

Arbovirus, Epidémies et Epidémiologie moléculaire en Nouvelle-Calédonie (et dans le Pacifique)

*Arboviruses, Epidemics and Molecular Epidemiology:
applications to New Caledonia (and the Pacific)*

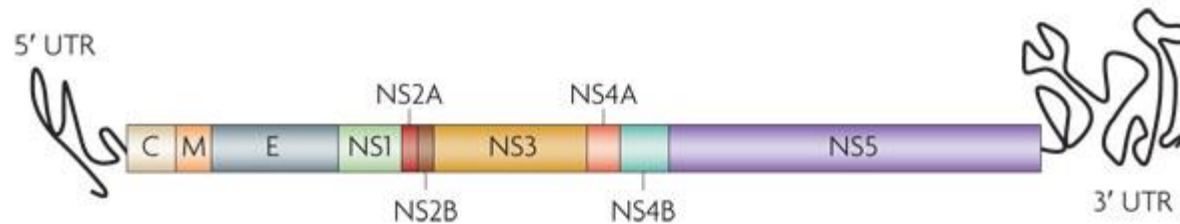
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Arboviruses

- ▶ Arboviruses (Arthropod-borne viruses)
 - *Flaviviridae*
 - Dengue (1 to 4), Yellow fever, Zika ...

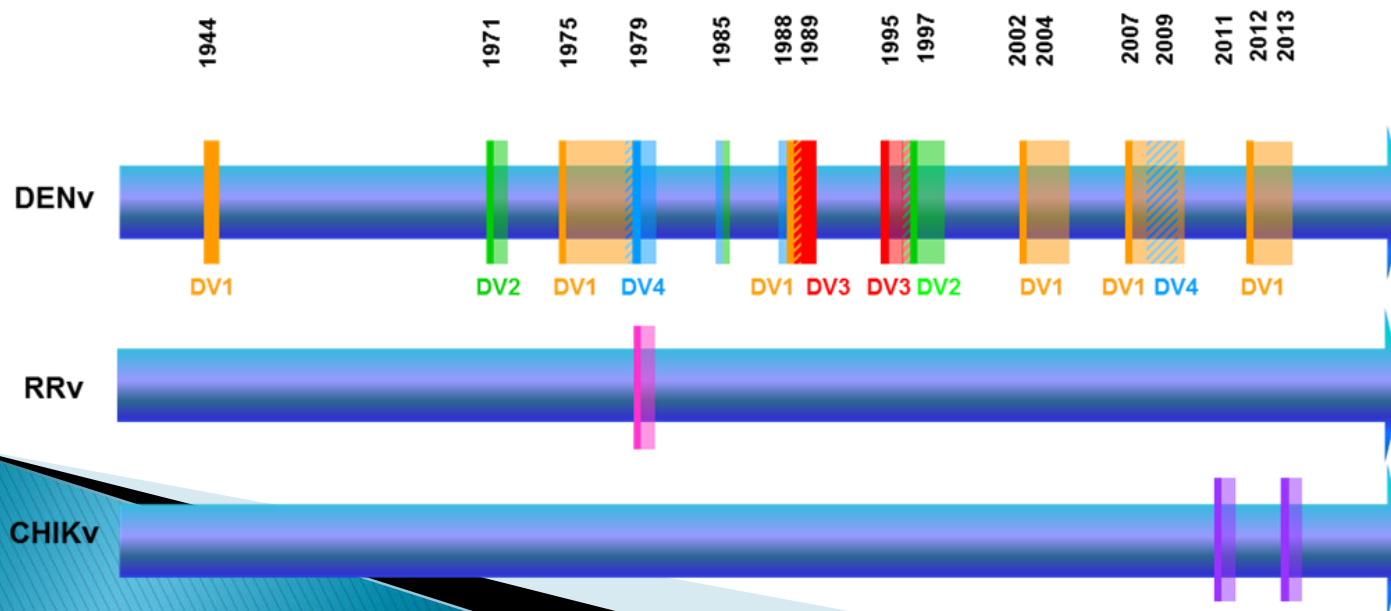


Guzman et al. 2010

- *Togaviridae*
 - Chikungunya, Ross River...
- All RNA viruses:
 - Genetic plasticity
 - Replication cycles in vertebrate hosts and arthropods

What about NC?

