905.

**Siegenthaler**, U. and H. Oeschger, 1978: Predicting future atmospheric carbon-dioxide levels. *Science*, **199**, 388-395

**Vitousek,** P.M. and C.B. Field, 1999: Ecosystem constraints to symbiotic nitrogen fixers: a simple model and its implications. *Biogeochemistry*, **46**, 179-202.

Change:

Keeling **C.D** and Shertz, 1992 should be Keeling **R.F**. and Shertz, 1992

Denman et al 1996: replace "feefbacks" by "feedbacks"

Denning et al 1999 reference should be changed to:

**Denning**, A. S., M. Holzer, K. R. Gurney, M. Heimann, R. M. Law, P. J. Rayner, I. Y. Fung, S.-M. Fan, S. Taguchi, P. Friedlingstein, Y. Balkanski, J. Taylor, M. Maiss, and I. Levin, 1999. Three-dimensional transport and concentration of $SF_6$: A model intercomparison study (TransCom 2). *Tellus,* 51B, 266-297.

in Fischer et al (1999), Whalin should be Whalen

in Fan et al (1998) add authors: , S Pacala, J Sarmiento, T Takahashi and P Tans

in Peybernes et al (2000) replace "deducted" by "deduced"

# Changes to Chapter 11, Final draft Report (22 October 2000)

Page 4 Line 11, add:
It is very likely that 20th century sea level rise is at least partly due to 20th century climate change.

Page 29 Line 22, add:
The sum of terms not related to 20th century climate change is -1.1 to +0.9 mm/yr, less than the observational lower bound of sea level rise. Hence it is very likely that 20th century sea level rise is at least partly due to 20th century climate change.

Renumbered figures:
5 becomes new 3, old 3 becomes new 4, old 4 becomes new 5.