- ▶ History of DENV/arboviruses epidemics:
 - Earliest: second part of the XIXth century
 - World War II, first reported dengue pandemic (DENV-1)
 - Since the 70s, whole chains of DENV epidemics occurred in the Pacific and in NC



Why studying the molecular epidemiology of Arboviruses?

▶ Phylogenetic studies

◦ Genotype definition:

- Genetically distinct
- Geographically based
 - Ex: DENV-1 = 5 genotypes (SE-Asia, Thailand, Malaysia, Pacific, American)
 - Ex: CHIKV = West Africa, Asian, East-Central-South Africa

◦ Follow genotype introduction, replacement and extinction

Why studying the molecular epidemiology of Arboviruses?

▶ Example

- DENV-2 epidemic in Americas
 - American to SE-Asian genotype replacement
 - Severity (DHF/DSS) linked to SE-Asian genotype (Rico-Hesse et al., 1997)
- Observation associated with:
 - *Ae. aegypti* infection rate higher for SE-Asian genotype
 - SE-Asian genotype replicate more efficiently in human dendritic cells

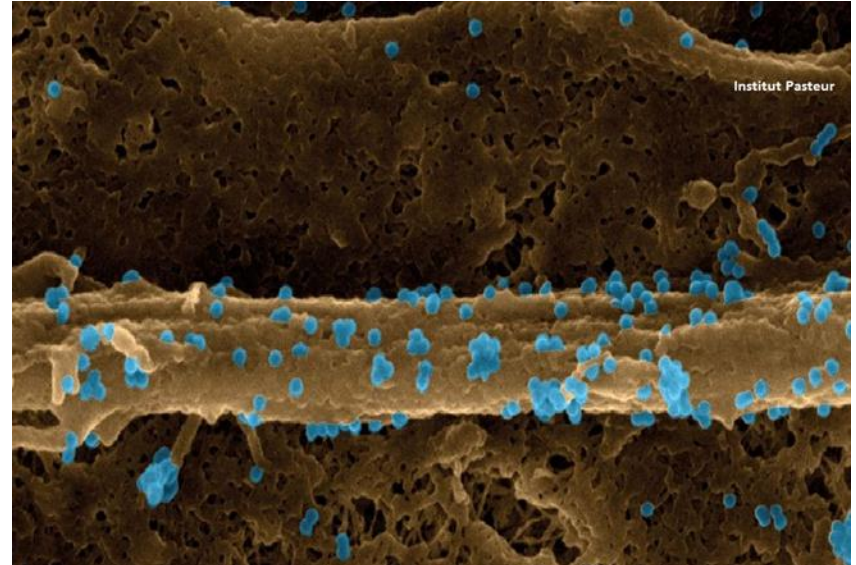
Chikungunya

▶ CHIKV

- 3 lineages:
 - West Africa
 - Asia
 - ECSA

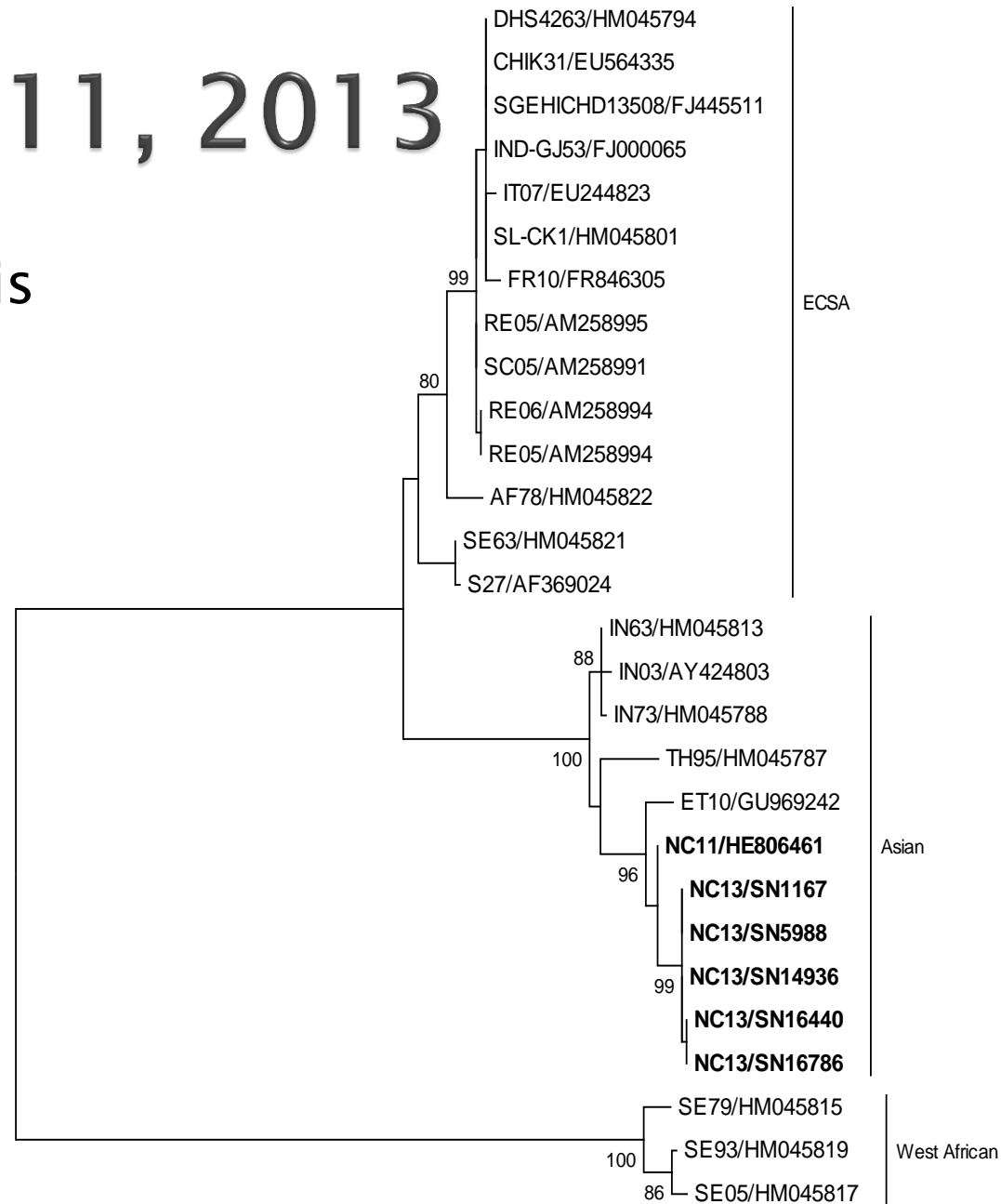
▶ Outbreaks

- In the past: Africa–Asia
- Re-emerged in 2006 in Indian Ocean Region and South–East Asia
- Adaptation to *Aedes albopictus*/ ECSA mutation E1 – A226V



CHIKV-NC 2011, 2013

- Phylogenetic analysis

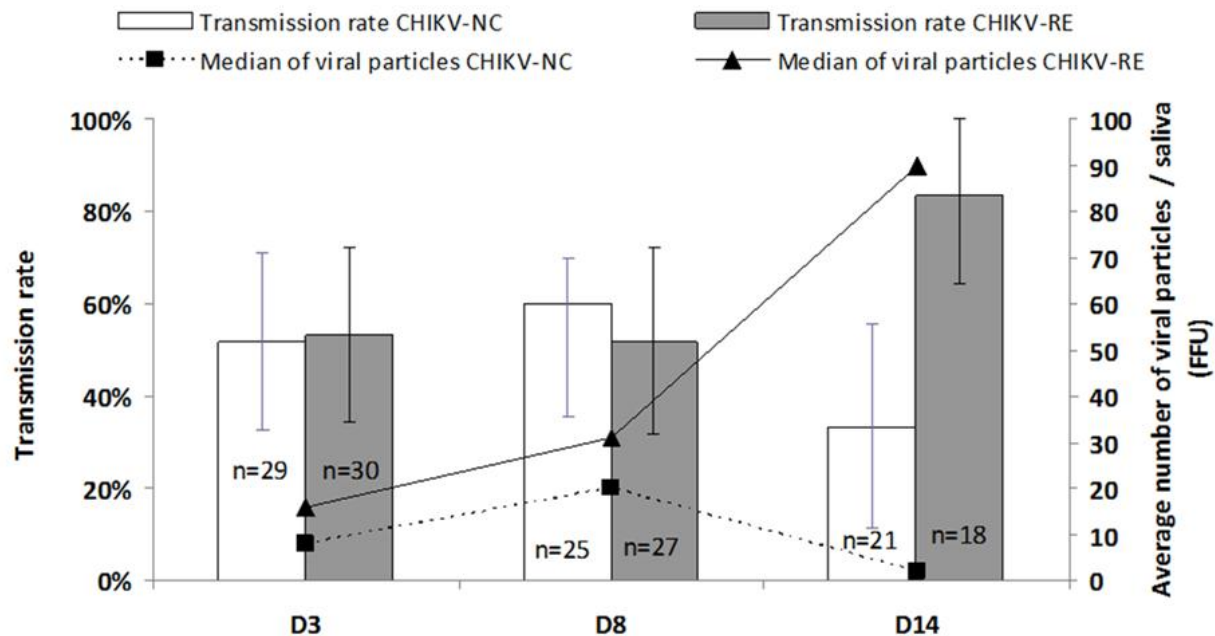


ML K2P, 1000 replicats, Partial E1

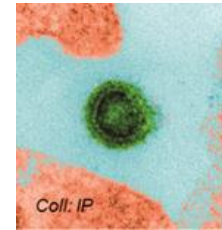
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CHIKV-NC 2011

- CHIKV-NC 2011, vector competence study on the local *Ae. aegypti*



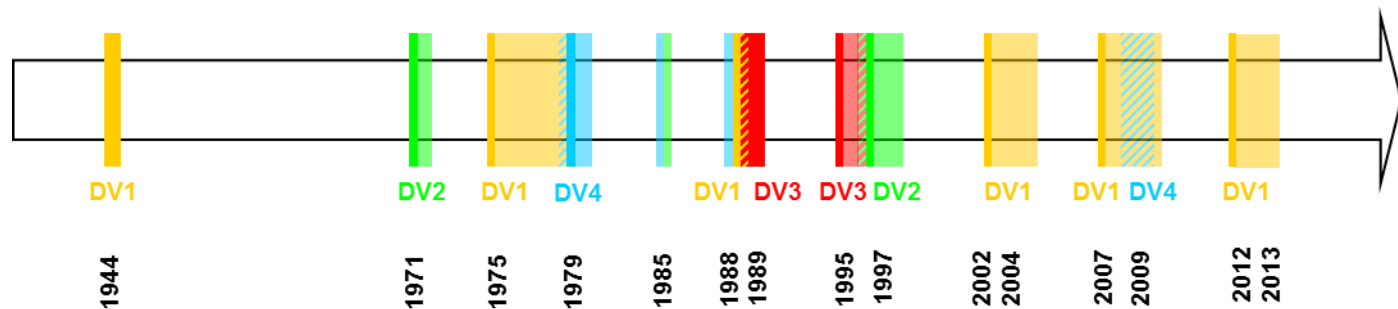
Dengue



▶ DENV

- 4 antigenically distinct serotypes (DENV-1-4) (+5?)
 - Genotypes: genetically distinct within a serotype

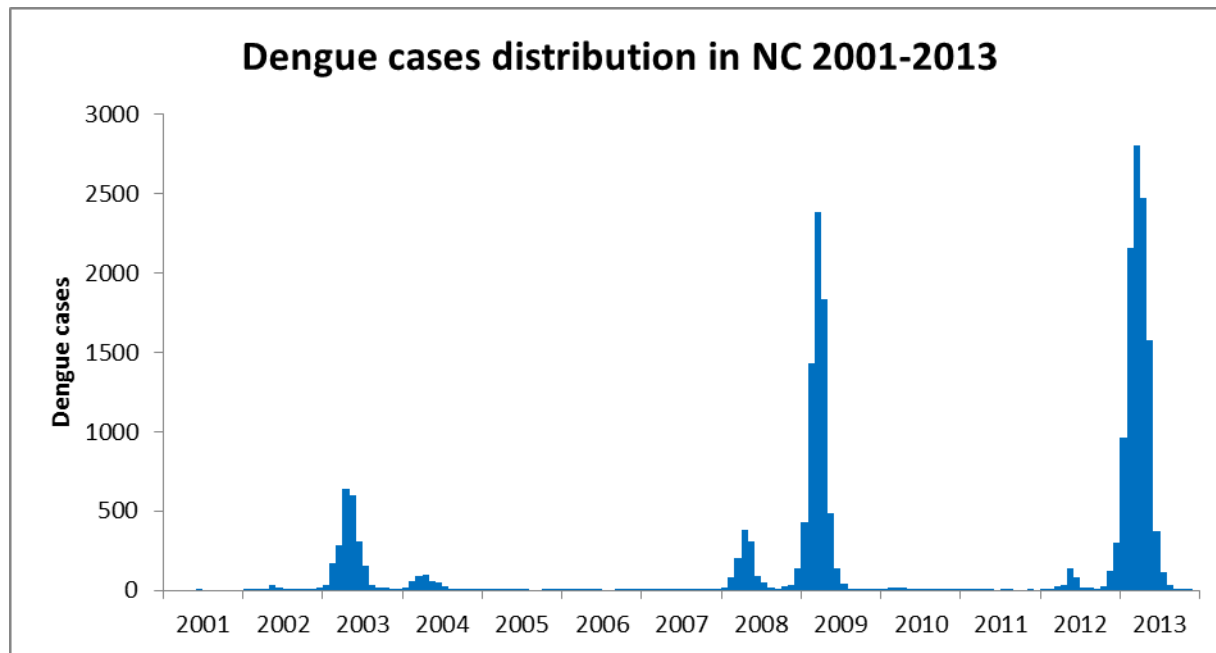
▶ DENV in NC



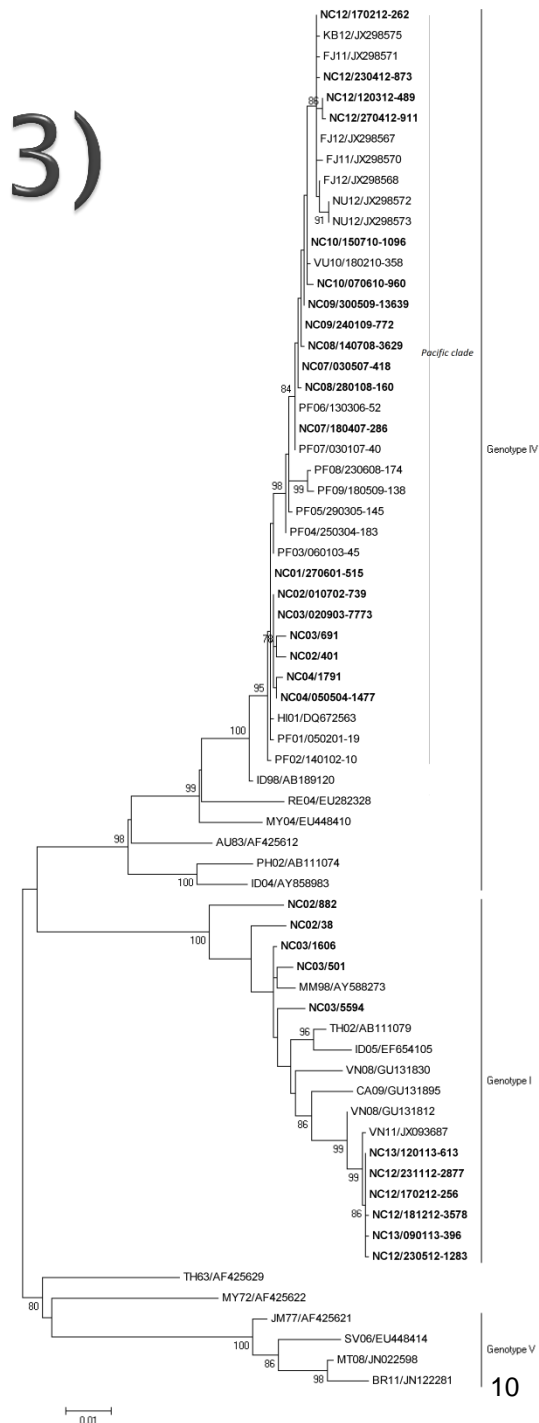
- Unusual persistence of DENV-1 circulation in NC

DENV in NC (2001-2013)

► Phylogenetics studies

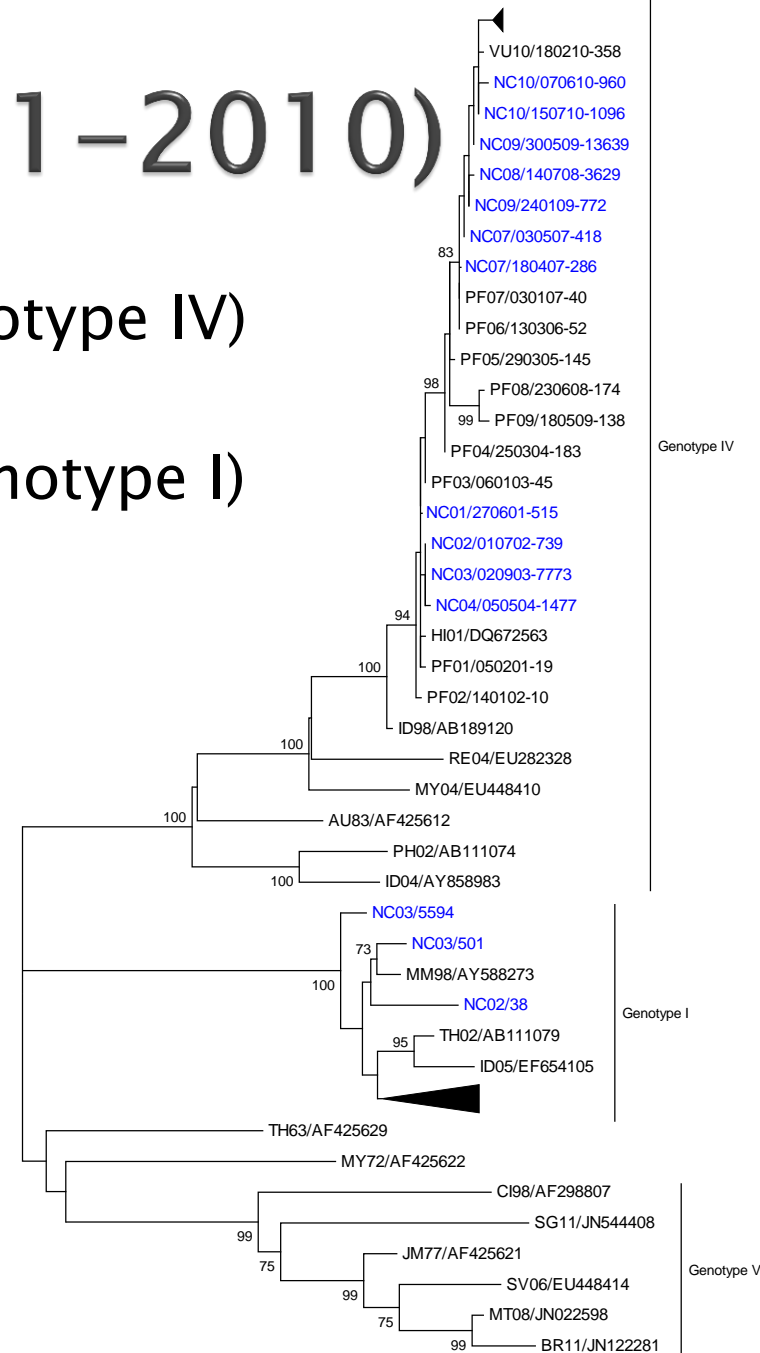
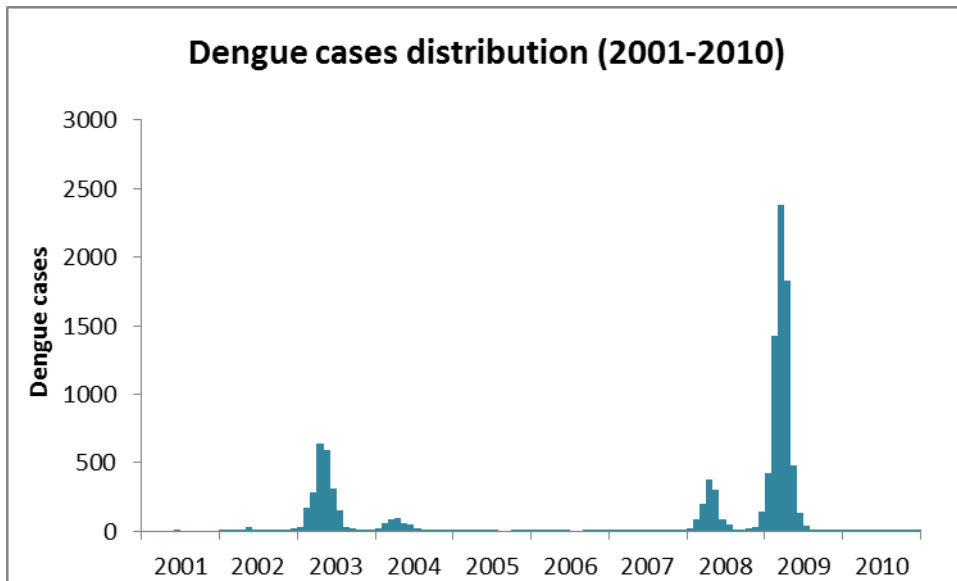


ML K2P, 1000 replicats, *E gene*



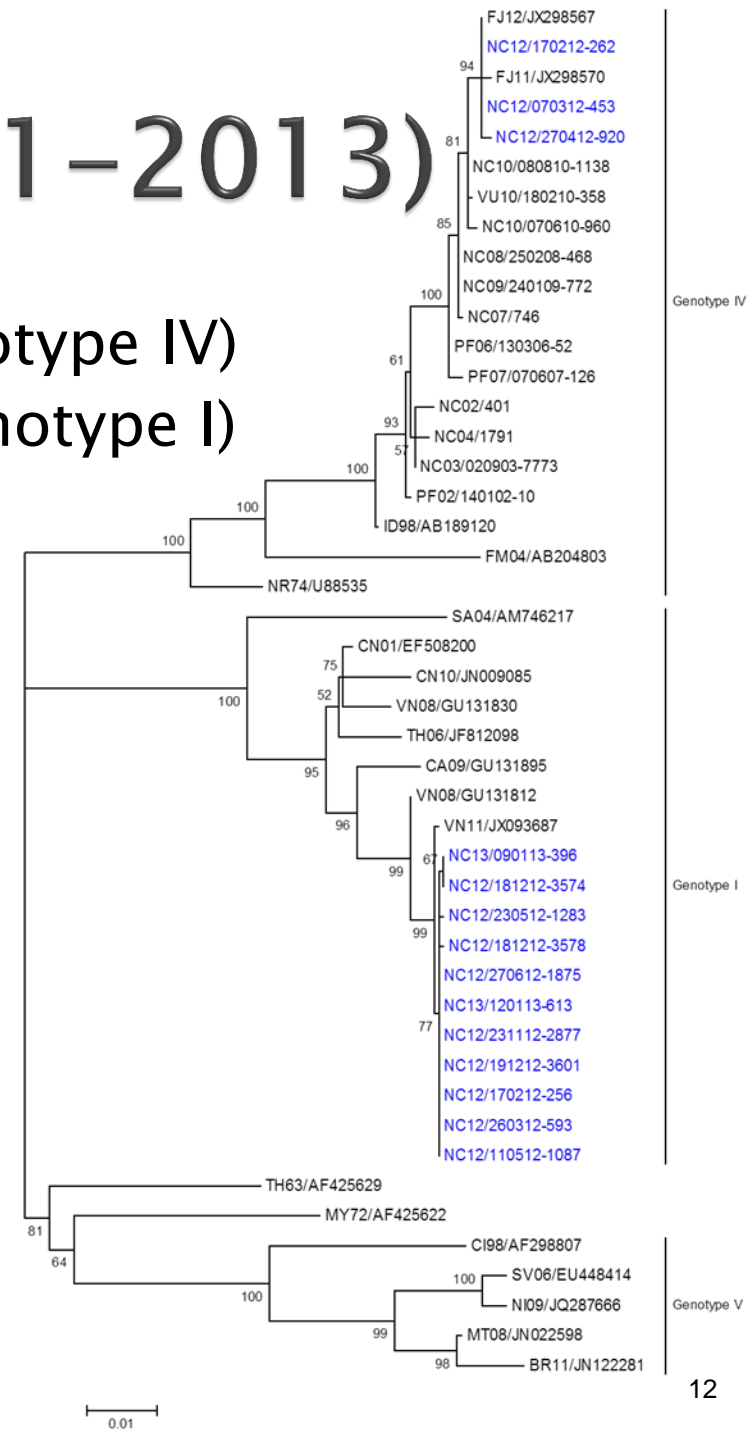
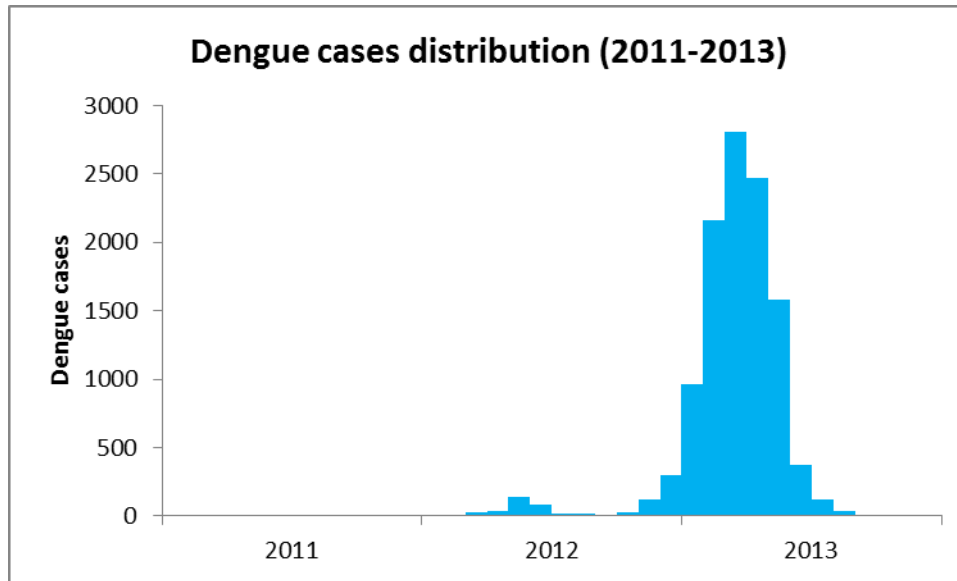
DENV-1 in NC (2001-2010)

- Introduction from Pacific (genotype IV)
 - French Polynesia, SPICs
- Introduction from SE-Asia (genotype I)
 - ?



DENV-1 in NC (2011-2013)

- Introduction from Pacific (genotype IV)
- Introduction from SE-Asia (genotype I)
- Genotype switch (IV to I)



Conclusions

▶ CHIKV

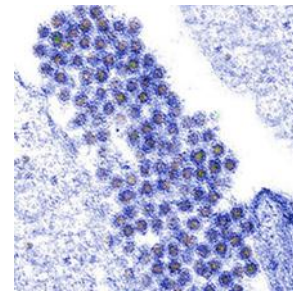
- Asian lineage

▶ DENV

- Predominant circulation of a single serotype, DENV-1
 - Genotype IV (Pacific) between 2001–2012
 - Genotype I (Asia) from 2012 → Genotype Switch
- No DENV-1 / DENV-4 replacement
- Epidemic profile in NC still in favour of DENV introduction from overseas

Perspectives

- ▶ Why such an epidemic in 2013?
 - By the beginning of 2012, DENV-1 herd immunity not reached
- ▶ Explain the 2013 DENV-1 epidemic profile:
 - Vector competence studies (DENV-1 genotype IV/I)
 - Viral kinetics replications (DENV-1 genotype IV/I)



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 - QUT: J. Aaskov
 - DASS-NC: JP. Grangeon
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